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SPINDLE CELL & VASCULAR LESIONS OF THE BREAST  
AND THEIR DIFFERENTIAL DIAGNOSIS  

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Bullet points:  
- Most benign spindle cell lesions of the breast are myofibroblastic.  
- Distinction of mammary fibromatosis (which is locally aggressive) from nodular fasciitis or scar tissue can be difficult, especially in small biopsies.  
- Spindle cell sarcomas arising in breast are extremely rare; multiple keratin stains and thorough sampling are needed to exclude the more frequent spindle cell/sarcomatoid carcinomas and malignant Phyllodes tumors.  
- In mammary parenchyma, angiosarcoma is more common than hemangioma and can be deceptively very bland – a dissecting growth pattern may be the best clue.  
- Close clinicopathologic correlation and collaboration are often necessary for accurate diagnosis of spindle cell lesions in the breast.
This brief overview focuses on pure spindle cell lesions of the breast, foremost among which are fibroblastic/myofibroblastic lesions, and vascular lesions, most importantly angiosarcoma. Spindle cell (metaplastic) carcinoma is also described, since it represents the principal and most significant differential diagnosis, but fibroepithelial proliferations (including Phyllodes tumor) are not included.

**FIBROUS/MYOFIBROBLASTIC LESIONS**

Fibrous lesions at this location challenge the pathologist, partly because of the considerable morphologic spectrum that these entities can exhibit and also because there is clinical, radiologic and morphologic overlap between reactive and neoplastic fibrous lesions and between fibrous and non-fibrous lesions. To compound the difficulty, the pathologist initially often has a limited tissue sample such as a core needle biopsy from which to formulate a diagnosis.

Many fibrous lesions that involve other body sites can also occur in the breast and there also exist uncommon but distinctive fibrous lesions that occur more characteristically in the breast. Fibrous lesions of the breast include scars, nodular fasciitis, pseudoangiomatous stromal hyperplasia and the desmoplastic reaction associated with many breast carcinomas, in addition to neoplastic entities such as mammary myofibroblastoma, primary mammary fibromatosis and, more rarely, sarcomas. It is important to recognize that secondary (granulation tissue-like) changes from a previous needle biopsy may further complicate the morphologic appearance of these lesions. The ubiquitous myofibroblast is an important constituent of these various lesions and thus there is considerable overlap in morphology, immunohistochemical staining patterns and ultrastructural appearances.

**NODULAR FASCIITIS**

Although its clinicopathologic features are quite well known, nodular fasciitis (NF) still causes diagnostic difficulties, especially when it occurs in an unusual anatomic location. In one study, 21% of cases of NF were diagnosed initially as sarcoma. The lesion occurs most commonly in young adults but can occur in patients of any age. It typically affects subcutaneous tissue of the upper extremities and trunk but may occur at any site, including rarely the breast where also it may be mistaken clinically, radiologically and morphologically for a malignant
Lesions can occur in either the breast parenchyma or in the overlying subcutaneous tissue and usually measure < 5 cm. NF usually has a brief pre-clinical history measured in weeks, but occasional cases may have been present for more than 6 months prior to diagnosis. Tenderness or pain are frequent symptoms. The natural history of NF in the breast, as at other sites, is spontaneous involution with disappearance of the lesion within 3-4 months. Complete involution has been well described in cases diagnosed by fine needle aspiration cytology (FNAC) and subsequently followed. In general, local excision is performed for definitive diagnosis and is curative, irrespective of margin involvement, in almost all cases. NF recurs locally in 1-2% of cases, usually following incomplete excision of an actively growing lesion.

