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Review

Spindle cell lesions of the breast: Multimodality imaging and clinical differentiation of pathologically similar neoplasms

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ABSTRACT

Spindle cell lesions of the breast comprise a wide-range of entities including reactive, benign and malignant proliferations. They can be pathologically challenging to differentiate as there is often immunohistochemical and morphologic similarities with characteristic spindle shaped cellular patterns. Radiological and pathological correlation is essential. Radiology detects, defines the size and extent, and assists in localizing the lesions. Pathology confirms the diagnosis and provides prognostic parameters. Familiarity with the clinicoradiological features of these diagnostically challenging lesions helps to establish an accurate pathological diagnosis and subsequent clinical decision making.

1. Introduction

Spindle cell lesions are a diverse spectrum of mesenchymal neoplasms consisting of spindle shaped cells that are differentiated based on cellularity, nuclear features, collagen content, and growth pattern. Although they represent only a small fraction of all breast pathology, this heterogeneous group of lesions has a large scope ranging from reactive and benign proliferations to aggressive malignant neoplasms (Table 1). Spindle cell lesions have an increased number of spindled and pleomorphic cells with intermixed fascicles of relatively regular cells with fusiform nuclei (Fig. 1). Given the similar appearance of these lesions, differentiating benign lesions from malignant growths can be challenging by histology alone, posing a substantial diagnostic problem given the wide range of differential diagnoses and treatment approaches. With this challenge in immunohistologic diagnosis, the contribution of clinicians and radiologists familiar with the clinical features and imaging of these lesions and radiology-pathology correlation are often essential in the diagnosis of indeterminate lesions

Pathologists can broadly categorize spindle cell lesions as cytomorphologically bland or pleomorphic. Mammary spindle cell lesions with a predominantly **bland** cytomorphology include pseudoangiomatous stromal hyperplasia (PASH), mammary fibromatosis, nodular fasciitis, myofibroblastoma, and scarring from biopsy or intervention (Table 2). Mammary spindle cell lesions with **pleomorphic** cytomorphology include spindle cell carcinoma, angiosarcoma, malignant phyllodes tumor, solitary fibrous tumor/hemangiopericytoma, dermatofibrosarcoma protuberans, leiomyosarcoma, fibrosarcoma, malignant fibrous histiocytoma, and other metastatic spindle cell lesions to the breast (Table 3).

We identified cases from our institutions which are classic examples of both commonly encountered and rare spindle cell lesions. The presented figures illustrate the characteristic imaging features of these lesions and are described utilizing the BI-RADS lexicon.

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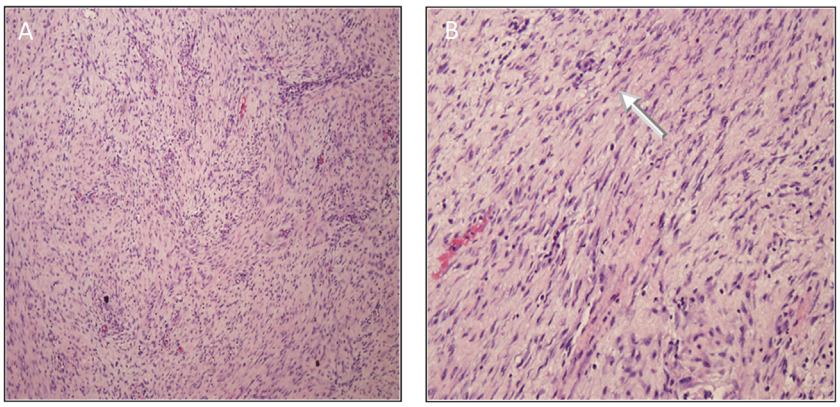

Fig. 1. Histologic features of spindle cell lesions of the breast. A and B, Photomicrographs (H&E stain, 40x and 100x, respectively) depict cellular spindled and pleomorphic cells with fascicles of relatively regular cells with fusiform nuclei (arrow). The similar appearance of these lesions can be challenging to distinguish benign from malignant entities.

Table 1
Major Spindle Cell Lesions of the Breast.

