Breast cancer is the second leading cause of cancer death in women, exceeded only by lung cancer, and the 5-year survival rate is largely dependent on disease stage. The American Joint Committee on Cancer (AJCC) staging system for breast cancer (7th edition) provides a tumor-node-metastasis (TNM) classification scheme for breast cancer that is important for determining prognosis and treatment. Ascertainment of the correct stage of breast cancer can be challenging, and the importance of the radiologist’s role has increased over the years. The radiologist should understand how breast cancer stage is assigned and should be familiar with the AJCC’s TNM classification scheme. The authors review the AJCC’s TNM staging system for breast cancer with emphasis on clinical and preoperative staging, the different imaging modalities used in staging, and the key information that should be conveyed to clinicians. Radiologic information that may alter stage, prognosis, or treatment includes tumor size; number of tumor lesions; total span of disease; regional nodal status (axillary levels I–III, internal mammary, supraclavicular); locoregional invasion (involvement of the pectoralis muscle, skin, nipple, or chest wall); and distant metastases to bone, lung, brain, and liver, among other anatomic structures.

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Introduction

Breast cancer is the second most common cancer among women in the United States next to skin cancer. About one in eight women (12.5%) will develop invasive breast cancer during their lifetime. Breast cancer is the second leading cause of cancer death in women, exceeded only by lung cancer. According to the American Cancer Society’s estimates for breast cancer in the United States for 2013, approximately 232,340 new cases of invasive breast cancer and 63,640 new cases of carcinoma in situ will be diagnosed, and about 39,620 women will die of breast cancer (1). The death rates from breast cancer have been declining since about 1989, and these decreases are believed to be the result of earlier detection through screening mammography and improved treatment.

Prognosis and treatment are currently determined largely on the basis of breast cancer stage. However, evaluation of tumor biologic features represents an evolving area of interest in treatment and is becoming increasingly important. The staging information will help in choosing between breast conservation and mastectomy, preoperative and postoperative chemotherapy or hormonal therapy, sentinel lymph node biopsy (SLNB) and axillary lymph node dissection (ALND), and radiation therapy. The role of imaging in breast cancer staging has evolved rapidly over the past few years, and radiologic findings are now incorporated into clinical staging.
In this article, we review the American Joint Committee on Cancer (AJCC) tumor-node-metastasis (TNM) staging system for breast cancer (7th edition), with emphasis on the preoperative-clinical stage. Preoperative stage is largely determined by the clinician as he or she synthesizes physical examination findings and radiologic findings. Because the role of the radiologist is crucial, familiarity with the TNM staging system and knowledge of what information to convey to the clinician are important. We discuss each subsection and descriptor of the TNM staging system and review the different imaging modalities that may be used, with emphasis on mammography, ultrasonography (US), and magnetic resonance (MR) imaging. Screening mammography performed in asymptomatic women allows the detection of early-stage breast cancer. Diagnostic mammography is performed in women with abnormal clinical breast examination findings or an abnormality seen at screening mammography. Diagnostic mammography includes the standard mediolateral oblique and craniocaudal views, as well as additional views that may include spot compression or magnification views for suspected abnormalities. Currently, US is mainly used as a diagnostic tool; however, its use for screening purposes is becoming more widely accepted. Contrast material–enhanced breast MR imaging is commonly used to improve breast cancer staging but is not a replacement for mammography and US. Finally, computed tomography (CT), bone scintigraphy, and positron emission tomography (PET)/CT are used to evaluate asymptomatic patients at high risk for metastasis or patients with signs or symptoms of metastatic disease.

TNM staging includes information about tumor size and degree of locoregional invasion by the primary tumor (T), extent of regional lymph node involvement (N), and presence or absence of distant metastases (M). Table 1 illustrates overall preoperative staging as performed with the AJCC's TNM staging system for breast cancer (2).

The TNM staging system also incorporates pathologic staging based on histologic findings in the surgical specimen; however, we do not focus on pathologic staging in this article. Nevertheless, there is a distinction between the clinical, pathologic, and postneoadjuvant chemotherapy stages. These stages are designated by the prefixes “c,” “p,” and “yp,” respectively, and can differ based on information obtained before or after treatment. Clinical staging is important in its own right, since it helps in planning the surgical approach—for example, whether to (a) perform lumpectomy or mastectomy, (b) perform SLNB or ALND, or (c) proceed first with preoperative (neoadjuvant) chemotherapy.