The histologic appearance of NF in the breast is similar to that at other sites. Lesions are generally reasonably well circumscribed but unencapsulated. Breast ducts and lobules are generally pushed aside by the lesion but, rarely, breast elements may be seen within the lesion. The appearance varies from being highly cellular in an early lesion to showing keloidal-type collagen in an older (regressing) lesion. In an early lesion, plump myofibroblasts with readily identified mitoses are arranged in short fascicles and whorls in a loose myxoid (‘feathery’) matrix. Nuclear atypia and necrosis are not seen. The background can be variably myxoid, microcystic, or collagenized depending on the age of the lesion and there may be variation in the stroma within a single lesion. The central zone may be markedly hypocellular and even cystic. Multifocal red cell extravasation and a patchy lymphocytic infiltrate are characteristically seen and scattered osteoclast-like giant cells may be present. Usually, there are prominent thin-walled blood vessels in the stroma. These appearances may be recapitulated in fine needle aspiration cytology specimens (FNAC).

The spindle cells are generally immunoreactive, at least focally and often diffusely, for muscle specific actin and smooth muscle actin. Focal desmin positivity is seen occasionally. Any osteoclastic cells and scattered macrophages stain strongly with antibodies to CD68.

The main differential diagnosis of NF includes sarcoma, metaplastic carcinoma and fibromatosis. The presence of numerous mitotic figures may be worrisome for malignancy, but the absence of cytologic/nuclear atypia or hyperchromasia is a key distinguishing feature. Sarcomas and metaplastic carcinomas almost invariably show greater nuclear atypia and hyperchromasia and clusters of more epithelioid cells may be seen in metaplastic spindle cell carcinoma. NF does not have the characteristic infiltrative edge of fibromatosis that enwraps
adjacent normal structures and lacks the long (and often broad) fascicles of fibromatosis. It is important to be aware of the overlapping immunoprofile of NF and other myofibroblastic and myogenic lesions which may lead to misinterpretation of NF as a leiomyosarcoma.

**FIBROMATOSIS**

Fibromatosis is a locally aggressive, but non-metastasizing, proliferation of fibroblastic and myofibroblastic cells with a propensity for local recurrence as a consequence of its markedly infiltrative margin and frequently inadequate surgical excision. Fibromatosis is a clonal process. It has been described in many anatomic sites, involving particularly the trunk, including the chest wall and the extremities. Musculo-aponeurotic fibromatosis can involve the breast by secondary spread from the chest wall. Primary mammary fibromatosis (PMF) also occurs but is relatively uncommon. The reported age range of PMF is 13 to 80 years but it most often affects females from the third to fifth decades. Occasional cases have been reported in males. Bilateral fibromatosis has been reported rarely with no apparent extension across the midline, occurring synchronously in most cases and metachronously with an interval of 2 years in one case. Examples of coexistent but discontiguous mammary and pectoral (musculoaponeurotic) fibromatosis have been described.

Almost invariably, the presenting symptom is a palpable, firm breast mass which is most often painless and clinical suspicion for carcinoma is common. Skin dimpling and tethering may be seen. Subareolar location is rare and nipple discharge is very uncommon. With increased use of mammography as a screening tool, the lesion may be a non-palpable incidental finding. Mammography typically reveals a stellate spiculated mass that may be indistinguishable from carcinoma.

Most cases of PMF are sporadic; however it may also occur as part of the spectrum of Familial Adenomatosis Polyposis (FAP) or as part of a hereditary desmoid syndrome such as familial multicentric fibromatosis. Occurrence of fibromatosis at any site is a hundred-fold more common in patients with FAP than in the general population and occurs in approximately 10% of cases of FAP. Mammary fibromatosis has been described in association with hereditary desmoid disease and also Gardner’s syndrome with occasional bilateral breast involvement in Gardner’s syndrome. Coexistent somatic and germ-line mutations of the Adenomatosis Polyposis Coli (APC) gene (located on chromosome 5q) are present in fibromatosis from patients...
with FAP. The clinical phenotype differs depending on the location of the mutation along the APC gene. Mutations or deletions of the APC gene also contribute to the development of sporadic fibromatosis, including mammary lesions. Rarely patients report a history of antecedent trauma at the site of fibromatosis and some cases arise in association with both saline and silicone breast implants. As at other locations, there are suggestions that hormonal disturbances contribute to the development of PMF, although an association with pregnancy, as in some abdominal wall desmoids, has not been recognized.

