Breast ductal carcinoma in situ: Epidemiology, clinical manifestations, and diagnosis

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INTRODUCTION

Ductal carcinoma in situ (DCIS) of the breast represents a heterogeneous group of neoplastic lesions confined to the breast ducts and lobules that differ in histologic appearance and biological potential. The diagnosis has increased dramatically with the introduction of breast cancer screening mammography [1]. The goal of therapy of DCIS is to prevent the occurrence of an invasive breast cancer.

EPIDEMIOLOGY

Incidence — The incidence of DCIS markedly increased from 5.8 per 100,000 women in the 1970s to 32.5 per 100,000 women in 2004 and then reached a plateau [1-3]. Approximately 20 percent of breast cancers diagnosed in the United States (US) are DCIS, and over 60,000 women will be diagnosed in the US alone in 2015 [4]. This increase is attributed primarily to the utilization of breast cancer screening by mammography.

DCIS is less common than invasive breast cancer, but, as with invasive breast cancer, the risk increases with age. DCIS is uncommon in women younger than 30 years of age. The rate of DCIS increases with age from 0.6 per 1000 screening examinations in women aged 40 to 49 years to 1.3 per 1000 screening examinations in women aged 70 to 84 years [1,5]. The risk of development of metastases and/or death in a patient diagnosed with pure DCIS is rare (<1 percent) [6].

Mammographic screening — The widespread adoption of mammographic screening in the US, Europe, and other developed countries dramatically increased the number of cases of DCIS. More than 90 percent of all cases of DCIS are detected only on imaging studies [7]. (See "Screening for breast cancer: Strategies and recommendations".)

Risk factors — The risk factors for DCIS and invasive breast cancer are similar and include family history of breast cancer, increased breast density, obesity, and nulliparity or late age at first birth [8-12]. DCIS is also a component of the inherited breast-ovarian cancer syndrome defined by deleterious mutations in the *BRCA1* and the *BRCA2* genes; mutation rates are similar to those for invasive breast cancer [12].

Similar to invasive breast cancer, DCIS tends to occur at a younger age in women with inherited *BRCA* mutations [13]. An association between long-term use of postmenopausal hormone replacement therapy and DCIS, unlike with invasive breast cancer, has not been established [11,14,15].

- (See "Factors that modify breast cancer risk in women".)
- (See "Overview of hereditary breast and ovarian cancer syndromes".)
- (See "Menopausal hormone therapy: Benefits and risks".)

Chemoprevention — For women at high risk for breast cancer, endocrine therapy can reduce the risk of invasive breast cancer and DCIS. The choice of agents and duration of therapy are discussed separately. (See "Selective estrogen receptor modulators and aromatase inhibitors for breast cancer prevention".)

Following local treatment in patients with DCIS, the decision to administer endocrine therapy to reduce the risk of subsequent cancers depends upon the tumor hormone receptor status and the choice of local therapy. The choice of agents and duration of therapy are discussed separately. (See "Ductal carcinoma in situ: Treatment and prognosis", section on 'Endocrine therapy'.)

CLINICAL FEATURES

Patient presentation — There are no specific clinical manifestations for patients with DCIS. Most patients with an abnormal mammogram suggestive of DCIS will present with no breast-related symptoms or findings on physical examination [1-3]. Prior to the use of widespread screening mammograms, DCIS presented as a palpable mass, nipple discharge, or Paget's disease [16-18]. (See "Nipple discharge" and "Paget disease of the breast (PDB)".)

Imaging studies

Mammography — Ninety percent of women with DCIS have suspicious microcalcifications on mammography [19], and DCIS accounts for 80 percent of all breast cancers presenting with calcifications [20]. Less common findings include a mass or other soft tissue change [21].

All patients with suspected DCIS should have diagnostic bilateral mammograms with magnification views to assess the morphology and the full extent of any calcifications.

Some mammographic patterns of microcalcifications are highly suggestive of DCIS. Linear branching or segmental types of pleomorphic microcalcifications are frequently associated with high-nuclear-grade DCIS with comedo necrosis, while fine, granular calcifications are primarily associated with low-grade, micropapillary, or cribriform pattern DCIS [22]. However, most patients diagnosed with DCIS have microcalcifications of indeterminate morphology. The advent of digital mammography has led to improved detection of microcalcifications and thus increased the number of women diagnosed with DCIS [23]. (See "Breast imaging for cancer screening: Mammography and ultrasonography".)

Mammography may underestimate the extent of DCIS and the number of foci in instances of multifocal disease. This underestimation increases with increasing lesion size. High-grade lesions tend to be continuous, but over one-half of low- to intermediate-grade lesions are multifocal, with interfoci gaps of up to 1 cm [19,22,24]. Features such as associated mass, asymmetry, architectural distortion, and large extent of calcifications if densely packed may predict upgrade to invasive cancer at the time of surgery [25].