### TNM Descriptors

**Tumor**

Tumor (T) stage is based on tumor size and degree of locoregional invasion, which includes involvement of the skin, nipple, and chest wall (Table 2) (2). The primary tumor is usually measured in three orthogonal dimensions, with the largest dimension used for staging purposes. The Tis category includes ductal carcinoma in situ (DCIS), lobular carcinoma in situ, and Paget disease of the nipple not associated with invasive carcinoma or carcinoma in situ in the underlying breast parenchyma (Fig 1, Table 2). Paget disease associated with carcinoma in the breast parenchyma should be categorized on the basis of parenchymal disease, although the presence of Paget disease should still be noted. Tis tumor is stage 0, with an excellent prognosis and a 5-year survival rate of 100% (3). Also, Tis tumor without an invasive component usually does not require axillary surgery such as SLNB, since DCIS is by definition not an invasive malignancy and should not be capable of metastasizing to...
Table 2: T Descriptors in the TNM Staging of Breast Cancer

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>Primary tumor cannot be assessed</td>
</tr>
<tr>
<td>T0</td>
<td>No evidence of primary tumor</td>
</tr>
<tr>
<td>Tis</td>
<td>Carcinoma in situ (DCIS, LCIS, Paget disease of the nipple not associated with invasive carcinoma or carcinoma in situ in the underlying breast parenchyma)</td>
</tr>
<tr>
<td>T1</td>
<td>Tumor ≤20 mm</td>
</tr>
<tr>
<td>T1mi</td>
<td>Tumor ≤1 mm</td>
</tr>
<tr>
<td>T1a</td>
<td>Tumor &gt;1 mm but ≤5 mm</td>
</tr>
<tr>
<td>T1b</td>
<td>Tumor &gt;5 mm but ≤10 mm</td>
</tr>
<tr>
<td>T1c</td>
<td>Tumor &gt;10 mm but ≤20 mm</td>
</tr>
<tr>
<td>T2</td>
<td>Tumor &gt;20 mm but ≤50 mm</td>
</tr>
<tr>
<td>T3</td>
<td>Tumor &gt;50 mm</td>
</tr>
<tr>
<td>T4</td>
<td>Tumor of any size with direct extension to the chest wall and/or to the skin (ulceration or skin nodules)*</td>
</tr>
<tr>
<td>T4a</td>
<td>Extension to the chest wall†</td>
</tr>
<tr>
<td>T4b</td>
<td>Ulceration, ipsilateral satellite nodules, and/or edema of the skin (including peau d’orange)‡</td>
</tr>
<tr>
<td>T4c</td>
<td>T4a and T4b</td>
</tr>
<tr>
<td>T4d</td>
<td>Inflammatory carcinoma</td>
</tr>
</tbody>
</table>

Source.—Reference 2.
Note.—DCIS = ductal carcinoma in situ, LCIS = lobular carcinoma in situ.
*Invasion of the dermis alone does not qualify.
†Pectoralis muscle adherence/invasion alone does not qualify.
‡Not meeting the criteria for inflammatory breast cancer (IBC).

Figure 1. Stage 0, cTisN0M0 tumor. (a, b) Mediolateral oblique (a) and craniocaudal (b) mammographic views of the left breast demonstrate a cluster of suspicious fine pleomorphic calcifications (arrow). (c) Magnification view more clearly depicts the calcifications. Stereotactic-guided biopsy revealed DCIS.

The T1 category includes all invasive tumors that are 20 mm or less in their greatest dimension (Fig 2). This category is divided into subcategories based on tumor size: T1mi (≤1 mm), T1a (>1 mm but ≤5 mm), T1b (>5 mm but ≤10 mm), and T1c (>10 mm but ≤20 mm) (Table 2) (2). T2 tumors are greater than 20 mm but less
than or equal to 50 mm (Fig 3), narrow as T3 tumors are greater than 50 mm (Fig 4).