The lesional size varies from 1 to 10 cm, with an average size of 2.5 to 3.0 cm which is notably smaller than desmoids at other extra-abdominal locations. The lesion is often rather poorly circumscribed or ill-defined but may be stellate in configuration and is firm, white, tan, or gray and fibrous in appearance. Circumscribed or well-demarcated examples are occasionally seen.

The histologic features are essentially similar to those of desmoid-type fibromatosis occurring at other sites. Mammary fibromatosis is marked by the peripheral entrapment of adjacent parenchymal tissue, including fat, breast ducts and lobules. Parenchymal elements are generally inconspicuous or absent toward the center of the fibromatosis. Coincidental epithelial hyperplasia may be seen in peripheral entrapped breast ducts. The mitotic rate is variable, but most often low. The cells have oval to tapering nuclei with ill-defined palely eosinophilic cytoplasm and there is no pleomorphism. These bland spindle cells are characteristically distributed in long sweeping fascicles, but the degree of cellularity and amount of stromal collagen may vary considerably. A myxoid, fasciitis-like appearance, at least focally, is quite frequent in mammary fibromatosis and a keloidal-like pattern may be seen occasionally. Many lesions are relatively cellular at the periphery with a tendency for central hyalinization. Focal lymphocytic infiltrates are found in around half of the lesions and are more prominent at the periphery.

Two cases of extradigital inclusion body fibromatosis (IBF) have been reported in the breast. The spindle cells possessed intracytoplasmic inclusions, identical to those in infantile digital fibromatosis. These inclusions have also been described in the stroma of fibroepithelial tumors of the breast. It is hypothesized that the inclusions may result from some metabolic or organizational abnormality shared by neoplastic actin-rich cells.
By immunohistochemistry the tumor cells in mammary fibromatosis stain positively for muscle specific actin and smooth muscle actin. In our experience, S100 protein and desmin can also be detected in a small minority of tumor cells in many cases. Beta-catenin has recently been promulgated as a useful marker for desmoid tumors, in which nuclear localization is to be expected. Although this marker is positive in about 70-75% of desmoids, it also stains some examples of other fibroblastic tumors, such as solitary fibrous tumor.24

Trisomy 8 and trisomy 20 are the commonest nonrandom characteristic cytogenetic aberrations in fibromatosis,7,25 although mammary lesions have not been analyzed specifically. It is of interest that trisomy 8 and 20 have also been detected in cultured invasive breast carcinomas.26 It has been suggested that these aberrations are derived from admixed reactive fibroblastic cells representing the desmoplastic fibroblastic proliferation that often accompanies breast cancer.27 Chromosome 5q (the site of the APC gene) is often lost in fibromatosis.

Lesions that should be considered in the differential diagnosis of fibromatosis include scars, nodular fasciitis, metaplastic carcinoma and sarcoma. A history of local trauma or surgery, the presence of hemosiderin, foreign body granulomas or fat necrosis may suggest the diagnosis of a scar. Peripheral entrapment of breast parenchyma and a long fascicular pattern are not generally evident in a scar. It is important to remember, however, that in some cases of fibromatosis there may be a history of antecedent trauma or previous surgery. If a patient has recurrent fibromatosis, secondary scarring from surgery mingled with fibromatosis may complicate the diagnosis as well as margin assessment, as also happens at other anatomic locations. Fibromatosis can be distinguished from nodular fasciitis by the presence of long fascicles of bland spindle cells, a usually more collagenized stroma and its infiltrative margin. The most important differential diagnosis is metaplastic (sarcomatoid) carcinoma, of which a low-grade fibromatosis-like variant has been described.28 The presence of cytokeratin positivity, focal clusters of more epithelioid cells among the spindle cells and coarse nuclear chromatin are useful clues to the diagnosis of metaplastic carcinoma. Most true spindle cell sarcomas show increased cellularity, nuclear pleomorphism and more frequent mitoses, often including the presence of atypical mitotic figures.

