Spindle Cell Lesions of the Breast: Avoiding Perilous Pitfalls

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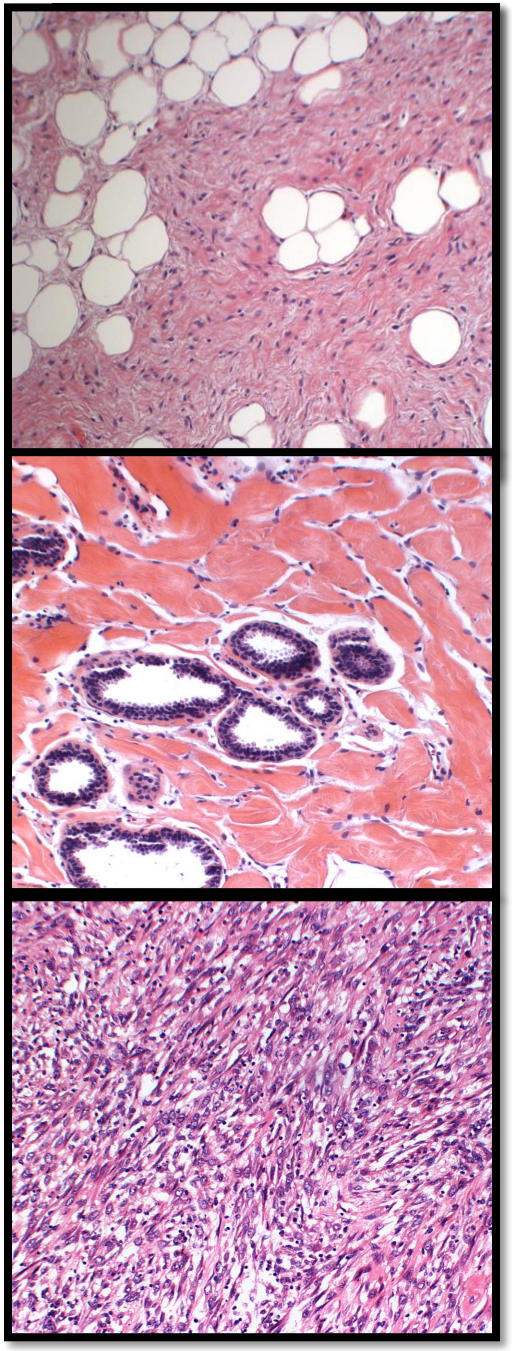
Susan C. Lester, M.D., Ph.D.

Breast Pathology Services
Brigham and Women's Hospital
Harvard Medical School
Dana Farber Cancer Institute



Spindle Cell Lesions of the Breast

Rare - <5% of all clinically detected lesions.

Detected as palpable or image detected masses.

The margins can be circumscribed, spiculated, or ill-defined.

Includes hyperplasias, benign neoplasms, and malignant tumors.