The T4 category includes tumors of any size that demonstrate direct extension into the chest wall or skin. This category is divided into T4a, T4b, T4c, and T4d subcategories. T4a tumor demonstrates direct invasion into the chest wall, including involvement of the ribs, serratus anterior muscle, or intercostal muscles. Chest wall involvement upgrades the tumor stage of breast cancer to at least an overall stage of IIIB regardless of tumor size. Contrast-enhanced breast MR imaging is the best imaging modality for determining chest wall involvement. According to the AJCC’s TNM staging system, involvement of the pectoralis major or minor muscle alone is not considered chest wall involvement and therefore does not change the clinical breast cancer stage. Pectoralis muscle involvement may be seen as muscle enhancement with obliteration of the fat plane between the tumor and muscle at MR imaging. However, obliteration of the fat plane as an isolated finding without associated muscle enhancement at MR imaging does not necessarily indicate muscle involvement (Fig 5) (12,13). Although pectoralis muscle involvement alone does not change the clinical breast cancer stage, it is important to include this information in radiology reports because it will alter surgical management.

The T4b subcategory includes skin involvement that is described as skin ulceration, ipsilateral skin satellite nodules, or edema of the skin (peau d’orange) but that does not meet the classic criteria for inflammatory carcinoma (Fig 6). T4c patients include those with findings in both the T4a and T4b subcategories. The “T4d” designation is reserved for disease that meets the classic criteria for IBC regardless of tumor size (Fig 7). The AJCC defines IBC as a clinical entity requiring features such as diffuse erythema and edema involving at least one-third of the skin of the breast. Microscopically, dermal lymphatic invasion is typically seen in this setting; however, this finding alone is neither necessary nor sufficient for a diagnosis of IBC or stage T4d cancer. According to the AJCC, cases in which the aforementioned clinical features are present but involve less than one-third of the breast are described as stage T4b, not T4d. IBC usually
Figure 3. Stage IIA, cT2N0M0 tumor. (a, b) Mediolateral oblique (a) and craniocaudal (b) mammographic views of the right breast demonstrate an irregularly shaped mass at the posterior 1-o’clock position (arrow) corresponding to the palpable marker (triangle). (c) Targeted US image of the right breast shows a 2.4-cm irregular hypoechoic mass with posterior acoustic shadowing. US-guided biopsy revealed an invasive ductal carcinoma. (d) Right axillary US image shows a benign-appearing lymph node.

Figure 4. Stage IIIA, cT3N1M0 tumor. (a, b) Mediolateral oblique (a) and craniocaudal (b) mammographic views of the right breast demonstrate a subpectoral saline implant and an irregular mass in the lower inner quadrant with associated fine pleomorphic microcalcifications (arrows). US-guided biopsy showed an invasive ductal carcinoma associated with DCIS. (c) Targeted US image shows a prominent right axillary lymph node with abnormal cortical thickening and a displaced fatty hilum. US-guided biopsy revealed metastases (N1). (d) Axial contrast-enhanced fat-saturated T1-weighted MR image demonstrates an irregular spiculated mass (arrow) with a maximum diameter of 5.2 cm (T3 tumor because >5 cm) that abuts the implant.
Figure 5. Pectoralis muscle involvement. (a, b) Axial (a) and sagittal (b) contrast-enhanced fat-saturated T1-weighted MR images demonstrate an irregular enhancing mass in the right breast. There is obliteration of the fat plane between the mass and the pectoralis musculature, as well as associated enhancement of the lateral aspect of the pectoralis major muscle (arrow) consistent with muscle invasion. (c) Contrast-enhanced fat-saturated T1-weighted MR image obtained in a different patient shows an irregular enhancing mass in the left breast (arrow) that abuts the pectoralis muscle without definite muscle enhancement, an isolated finding that does not necessarily indicate muscle involvement.

progresses rapidly over weeks to months owing to tumor emboli obstructing flow in the dermal lymphatic vessels. It may be difficult to detect a discrete breast mass at physical examination or imaging because of the widespread involvement of the lymphatic system (14). At mammography, IBC may manifest as skin thickening and stromal coarsening or diffusely increased breast density with or without an associated mass or malignant type microcalcifications. US is helpful in the depiction of masses masked by the pattern of edema at mammography and can also demonstrate skin thickening and axillary involvement (15). IBC usually manifests at an advanced stage, since detection of distant metastases at the time of diagnosis is not uncommon. Treatment is usually multimodal and includes neoadjuvant chemotherapy; surgery (typically, modified radical mastectomy); postmastectomy radiation therapy; and, sometimes, further adjuvant medical therapy with trastuzumab (anti-HER antibody) or hormonal therapy (14,15).