Recommended treatment of PMF, as for other extra-abdominal fibromatoses, is wide local excision. The reported frequency of local recurrence is similar to that of other fibromatoses and is reported to be up to 27%.11 Although the risk of recurrence of PMF is higher in patients
with documented positive margins, not all patients with positive margins develop recurrences and recurrences have also been documented in cases with apparently negative margins. Most recurrences occur within three years of diagnosis; however recurrences have been reported up to 10 years after surgery. Histologic features are generally not helpful in predicting recurrence.

MAMMARY-TYPE MYOFIBROBLASTOMA

Mammary-type myofibroblastoma is an uncommon, but well-described, benign and nonrecurring myofibroblastic tumor. Although this lesion was originally named in 1987 by Wargotz et al, the same entity had been reported as benign spindle cell tumor of the breast and as spindle cell lipoma. Myofibroblastoma occurs over a wide age range (25-85 years) but most often in the sixth to eighth decades. Although originally reported to be more frequent in men, these lesions now appear to arise with equal frequency in women; this altered incidence is a consequence of increased mammographic screening. Myofibroblastoma typically occurs as a solitary, mobile, slowly growing lesion, most often present for several months. There is no attachment to skin. Coincident gynecomastia may be present in males. Synchronous bilaterality has been reported in a man. Histologically similar lesions are seen occasionally at extramammary locations, mainly on the trunk or in the inguinal region, but even elsewhere such as the limbs. Radiographically, the tumors are homogeneous, lobulated, well circumscribed, and lack microcalcifications. The clinical and radiological differential diagnosis is usually a fibroadenoma, but rarely may include cancer.

The average lesional diameter is about 2 cm with most lesions being smaller than 4 cm, although we have seen exceptional cases measuring greater than 20 cm. The mass is firm and rubbery with a lobulated external surface. The cut surface consists of homogeneous, bulging gray to pink tissue which rarely may have myxoid gelatinous areas. Cystic degeneration, necrosis and hemorrhage are not seen, unless there has been a prior biopsy or aspiration.

The histology is similar in males and females. In the classic type, the lesions are well circumscribed but devoid of a true capsule. Compressed breast parenchyma forms a pseudocapsule. An infiltrative margin may occasionally be seen and we have seen several cases that exhibited a strikingly plexiform growth pattern. Occasionally one may see breast ducts or lobules entrapped in the lesion. Lesions are characterized by short fascicles of uniform, bipolar, spindle-shaped cells between bands of hyalinized collagen with prominent stromal mast cells,
thus resembling spindle cell lipoma (see below). Prominent nuclear palisading may rarely be seen. The nuclei of the spindle cells are round to stubby or oval with irregular nuclear contours and dispersed chromatin, with distinct nucleoli. In most cases, there is little or no nuclear pleomorphism. The cells may occasionally have a strikingly epithelioid appearance. Mitotic figures generally number less than 2 per 10 HPF, and are often undetectable. Multinucleated giant cells, often with a floret-like appearance may be seen infrequently and are sometimes prominent. Cellularity is somewhat variable, both within a single lesion and between different lesions and this is influenced by the amount of stromal collagen, which sometimes can be very prominent and hyalinized; alternatively there may be focal myxoid change. Variable amounts of adipose tissue are often seen as a component of the lesion. Occasionally either smooth muscle or cartilaginous metaplasia can be seen as a minor component. Nuclear pleomorphism with hyperchromasia can occur in isolated cases and in the rare cases when this is associated with increased mitotic activity, we have used the term “atypical myofibroblastoma”. To date, such lesions have not shown an increased likelihood to recur over classic myofibroblastoma. The vascular pattern is typically inconspicuous, with small to medium sized vessels which may be hyalinized. A perivascular lymphoplasmacytic infiltrate is sometimes present.