BREAST – (pure) spindle cell lesions

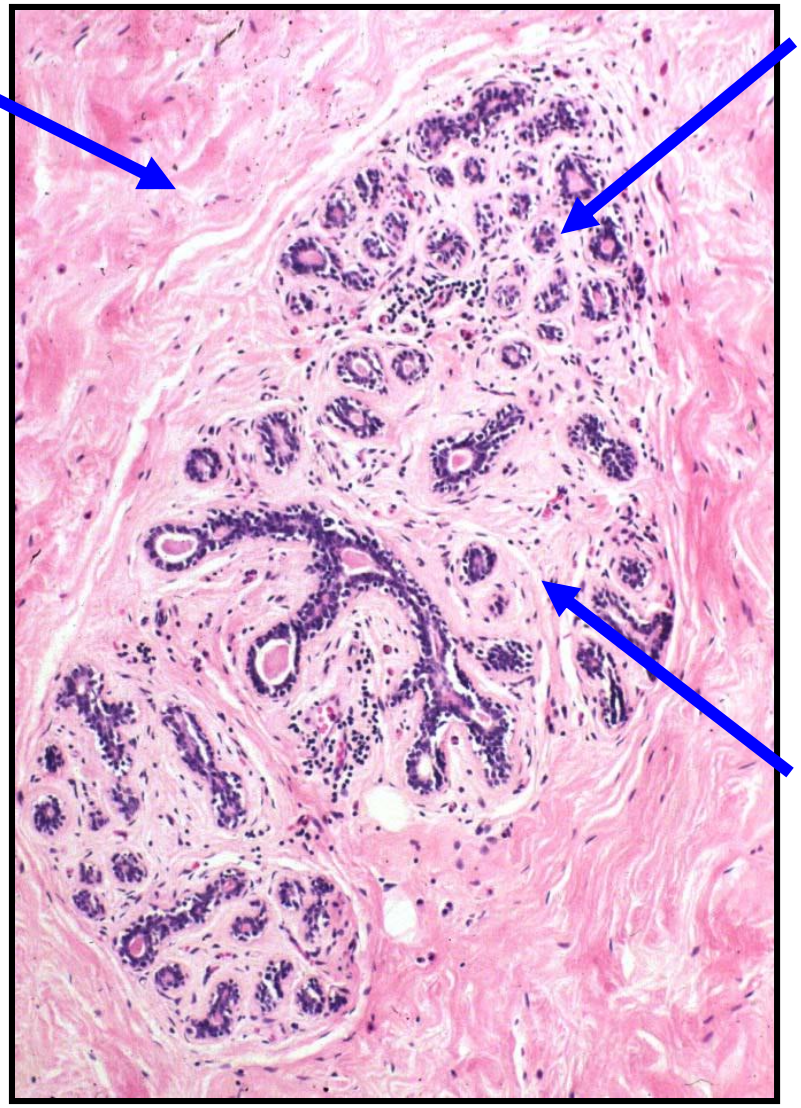
Interlobular stroma

CD34(+) family:

Reactive changes
Pseudoangiomatous stromal hyperplasia (PASH)
Myofibroblastoma
Sarcoma

CD34(-) family:

Fibromatosis
Nodular fasciitis



Epithelium

Spindle cell carcinoma

Biphasic:

Intralobular stroma

Fibroadenomatoid change
Fibroadenoma
Phyllodes tumor

BREAST – (pure) spindle cell lesions

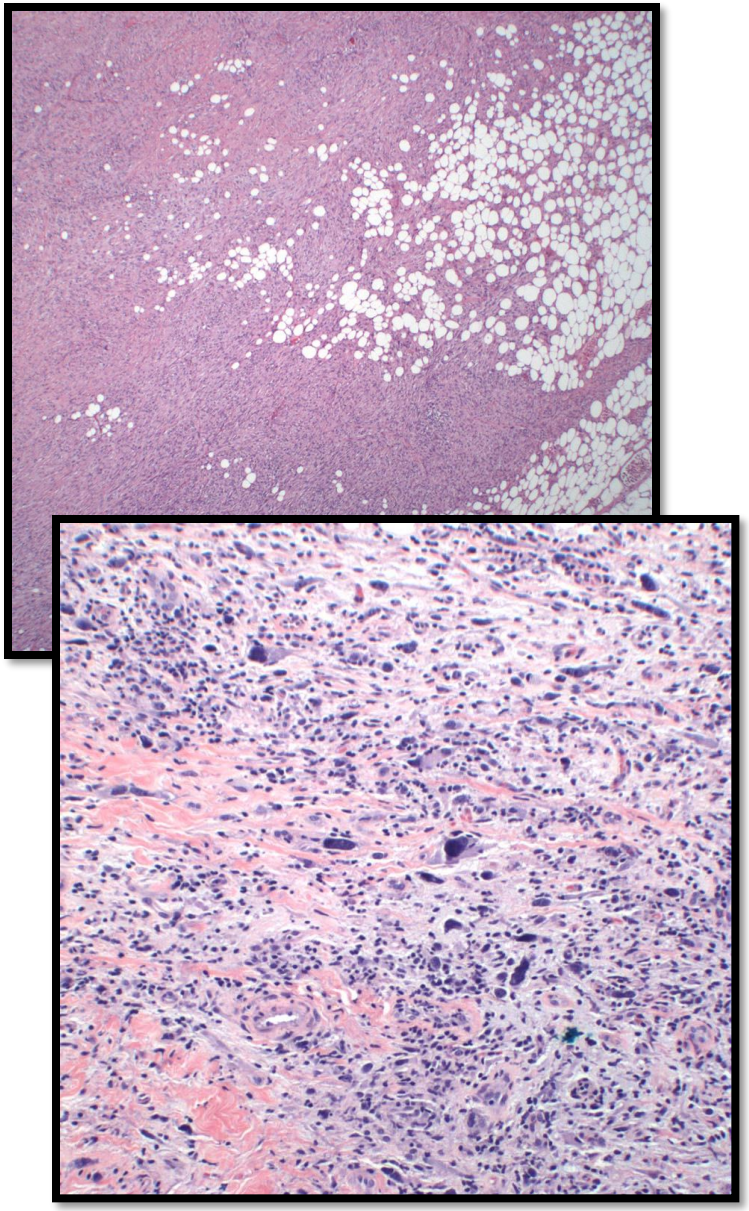
Learning Objectives:

Malignant spindle cell lesions

Perilous pitfalls: benign lesions that mimic malignant lesions

Perilous pitfalls: malignant lesions that mimic benign lesions

Malignant Spindle Cell Lesions



Usually present as a large (≥2 cm) palpable mass with spiculated margins.

Highly cellular (fascicular growth pattern)

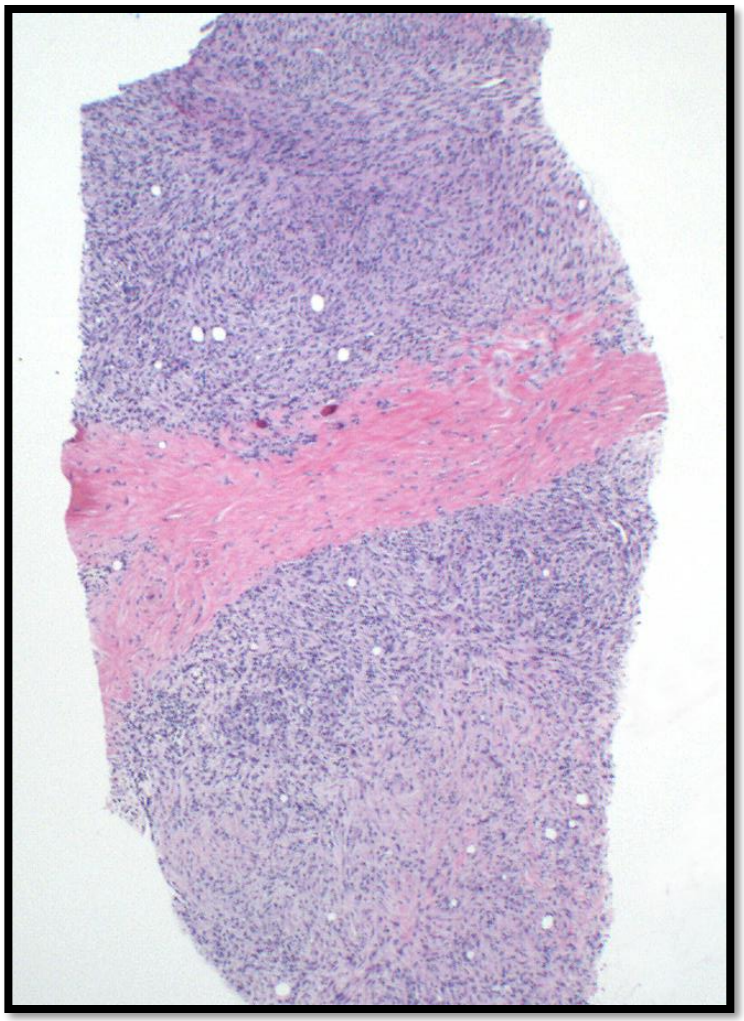
Infiltrates around normal ducts and lobules

Nuclear pleomorphism

Mitoses

+/- necrosis

Case received for consultation



Malignant spindle cell neoplasm on core needle biopsy of the breast.