It is important for radiologists to recognize and address specific imaging pitfalls regarding the tumor descriptor. If there is more than one malignant mass in the same breast, the size of the largest tumor should be used for staging purposes. Although the staging system does not take multifocal disease (two or more tumor foci in the same quadrant of the breast [Fig 8]) or multicentric disease (two or more foci in different quadrants) into consideration, these findings greatly impact surgical management and can help determine whether mastectomy or breast conservation surgery should be performed. The prevalence of multifocal and multicentric tumors varies widely in the literature, ranging from 6% to 60% of affected patients (16–18). In addition, advances in preoperative imaging are allowing greater detection of both multifocal and multicentric tumors (19–21).

Contrast-enhanced breast MR imaging is known to help identify foci of cancer that are not detectable at physical examination, mammography, or US. In a meta-analysis of 19 studies that included 2610 patients with breast cancer, MR imaging helped identify additional disease in the ipsilateral breast in a median of 16% of patients (21,22). However, the routine use of MR imaging for preoperative staging remains controversial, since the ultimate impact on survival remains unknown. Depending on individual circumstances,
Figure 6. Stage IIIC, cT4bN3bM0 tumor. (a) Contrast-enhanced chest CT image demonstrates an 8-cm enhancing mass in the left breast with associated skin ulceration and pectoralis muscle involvement (arrow). Skin ulceration represents T4b disease regardless of tumor size. (b, c) CT images demonstrate bulky level I (arrowhead in b) and level II-III (infraclavicular) (arrow in c) metastases in the left axilla. Ipsilateral internal mammary adenopathy (arrow in b) is also noted. (d) Left axillary color US image shows several abnormal lymph nodes posterior to and between the medial and lateral borders of the pectoralis minor muscle, findings that are consistent with level II axillary adenopathy. The presence of internal mammary, axillary, and infraclavicular adenopathy represents nodal stage N3b disease.

A patient with multifocal disease may be a candidate for breast conservation surgery, whereas multicentric disease is almost always treated with mastectomy. Even though multifocal and multicentric breast cancers are associated with poor prognostic factors such as lymphovascular invasion and lymph node metastases, such factors are not independent predictors of worse survival outcomes (16). When there are two or more malignant foci in the same breast, it is important to convey how far apart the lesions are by measuring the total span from the outer edge of one tumor to the outer edge of the other. Direct skin invasion and involvement of the nipple, pectoralis muscle, or chest wall should also be mentioned in radiology reports because their presence changes surgical planning.

The main imaging modalities used in combination with clinical evaluation to determine tumor size and extent are mammography, US, and contrast-enhanced breast MR imaging. Many centers also give careful attention to screening or “clearing” the contralateral breast, since women with cancer in one breast are more likely to have a second cancer in the contralateral breast than are age-matched women with no history of breast cancer (23,24). Identification of a second contralateral cancer may allow both tumors to be surgically treated at the same time (23). In a meta-analysis of 3252 women with unilateral breast cancer, mammographically occult synchronous tumors were found in the contralateral breast in 4% of patients at contrast-enhanced breast MR imaging, with the contralateral disease being DCIS in 35.1% of cases (22,25).