In the majority of myofibroblastomas, the spindle cells are immunoreactive for desmin and CD34 with variable positivity for smooth muscle actin. The distribution of staining may be focal. Electron microscopy reveals myofibroblasts and fibroblasts in variable proportions. Five cases studied (from both males and females) have shown strong staining for androgen receptor, not seen in a limited number of cases of other tumors, including leiomyosarcoma, fibromatosis, dermatofibrosarcoma protuberans, and monophasic synovial sarcoma; the significance of these findings is uncertain. The karyotype of myofibroblastoma is characterized by losses of 13q and 16q, karyotypic abnormalities that are shared with the morphologically very similar spindle cell lipoma. The precise relationship between these two tumor types remains uncertain, but likely very close.

Myofibroblastoma should be distinguished from solitary fibrous tumor, spindle cell lipoma, smooth muscle and neural tumors, metaplastic carcinoma, myoepithelioma, fibromatosis and nodular fasciitis. By current conventional criteria, spindle cell lipomas are rarely located in the breast but otherwise they seem very similar to myofibroblastoma. Perhaps subtle differences are that myofibroblastoma consistently has a spindle cell-predominant pattern and a more overtly
fascicular architecture. The stromal collagen bundles are also coarser when compared to the ropey, refractile bundles of spindle cell lipoma. Spindle cell lipomas are CD34 positive but in most cases are desmin negative. Hemangiopericytoma-like vessels, ‘patternless’ arrangement of spindle cells and desmin negativity are distinguishing features between solitary fibrous tumor and myofibroblastoma. It is important to be aware of the immunohistochemical positivity for myogenic markers in myofibroblastomas to avoid misdiagnosis of the lesion as a muscle tumor. Mitoses are acceptable in myofibroblastoma but, in a suspected smooth muscle tumor, may lead to misdiagnosis as leiomyosarcoma. Leiomyomas that occur in the breast are most commonly seen in association with the nipple and areola and resemble pilar leiomyomas. Leiomyomas occurring in the parenchyma of the breast are very rare. Leiomyosarcomas have more brightly eosinophilic cytoplasm, lack adipose tissue and most often are CD34 negative. Although nuclear palisading may be seen in myofibroblastomas, these lesions do not exhibit the S100 protein immunoreactivity of a schwannoma. Pseudoangiomatous stromal hyperplasia may rarely form a palpable nodule and occasional foci have been described with keloidal hyalinization and fascicles of spindle cells that are immunoreactive with CD34 and desmin, thus mimicking myofibroblastomas. Myofibroblastomas generally have a uniform appearance throughout, are usually well-circumscribed and entrapped breast elements are rarely seen. Myofibroblastomas can be distinguished from fibromatosis by the absence of elongated sweeping fascicles of cells and the presence of a well-circumscribed margin. Nodular fasciitis has a characteristically loose, more storiform pattern with extravasated red blood cells in contrast to the fascicular arrangement of spindle cells between bands of keloidal collagen, numerous stromal mast cells and possible admixed fat of a myofibroblastoma.

No recurrences of myofibroblastoma have been reported to date and local excision is regarded as adequate treatment.

METAPLASTIC (SPINDLE CELL/SARCOMATOID) CARCINOMA

Metaplastic carcinomas are essentially epithelial in origin with intermixed nonepithelial elements that may give rise to diverse morphologic components that may include spindle cells, giant cells, bone and cartilage. Metaplastic carcinomas consisting predominantly of spindle cells, often associated with the focal presence of squamous or glandular elements, have variously also been termed sarcomatoid carcinoma and spindle cell carcinoma. Metaplastic
carcinomas, which occur over the same age range as conventional ductal carcinoma, comprise less than 5% of breast malignancies and may appear as a well circumscribed or a spiculated mass on mammography. The overall prognosis of metaplastic carcinoma is judged to be similar to conventional ductal carcinoma of breast, albeit, in our experience, metastasis may occur earlier.