Immunoperoxidase studies are performed:

Cytokeratin AE1/AE3 negative

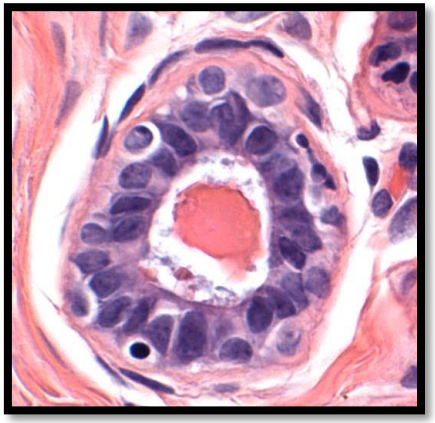
Vimentin positive

Question for consultant: What kind of sarcoma is this?

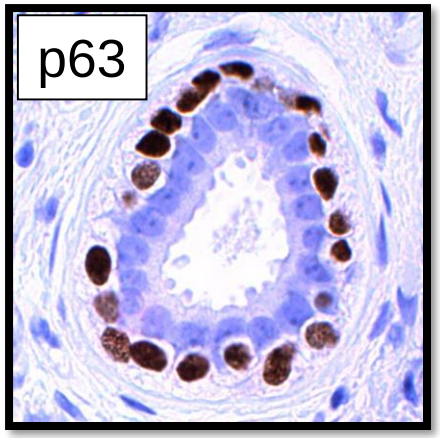
Differential diagnosis of malignant spindle cell lesions of the breast:

1) Spindle cell carcinoma
2) Spindle cell carcinoma
3) Spindle cell carcinoma
4) Spindle cell carcinoma
5) Spindle cell carcinoma
6) Spindle cell carcinoma
7) Spindle cell carcinoma
8) Malignant phyllodes tumor with stromal overgrowth (<1% of breast tumors)
9) Metastasis to the breast (primary usually known)
10) Sarcoma (<0.1% of breast tumors)

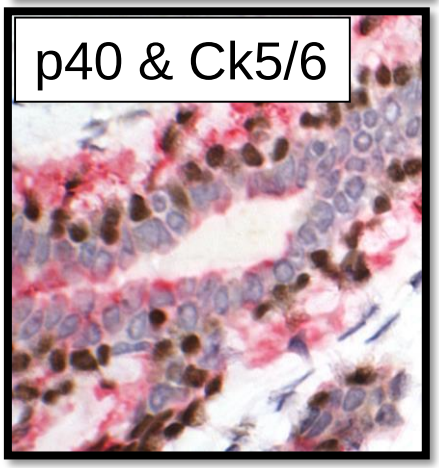
Malignant phyllodes tumors, metastases, and sarcomas are exceedingly rare.



Spindle cell carcinomas often express proteins found in myoepithelial cells and/or squamous cells:



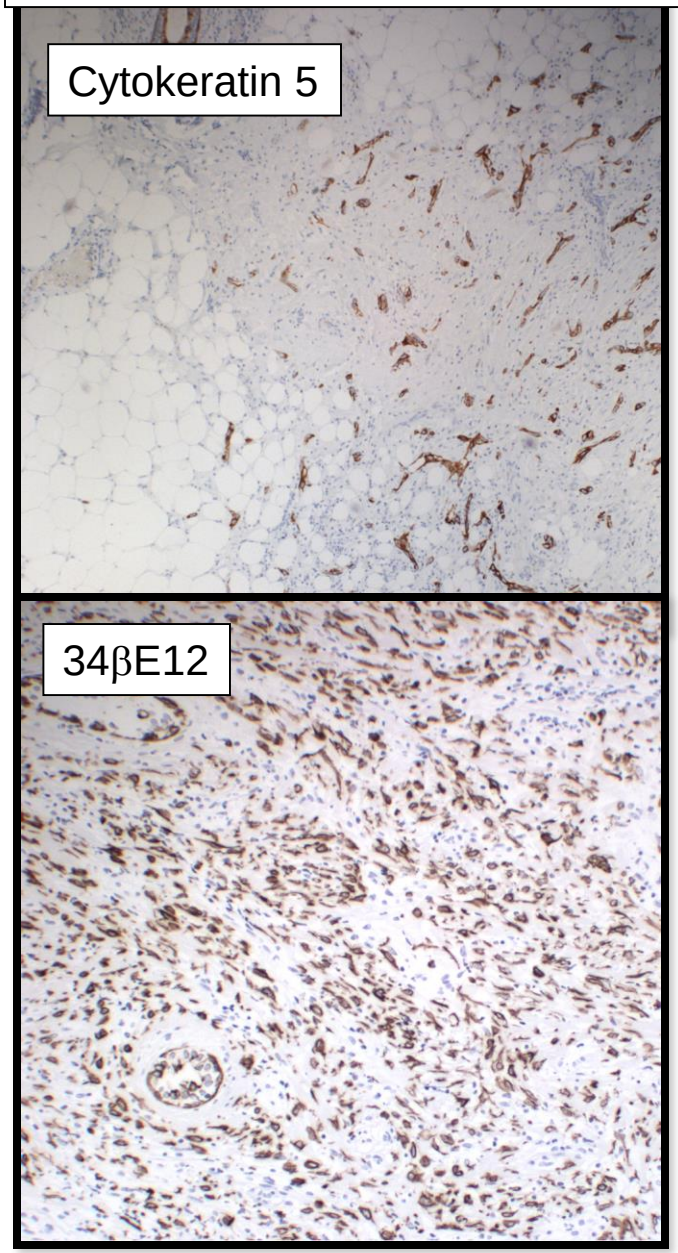
p63 (or p40)