Controversy exists as to which tumor measurement to use when there is a discrepancy in index tumor measurement at different imaging modalities. However, several studies have shown that MR imaging is the most accurate modality. In a study comparing imaging modalities with respect to breast cancer assessment, the index tumors were found at mammography in 90% of cases, at US in 85%, and at MR imaging in 98%. Tumor size was underestimated by 14% at mammography and by 18% at US, but the
size of the tumor at histologic analysis was not significantly different from that seen at MR imaging (26). However, contrast-enhanced breast MR imaging should be used judiciously in the evaluation of breast cancer patients. There is overlap in the contrast enhancement of benign and malignant breast disease processes at MR imaging, and 4%–21% of patients who undergo preoperative breast MR imaging have false-positive findings necessitating additional biopsy (21,25,27,28). In a meta-analysis of 50 studies that included 10,811 women with breast cancer, MR imaging findings prompted conversion from lumpectomy to mastectomy in 12.8% of cases,
Figure 8. Multifocal disease (stage IIB, cT2N1M0 tumor). (a, b) Mediolateral oblique (a) and craniocaudal (b) mammographic views demonstrate two irregular masses in the same quadrant of the left breast, findings that are consistent with multifocal disease, as well as a prominent left axillary lymph node (arrow in a). (c, d) Targeted US images show two discrete masses: a 1.4-cm mass at the 1-o’clock position (c), and a 2.4-cm mass at the 2-o’clock position (d). Because stage is based on the largest tumor (2.4 cm in this case), these masses represent stage T2 disease. (e) Left axillary US image shows an abnormal level I lymph node with an irregularly thickened cortex. US-guided biopsy revealed metastases.

whereas this conversion was inappropriate in 6.3% (29). Therefore, it is important to obtain biopsy proof of suspicious lesions found at MR imaging before proceeding to more extensive surgery. Ultimately, preoperative stage is determined on the basis of both clinical and imaging findings. The multidisciplinary team must decide which imaging study or clinical examination is most accurate in determining T stage.

Node

Appropriate evaluation of regional lymph node status (N) is important for staging, treatment planning, and prognosis. Lymph node status is one of the most important prognostic indicators and is used to establish tumor aggressiveness (Table 3). Clinical staging of the nodes is based on (a) clinical or imaging findings, (b) whether the nodes are fixed (matted) to the axilla or chest wall, and (c) location outside the axilla (eg, supraclavicular or internal mammary chain). In contrast, pathologic staging is based on the number of axillary nodes involved as determined at surgery. As part of clinical staging, preoperative axillary US and US-guided biopsy (fine-needle aspiration biopsy or core biopsy) are increasingly being used to detect nodal metastases (30). Although US may help detect nonpalpable nodal metastases, the routine use of preoperative axillary US remains controversial.

Patients with invasive cancers who are clinically node negative (cN0) will usually undergo SLNB at the time of surgery to determine if “completion” ALND is necessary. In the past, if there was a preoperative diagnosis of axillary
nodal metastasis, the patient proceeded directly to ALND. However, several recent studies have shown that axillary lymph node clearance may not be necessary in women with one or two positive sentinel lymph nodes who are undergoing breast-conserving surgery (31–35). Specifically, the American College of Surgeons Oncology Group Z0011 trial enrolled women with T1–T2 estrogen receptor–positive invasive cancers undergoing lumpectomy who were clinically node negative. Note that the cN0 designation was based on clinical findings alone, and that no preoperative axillary US was performed in these patients. Patients with one or two sentinel node metastases identified at SLNB were randomized to completion ALND or SLNB alone. These women underwent adjuvant chemotherapy or hormonal therapy and whole-breast radiation therapy (including irradiation of the axilla) following surgery. With a median follow-up of 6.3 years, the “SLNB alone” group did not have inferior survival rates compared with the “ALND” group (35). With these favorable results, the surgical management of the axilla is changing in selected patients who fit the criteria. The role of axillary US in this new era will need to be further investigated.

Mammography is typically suboptimal for complete axillary node evaluation. High-resolution US is useful in the evaluation of nonpalpable low-level axillary nodes and palpable lymph nodes at all levels; however, results may vary depending on the operator. In addition to the detection of axillary lymph nodes, MR imaging can help detect internal mammary and supraclavicular adenopathy. At imaging studies, the size of the lymph node cannot reliably help distinguish between normal and abnormal nodes. Abnormal lymph nodes are identified on the basis of overall shape and changes in the appearance of the node cortex. They may manifest with loss of reniform shape, focal or diffuse cortical thickening, hilar indentation and compression, or loss of the normal central fatty hilum (36–42). It is important to biopsy the abnormal cortex of a suspicious lymph node for the greatest possible yield to determine if there is metastasis. The most suspicious lymph node should be biopsied, since the nodal stage impacts overall staging, surgical management, eligibility for various chemotherapy trials, and radiation therapy planning (43). In this portion of the article, we focus on clinical nodal staging based on clinical and imaging findings, rather than on the pathologic nodal stage as determined postoperatively.