Metaplastic carcinomas are typically white and firm and range in size from 1.2 to 7.0 cm (average 2.7 cm). The appearance of the spindle cells in these tumors can vary from relatively bland to highly pleomorphic. Spindle cell (sarcomatoid) carcinoma in the breast can be a great mimic of either benign reactive conditions, including even nodular fasciitis, as well as spindle cell sarcomas. Foci of classic invasive ductal carcinoma, ductal carcinoma in situ or atypical ductal hyperplasia may be identified within (or adjacent to) the lesion and provide clues to the epithelial nature of these tumors, although an epithelial component is quite often absent. Some cases arise in a pre-existing papilloma or sclerosing lesion. Focally, plump polygonal or more epithelioid tumor cells can be seen singly and in clusters amidst more spindled cells with the two cell types sometimes appearing to merge. Heterologous squamous differentiation may be seen and heterologous chondro-osseous differentiation (most often histologically malignant) is seen in 10-15% of cases. Lymph node metastasis is very infrequent and it is questionable whether sentinel node biopsy or lymph node dissection is appropriate in these patients. A low-grade variant of spindle cell metaplastic carcinoma of the breast has been described that morphologically resembles fibromatosis with little or no nuclear atypia. It has been said to be associated with a high rate of local recurrence and no distant or regional metastases, although this is controversial: we and others have encountered examples which metastasized.

A panel of antibodies against low and high molecular weight cytokeratins is recommended in suspected cases of metaplastic carcinoma. In our experience, broad spectrum antibodies which detect high molecular weight cytokeratins are usually positive in spindle cell carcinoma. Immunoreactivity for cytokeratin may be very focal or sometimes not discernible in the lesion and this is important to remember when dealing with a core biopsy of a spindle cell lesion. The spindle cells are usually also positive (at least focally) for vimentin, smooth muscle actin and muscle specific actin. Positivity for epithelial membrane antigen (EMA) is less frequent and usually focal. Importantly, a significant subset (perhaps the majority) of these tumors, particularly if low grade, stain positively for CK14 and p63 and less often for S-100 protein, favoring myoepithelial or basal cell differentiation. It is our experience (and that
of others) that metaplastic (spindle cell) breast carcinomas are consistently negative for hormone receptors and HER2/neu.

Malignant Phyllodes tumor can enter the differential diagnosis with sarcomatoid carcinoma. An epithelial component is usually seen in malignant Phyllodes tumor and is characteristically present as elongated epithelial-lined clefts. Identification of this component may require extensive sampling. Some degree of epithelial hyperplasia may be seen. Marked morphologic heterogeneity is often present and there may be prominent stromal myxoid change. Cytokeratin expression is usually not seen in the spindle cell component of Phyllodes tumor, while CD34 is often positive. At the ultrastructural level, the spindle cells have features of myofibroblasts and fibroblasts. Radial scars and complex sclerosing lesions of breast may have an abundant spindle cell component, and may enter the differential diagnosis with metaplastic carcinoma. Pleomorphism of the spindle cells is generally not seen. It is important to remember that squamous metaplasia can also occur in benign epithelial breast lesions, such as intraductal papilloma. A variety of soft tissue sarcomas also occur rarely in the breast (see below), but it is advisable to generously sample such lesions to avoid missing clues more in keeping with spindle cell metaplastic carcinoma (with or without heterologous elements) or a malignant Phyllodes tumor.

**SPINDLE CELL SARCOMAS IN BREAST**

The more frequently occurring sarcomas arising in breast parenchyma are angiosarcoma (see below) and liposarcoma; however post-irradiation sarcomas in breast tissue (many of which are histologically unclassifiable) appear to be increasing in incidence, in the same manner that post-irradiation cutaneous angiosarcomas are becoming noticeably more frequent following breast-conserving therapy for carcinoma.