Magnetic resonance imaging — At present, magnetic resonance imaging (MRI) is **not** routinely indicated in the evaluation of newly diagnosed DCIS. In a population-based study of over 10,000 women with DCIS (23 percent underwent preoperative MRI), breast MRI prior to breast-conserving surgery did not reduce margin involvement, whereas patients undergoing MRI were more likely to have a mastectomy (odds ratio 2.11, 95% CI 1.91-2.33) [26].

MRI has high sensitivity but low specificity in the imaging of breast cancer. Its optimal utility in evaluation of DCIS is still under investigation [27], but it may be helpful to determine the extent of DCIS and identify multicentric disease and synchronous disease in the contralateral breast [28-32]. While highly sensitive, MRI also fails to identify some mammographically detected foci of DCIS (false negatives) [33-35]. Neither technique is fail-safe.

MRI estimates of the size of DCIS correlate only moderately well with the pathologic evaluation. Like mammography, MRI can underestimate the size of a DCIS lesion [36,37]. Importantly, size is also overestimated in up to 25 percent of cases, particularly if the MRI findings are heterogeneous [38].

MRI appears to be no better than mammography for distinguishing DCIS from benign, atypical proliferative lesions (false positives) or microinvasion, but advanced technologies

such as dynamic contrast-enhanced magnetic resonance and magnetic resonance spectroscopy may improve this capacity [33,38-40]. (See "Diagnostic evaluation of suspected breast cancer", section on 'Breast MRI' and "MRI of the breast and emerging technologies".)

MRI and other emerging technologies used in breast cancer detection are also discussed elsewhere. (See "MRI of the breast and emerging technologies".)

DIAGNOSIS

The diagnosis of DCIS is confirmed by pathologic examination of a breast biopsy specimen, such as a core or excisional biopsy, typically performed for suspicious calcifications detected by a screening mammogram.

Pathologic diagnostic criteria — DCIS is characterized by proliferation of neoplastic epithelial cells within the mammary ductal system, with no evidence of invasion into the surrounding stroma on microscopic examination [3]. DCIS is principally categorized by the nuclear grade; the presence of comedo necrosis and, to a lesser degree, the architectural pattern are also included in some classification schemes [41]. The extent of disease (including size, if available) should also be reported. A discussion of the pathologic criteria for DCIS is reviewed separately. (See "Pathology of breast cancer", section on 'Ductal carcinoma in situ'.)

DIAGNOSTIC EVALUATION

An abnormal lesion detected by breast imaging can be assessed by a core needle sampling or as an excisional biopsy, depending upon the technical limitations of the stereotactic procedure. Fine needle aspiration, which provides a sampling of cells rather than tissue, is inadequate to distinguish between invasive and in situ disease. Breast biopsy techniques are reviewed in detail separately. (See "Breast biopsy".)

Most, but not all, patients with microcalcifications are candidates for stereotactic core biopsy. The thickness of the breast in compression must be adequate, and abnormalities just beneath the skin or in deep posterior locations (adjacent to the chest wall or a breast implant) may be technically inaccessible. In addition, patients who are unable to lie prone are not suitable candidates for this approach. Upright stereotactic tables are an option but are not always available.

Core biopsy — A core biopsy performed under stereotactic guidance is preferred for evaluation of mammographically or MRI-detected microcalcifications if also visible on mammography [42-44]. Ultrasound-guided biopsies can be performed for evaluation of a

sonographically visible mass, irrespective of the presence of calcifications, or if the lesion is palpable or nonpalpable.

Approximately 10 to 20 percent of lesions interpreted as DCIS on core needle biopsy are upgraded to invasive cancer in a surgical excision specimen. Of note, approximately 10 to 25 percent of lesions histologically interpreted as atypical ductal hyperplasia (ADH) are upgraded to DCIS or invasive cancer at the time of a surgical excision [45-51]. Consequently, lesions showing ADH on core biopsy are routinely recommended to undergo excision. (See "Atypia and lobular carcinoma in situ: High-risk lesions of the breast", section on 'Atypical ductal hyperplasia'.)

Vacuum-assisted biopsy (VAB) techniques sample a greater volume of tissue and have lower false negative rates compared with non-VAB approaches [42,52]. VAB is reviewed in detail separately. (See "Breast biopsy", section on 'Core needle biopsy'.)

Surgical excisional biopsy — When patients are not candidates for stereotactic core biopsy procedures for the aforementioned reasons, or when the calcifications are too faint to be biopsied stereotactically, the alternative is image-guided localization and (surgical) excisional biopsy [47].