Axillary lymph nodes are divided into levels I, II, and III. The level is based on the relationship of the lymph node to the pectoralis minor muscle. Level I includes lymph nodes that are inferior to the inferolateral border of the pectoralis minor muscle; level II, lymph nodes that are posterior to and between the lateral and medial borders of the pectoralis minor muscle (Fig 6d); and level III, lymph nodes that are medial to the superior border of the pectoralis minor muscle (including infraclavicular nodes).

### Table 3: N Descriptors in the TNM Staging of Breast Cancer

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX</td>
<td>Regional lymph nodes cannot be assessed</td>
</tr>
<tr>
<td>N0</td>
<td>No regional lymph node metastases</td>
</tr>
<tr>
<td>N1</td>
<td>Metastases to movable ipsilateral level I-II axillary lymph nodes</td>
</tr>
<tr>
<td>N2</td>
<td>Metastases in ipsilateral level I-II axillary lymph nodes that are clinically “fixed” (matted), or in clinically detected* ipsilateral internal mammary nodes in the absence of clinically evident axillary lymph node metastases</td>
</tr>
<tr>
<td>N2a</td>
<td>Metastases in ipsilateral level I-II axillary lymph nodes matted to one another or to other structures</td>
</tr>
<tr>
<td>N2b</td>
<td>Metastases only in clinically detected* ipsilateral internal mammary nodes in the absence of clinically evident level I-II axillary lymph node metastases</td>
</tr>
<tr>
<td>N3</td>
<td>Metastases in ipsilateral infraclavicular (level III) lymph nodes with or without level I-II axillary lymph node involvement, in clinically detected* ipsilateral internal mammary lymph nodes with clinically evident level I-II axillary lymph node metastases, or in ipsilateral supraclavicular lymph nodes with or without axillary or internal mammary lymph node involvement</td>
</tr>
<tr>
<td>N3a</td>
<td>Metastases in ipsilateral infraclavicular lymph nodes</td>
</tr>
<tr>
<td>N3b</td>
<td>Metastases in ipsilateral axillary and internal mammary lymph nodes</td>
</tr>
<tr>
<td>N3c</td>
<td>Metastases in ipsilateral supraclavicular lymph nodes</td>
</tr>
</tbody>
</table>

Source.—Reference 2.
*Detected at imaging studies (excluding lymphoscintigraphy) and confirmed with fine-needle aspiration biopsy, core biopsy, or clinical examination, having characteristics that are highly suspicious for malignancy.
The “N1” designation refers to metastases to movable ipsilateral level I-II axillary lymph nodes (Fig 4c).

The N2 category is subdivided into subcategories N2a (ipsilateral level I-II axillary lymph nodes that are clinically matted to one another or to other structures) and N2b (“clinically detected” ipsilateral internal mammary lymph nodes without clinically evident axillary lymph node metastasis). The term *clinically detected* refers to (a) lymph nodes that are detected at imaging studies (excluding lymphoscintigraphy) and confirmed with fine-needle aspiration biopsy or core biopsy, or (b) suspicious palpable adenopathy detected at physical examination.

The N3 category, which includes metastases in the level III (infraclavicular) and supraclavicular nodal stations, is subdivided into subcategories N3a, N3b, and N3c. N3a includes metastases in the ipsilateral infraclavicular nodes with or without level I-II axillary involvement; N3b, ipsilateral internal mammary lymph node metastases with level I-II axillary nodal involvement (Fig 6); and N3c, ipsilateral supraclavicular lymph node involvement with or without level I-II axillary involvement.