Mammary Spindle Cell Lesions with Predominantly Bland Cytomorphology	Mammary Spindle Cell Lesions with Pleomorphic Cytomorphology
• Spindle Cell Carcinoma*	• Spindle Cell Carcinoma*
• Pseudoangiomatous Stromal Hyperplasia (PASH)	• Angiosarcoma
• Mammary Fibromatosis	• Malignant Phyllodes tumor
• Nodular Fasciitis	• Solitary Fibrous Tumor/Hemangiopericytoma
• Myofibroblastoma	• Dermatofibrosarcoma Protuberans
• Biopsy site/Reactive Scars	• Leiomyosarcoma
	• Fibrosarcoma
	• Malignant Fibrous Histiocytoma
	• Metastatic spindle cells lesions to the breast (i.e. melanoma)

* Spindle Cell Carcinoma can have a variable cytomorphologic appearance presenting as both predominantly bland and pleomorphic. For the purposes of this review, spindle cell carcinomas will be categorized in the lesions pleomorphic cytomorphology section.

2. Mammary spindle cell lesions with a predominantly bland cytomorphology

2.1. Pseudoangiomatous stromal hyperplasia (PASH)

Pseudoangiomatous stromal hyperplasia (PASH) is a benign lesion that most often presents as incidental finding on core biopsy microscopy, and less commonly as a palpable nodule on exam (Fig. 2) [1,2]. While the etiology is still unclear, the lesion is likely a result of hormonally influenced proliferation of myofibroblasts [2]. It is primarily seen in premenopausal women or older women on hormone replacement therapy, which reflects hormonal regulation of this lesion [3]. The lesion typically follows a benign course, although it can recur locally following excision [4]. Management of PASH is typically conservative, although surgical excision is performed if the lesion is discordant to the imaging features or has shown rapid growth.

On mammography the lesion presents as either a non-calcified, circumscribed, solitary mass or as a focal asymmetry [4,5]. Ultrasonography typically demonstrates a circumscribed, oval, hypoechoic mass. PASH can also present as heterogeneously echogenic tissues with central areas of hypoechogenicity [4,5]. Computed Tomography (CT) reveals a nonspecific circumscribed mass [5]. Magnetic Resonance Imaging (MRI) imaging findings are variable, but commonly shows clumped non-mass enhancement with Type 1 kinetics (progressive curve) [5]. Additionally, the presence of high signal slit-likes-spaces and cystic components on T2-weighted images are more specific for PASH. Positron Emission Tomography (PET) scan is non-specific but may show increased activity [5].

2.2. Mammary fibromatosis

Mammary fibromatosis, also known as an extra-abdominal desmoid tumor, represents 4% of all extra-abdominal desmoid tumors and 0.2% of primary breast lesions [6]. Mammary fibromatosis is a soft tissue tumor composed of spindle cells and collagen [7]. Commonly, mammary fibromatosis will have moderate cellularity, spindle cell proliferation with modest collagen deposition, and undetectable mitotic figures. This lesion is locally aggressive with infiltrating growth, has a high recurrence rate, and does not metastasize [6]. The etiology remains unknown. This condition may occur sporadically but has also been noted after trauma or previous breast surgical procedure such as augmentation or implants [8,9]. Clinically, breast fibromatosis presents as a firm palpable mass suspicious for malignancy that may adhere to the chest wall, sometimes causing dimpling or retraction of the skin [9].

Mammographically, fibromatosis can appear as an irregular shaped, non-calcified, high-density mass with spiculated margins [10]. Sonographically, fibromatosis typically presents as a solid, spiculated, or microlobulated, irregular hypoechoic mass, making it difficult to differentiated from malignancy [11]. The pectoralis and intercostal muscles may be involved, demonstrating the locally aggressive nature of fibromatosis [9]. Fibromatosis can also have a benign appearance with circumscribed borders and posterior acoustic enhancement, lack of echogenic halo or posterior acoustic shadowing, and parallel orientation [9,12]. MRI is the best imaging modality for evaluating the extent of fibromatosis, particularly for chest wall involvement [9]. The typical appearance is an irregular mass, isointense to muscles on the T1-weighted sequences, and variable signal on the T2-weighted sequences (depending on collagen content) [8,9]. Post-contrast imaging shows enhancement; however, the kinetics are variable [9].

Treatment of choice is wide local excision [13]. Recurrence rates are high and have been reported up to 29%, especially in cases involving the pectoralis major muscle [14,15]. In cases where surgery may result in significant morbidity, radiation therapy has been employed for local control [8].

2.3. Nodular fasciitis

Nodular fasciitis is a benign proliferation of myofibroblasts that often presents as a rapidly growing, palpable, and painful mass