Other spindle cell sarcomas very rarely encountered in the breast parenchyma are leiomyosarcoma or malignant peripheral nerve sheath tumor and one may also see metastases, particularly from synovial sarcoma, at this site. These lesions show no special features which distinguish them from their counterparts at more usually soft tissue locations. Probably the most important ‘take home’ message regarding sarcomatoid lesions of the breast is that metaplastic (spindle cell) carcinoma should always be first excluded, preferably using at least two different keratin antibodies. Virtually all cases formerly regarded as so-called ‘MFH’ or fibrosarcoma of
the breast would nowadays be reclassified as spindle cell carcinoma or, less often, malignant Phyllodes tumor.

**OTHER SPINDLE CELL NEOPLASMS**

The full range of cutaneous spindle cell neoplasms may arise in the skin of the breast but these are not strictly breast tumors, with the notable exception of the rarely occurring leiomyoma of nipple, which shows close similarities to pilar leiomyoma. Within breast parenchyma itself, spindle cell lesions other than those described elsewhere in this brief overview, are very uncommon and include infrequent examples of neurofibroma or, more rarely, schwannoma. Granular cell tumor may also present in the breast.

**VASCULAR LESIONS OF BREAST**

This brief overview focusses principally on vascular lesions which arise in breast parenchyma and does not include the currently topical cutaneous lesions which arise at this site following irradiation.\(^{54}\) Since, both clinically and mammographically, it may sometimes be difficult to distinguish subcutaneous from truly intraparenchymal lesions, then mention is also made of the more frequent subcutaneous lesions (which are quite often received as needle biopsy specimens).

**MAMMARY ANGIOSARCOMA**

The best known, diagnostically most treacherous and seemingly most common vascular neoplasm to arise in mammary parenchyma is angiosarcoma.\(^{55-57}\) In contrast to angiosarcomas at other sites, the age range is wider, with cases in the teenage years and 20s being well recognised. The overall median age is approximately 40. While most lesions are unilateral, as many as 10-15% of patients develop bilateral disease (synchronously or asynchronously) and it is sometimes difficult to know whether this represents separate primary lesions or locoregional metastasis. Some cases develop following radiation for a prior breast carcinoma, but parenchymal involvement is much less common than skin involvement in that context. Tumour size is variable and may be very large but most cases measure in the range of 2-8 cm. Preoperative duration is very variable.
Macropscopically these lesions are most often haemorrhagic masses with a variably defined margin. Histologic features are closely related to grade. Low-grade (grade I) tumours, which account for 40% of cases, are characterised by anastomosing and dissecting vascular channels which often involve and disrupt breast lobules and which typically show complex dissection through adipose tissue. There is generally endothelial nuclear hyperchromasia but mitoses are scarce and papillary or solidly cellular areas are absent, such that the morphology is often deceptively benign-looking. Intermediate-grade (grade II) lesions, accounting for 20% of cases, are characterised by focally increased cellularity, often with endothelial multilayering or papilla formation and, in these more cellular areas, mitoses may be identified more readily. High-grade (grade III) tumours, accounting for 40% of cases, are defined principally by the presence of solid spindle cell areas. These lesions show a higher mitotic rate, frequent necrosis and areas of extensive stromal haemorrhage (sometimes known as ‘blood lakes’). Immunostaining for CD31 and CD34 is the best way to distinguish solidly cellular lesions from pseudovascular spindle cell carcinomas. Epithelioid morphology is relatively rare.

In contrast to angiosarcomas at other locations (where grade seems to have little prognostic relevance), it has long been stated that the best predictor of outcome in mammary lesions is histologic grade, based on just one major study. Five-year survival probability for Grade I lesions was stated to be in the range of 75-80%, for Grade II lesions 60-70% and for Grade III lesions 10-15%. However, our more recent experience is quite different and we have found, in a series of almost 50 cases, that the metastatic risk is at least 50% in tumors of any grade. Irrespective of grade, these lesions are generally treated by mastectomy. Commonest sites of spread are lung, liver, contralateral breast, other skin/soft tissue locations and bone. Lymph node metastasis is very infrequent and axillary lymph node dissection is generally not justified.