It is important to identify the presence of internal mammary nodal metastases, which not only changes the nodal stage and prognosis of the patient but also affects the planning of radiation therapy, requiring a wider irradiation field.

### Metastasis

The TNM staging system categorizes distant metastatic disease (M) in a binary fashion (Table 1) (2). M0 indicates no evidence of distant metastatic disease, whereas M1 indicates the presence of distant metastases. The presence of distant metastases at the time of diagnosis indicates overall stage IV disease regardless of tumor size or nodal status. Stage IV disease has a 5-year survival rate of approximately 22%, although this rate varies significantly depending on numerous factors (3). Approximately 4% of patients with a diagnosis of breast cancer will have distant metastases at the time of presentation, and the majority of these patients will have signs and symptoms of metastasis (44). The most common sites of distant metastasis for breast cancer are bone, lung, brain, and liver. About 10% of patients with metastatic disease will have lesions at multiple sites (45). High-risk patients are screened for occult metastases with chest radiography, abdominal US, and bone scintigraphy, although the use of CT, MR imaging, and 2-[fluorine-18]fluoro-2-deoxy-D-glucose PET is increasing (Fig 9). Current guidelines lack a consensus regarding whom to image and how to evaluate for possible distant metastasis. However, the National Comprehensive Cancer Network guidelines state that workup for metastases should be considered in asymptomatic patients with stage IIIA or higher disease and in symptomatic patients (46).

If a patient presents with M1 disease before undergoing neoadjuvant systemic therapy, the disease is considered stage IV regardless of response to therapy. On the other hand, stage designation can be changed from M0 to M1 if postsurgical imaging studies reveal the presence of distant metastases, provided these studies are performed within 4 months of diagnosis in the absence of disease progression.

### Overall Stage

Overall stage is based on all three descriptors (ie, T, N, and M) (Table 1) (2). The 5-year survival rate largely depends on the overall stage (3).

Stage 0 is TisN0M0 (Fig 1). Stage IA is T1N0M0 (Fig 2), and stage IB is T0–T1 with N1mi (disease with nodal micrometastases between 0.2 and 2 mm) and M0.

Stage IIA is T0–T1 with N1M0 or T2N0M0 (Fig 3), and stage IIB is T2N1M0 or T3N0M0.

Stage IIIA is T0–T2 with N2M0 or T3 with N1–N2 and M0 (Fig 4), stage IIIB is T4 with N0–N2 and M0, and stage IIIC is any T with N3M0 (Fig 6).

Stage IV is M1 with any T and any N (Figs 7, 9).
Conclusion

The role of the radiologist in breast imaging has become increasingly important over the years. In addition to making the diagnosis of breast cancer, the radiologist provides information that is critical to clinical staging and treatment. Familiarity with the AJCC’s TNM staging system for breast cancer (7th edition) will allow the radiologist to convey valuable information to the clinician, thereby optimizing patient care and outcome.

References

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According to the AJCC's TNM staging system, involvement of the pectoralis major or minor muscle alone is not considered chest wall involvement and therefore does not change the clinical breast cancer stage.

The AJCC defines IBC as a clinical entity requiring features such as diffuse erythema and edema involving at least one-third of the skin of the breast. Microscopically, dermal lymphatic invasion is typically seen in this setting; however, this finding alone is neither necessary nor sufficient for a diagnosis of IBC or stage T4d cancer. According to the AJCC, cases in which the aforementioned clinical features are present but involve less than one-third of the breast are described as stage T4b, not T4d.

If there is more than one malignant mass in the same breast, the size of the largest tumor should be used for staging purposes.

Axillary lymph nodes are divided into levels I, II, and III. The level is based on the relationship of the lymph node to the pectoralis minor muscle. Level I includes lymph nodes that are inferior to the inferolateral border of the pectoralis minor muscle; level II, lymph nodes that are posterior to and between the lateral and medial borders of the pectoralis minor muscle; and level III, lymph nodes that are medial to the superior border of the pectoralis minor muscle (including infraclavicular nodes).

It is important to identify the presence of internal mammary nodal metastases, which not only changes the nodal stage and prognosis of the patient but also affects the planning of radiation therapy, requiring a wider irradiation field.