High molecular weight (HMW) basal keratins CK14 and CK17 or keratins 5 and 6

PAN-K (MNF-116) – includes CKs 5, 6, 17
34βE12 (903) – includes CKs 5 and 14

Spindle cell carcinoma – IHC for keratins

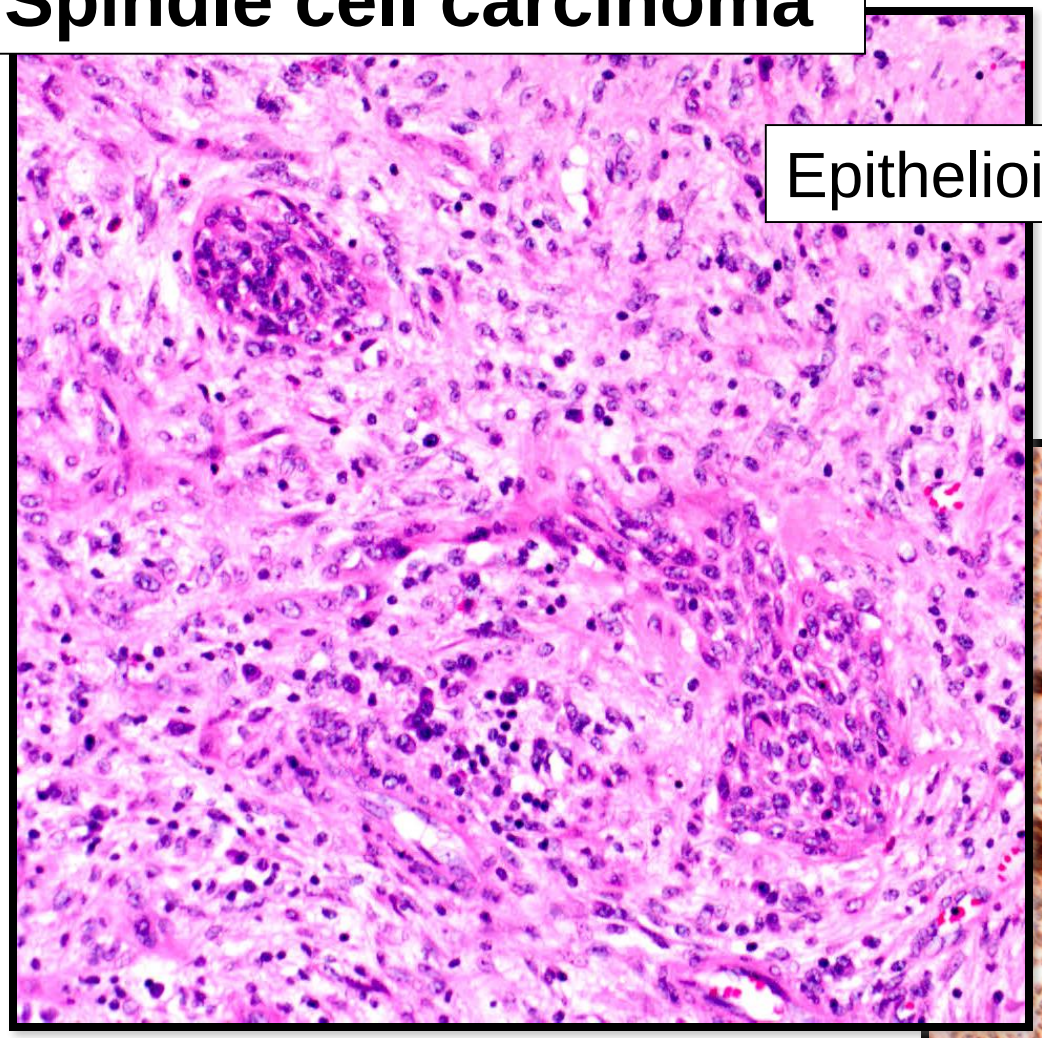


Antibodies for HMW keratins (e.g. PAN-K and 34βE12) are more likely to be positive than antibodies for low molecular weight (LMW) keratins (e.g. AE1/AE3, CAM5.2, cytokeratin 7).

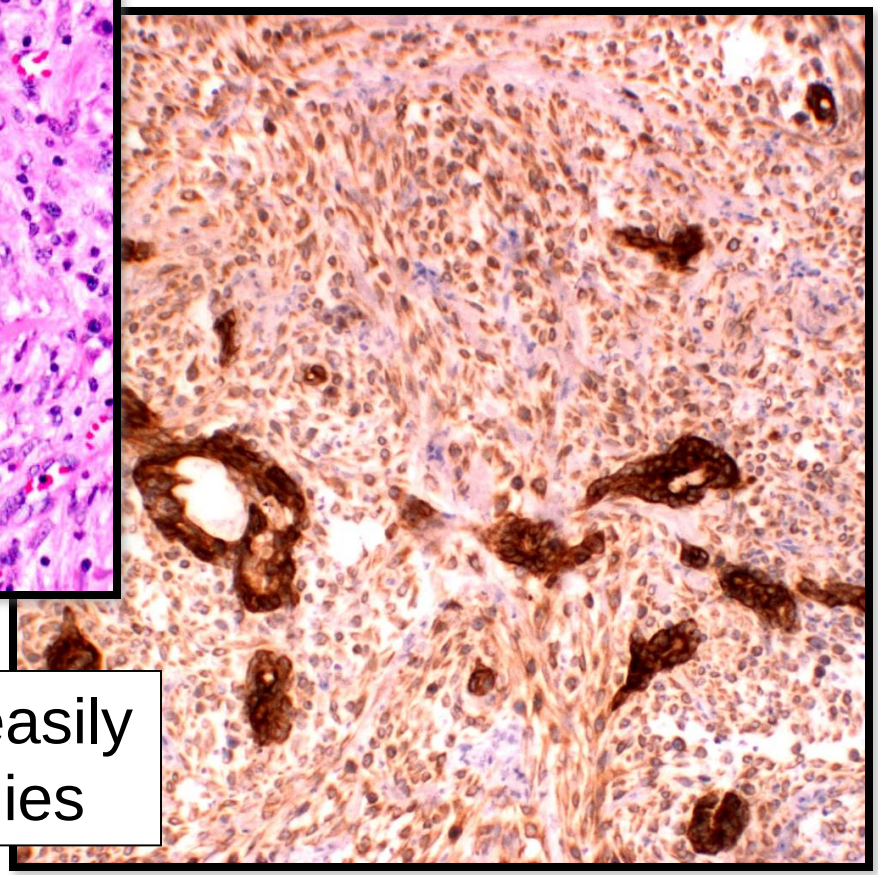
However, both HMW and LMW keratins should be tried before concluding a lesion is negative for keratins.