**HAEMANGIOMAS OF BREAST**

Haemangiomas arising in mammary parenchyma and giving rise to a palpable or mammographically detectable mass are not common and, in my experience, are histologically very heterogeneous. Most do not fit neatly into classification schemes applied to skin or soft tissue lesions, but some have conventional cavernous or capillary features. Rare cases have prominent muscular walls suggestive of venous origin. With the exception of the very rare
entity of angiomatosis, most benign haemangiomas of breast are at least partially circumscribed and they do not disrupt lobular structures. They do not show a dissecting growth pattern and they entirely lack endothelial atypia or multilayering.

The entity known as perilobular haemangioma seems somewhat more common but is always an incidental microscopic finding, generally < 2 mm in size. These lesions are virtually never detected clinically or macroscopically. Despite their name, they may involve either breast lobules or extralobular stroma. They are characterised by clusters of ectatic and often congested capillary vessels lined by attenuated endothelium. Rare lesions which have been described as ‘atypical perilobular haemangiomas’ appear to represent cellular and often mitotic examples of lobular capillary haemangioma (comparable to pyogenic granuloma).

**OTHER VASCULAR LESIONS**

Perhaps the commonest lesion to raise concern for angiosarcoma at this site is angiolipoma. Angiolipomas of breast affect mainly middle-aged adults and are more often subcutaneous rather than truly intraparenchymal. At this site, they are most often solitary and may be painful. As at other soft tissue locations, cellularity may be variable and highly cellular lesions (known as cellular angiolipoma) seem to be relatively more common, often presenting a diagnostic problem on needle biopsy. Important clues to the distinction from angiosarcoma are the generally small lesional size (most are < 2 cm), the circumscribed margin, the lack of a dissecting growth pattern or endothelial atypia and most importantly, the presence of fibrin microthrombi. An additional mimic of angiosarcoma is sinusoidal haemangioma, which is also usually subcutaneous. This is essentially a variant of cavernous haemangioma, composed of thin-walled dilated vessels, arranged back-to-back. These lesions often show intraluminal thrombi, sometimes with dystrophic calcification, and may therefore be detected mammographically. They are typically well circumscribed and lack endothelial multilayering or significant atypia. Intravascular papillary endothelial hyperplasia (Masson’s tumour) is uncommon in the breast and is more often subcutaneous rather than intraparenchymal. As at other locations, it is typically associated with organising/organised thrombus within a pre-existing vessel or haemangioma. There is no endothelial atypia or multilayering and no evidence of a dissecting growth pattern.
CONCLUSION

The correct management of spindle cell lesions of the breast is dependent on the pathologist being familiar with their varied microscopic appearances and their simulation of other more common breast diseases clinically, radiologically and pathologically. Fibrous lesions encompass reactive conditions and both benign and malignant tumors with differing clinical significance in relation to treatment and prognosis. It is also essential to remember that metaplastic (spindle cell) carcinoma is far more common than spindle cell sarcomas in this location, so staining for several keratins is often critical. In the context of vascular lesions, the most important points to remember are that, among truly intraparenchymal lesions, angiosarcoma is more common than haemangioma and that angiosarcomas may appear remarkably bland, such that reliance on an abnormal dissecting architecture may be the best clue. Furthermore, despite traditional teaching, it seems that histologic grade may not be of prognostic importance in mammary angiosarcoma, just as is the case at other sites. Sufficient lesional material in all of these tumor types should be obtained for definitive diagnosis. With the increasing popularity of core needle biopsy as the initial step in the clinical management of an abnormal mammographic finding, caution must be exercised in the interpretation of fibrous or vascular lesions of the breast on a limited tissue specimen. In general, excision is recommended because of the problem of morphologic overlap. Close clinicopathological correlation is advised in the evaluation of both fibrous and vascular lesions of the breast.

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