DIFFERENTIAL DIAGNOSIS

Microinvasive carcinoma — One of the most important goals in the histologic examination of DCIS is the identification of minute foci of stromal invasion, also termed microinvasion. If microinvasive disease is found, management recommendations are changed accordingly. The management of microinvasive disease is discussed separately. (See "Microinvasive breast carcinoma".)

Atypical ductal hyperplasia — Atypical ductal hyperplasia (ADH) is characterized by a proliferation of uniform epithelial cells with monomorphic round nuclei that either partially fill an involved duct or completely fill a duct(s) <2 mm in dimension. ADH shares the cytologic and architectural criteria of low-nuclear-grade DCIS [53]; if these qualitative criteria are met, the aforementioned size/extent criteria determine the diagnosis of ADH versus low-grade DCIS. (See "Atypia and lobular carcinoma in situ: High-risk lesions of the breast", section on 'Atypical ductal hyperplasia'.)

Lobular carcinoma in situ — Lobular carcinoma in situ (LCIS) is a noninvasive lesion that arises in the terminal duct lobules of the breast and was formerly categorized as a noninvasive cancer. LCIS has been removed from the current American Joint Committee on Cancer (AJCC) staging system so as not to confuse providers and patients alike. LCIS is not cancer, though it is a nonobligate precursor lesion. LCIS differs from DCIS with regard to

radiologic features, morphology, biologic behavior, and distribution in the breast. LCIS almost always represents an incidental finding. Pleomorphic LCIS is a subset of LCIS that behaves more similarly to DCIS than classic LCIS, which leads some to treat pleomorphic LCIS as DCIS. The optimal management for LCIS is evolving and discussed elsewhere. (See "Atypia and lobular carcinoma in situ: High-risk lesions of the breast", section on 'Lobular carcinoma in situ'.)

Usual ductal hyperplasia — Usual ductal hyperplasia (UDH) is a benign proliferative lesion that may be a histologic mimic for DCIS, particularly intermediate-grade DCIS. UDH is characterized by a proliferation of epithelial cells with nuclei of variable size and shape. It is not usually an imaging target unless involving a papilloma or a complex sclerosing lesion.

POSTDIAGNOSTIC EVALUATIONS

TNM staging — According to the tumor, node, metastasis (TNM) staging system developed and maintained by the American Joint Committee on Cancer (AJCC) and the International Union for Cancer Control (UICC), DCIS is designated as Tis (DCIS) and stage 0, as it is confined within the ducts (TisN0M0). (See "Tumor, node, metastasis (TNM) staging classification for breast cancer", section on 'The eighth edition TNM staging system'.)

Risk assessment for hereditary breast cancer — Assessment of risk for hereditary breast cancer (eg, *BRCA1*/*BRCA2*) may be required following a diagnosis of invasive breast cancer and DCIS. If the patient is at high risk (greater than 10 percent chance) for carrying a deleterious mutation as determined by published risk assessment tools, and the information gained will impact treatment planning, a referral for genetic counseling is appropriate, particularly for those with a family history of ovarian cancer [54]. (See "Genetic testing and management of individuals at risk of hereditary breast and ovarian cancer syndromes", section on 'Risk assessment models'.)

TREATMENT

Local and systemic treatment options for patients diagnosed with DCIS are discussed in detail separately. (See "Ductal carcinoma in situ: Treatment and prognosis".)

PROGNOSIS

Prognosis is discussed separately. (See "Ductal carcinoma in situ: Treatment and prognosis".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Ductal carcinoma in situ".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see "Patient education: Ductal carcinoma in situ (DCIS) (The Basics)")

SUMMARY AND RECOMMENDATIONS

- Ductal carcinoma in situ (DCIS) of the breast represents a heterogeneous group of neoplastic lesions confined to the breast ducts and lobules. Its diagnosis has increased dramatically with the introduction of breast cancer screening mammography. (See 'Introduction' above.)
- The risk of DCIS increases with age. It is uncommon in women younger than 30 years of age and is as high as 88 per 100,000 in women aged 50 to 64 years. (See 'Epidemiology' above.)
- The risk of cancer-related death in women with DCIS is low, estimated at 1.9 percent within 10 years. (See 'Epidemiology' above.)
- Most cases of DCIS are detected only on imaging studies (most commonly by the presence of mammographic microcalcifications). (See 'Mammography' above.)
- Percutaneous core biopsy under stereotactic or ultrasound guidance is preferred in the evaluation of mammographically identified microcalcifications. Fine needle aspiration biopsy is inadequate for the diagnosis of DCIS as it cannot distinguish between invasive

and in situ disease. In technically challenging stereotactic cases, image-guided surgical excision may be preferable. (See 'Diagnostic evaluation' above.)

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