Positivity can be focal and weak.

Spindle cell carcinoma

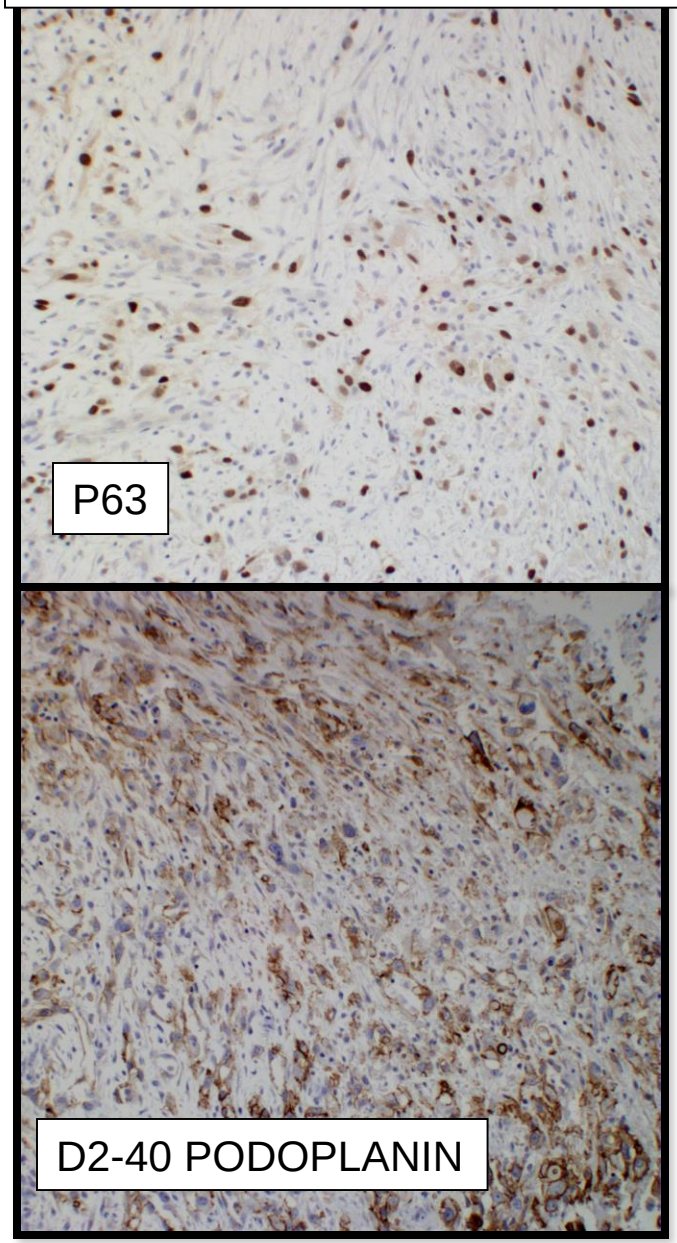


Epithelioid areas may be present.



These areas may be more easily appreciated with keratin studies

Spindle cell carcinoma - IHC



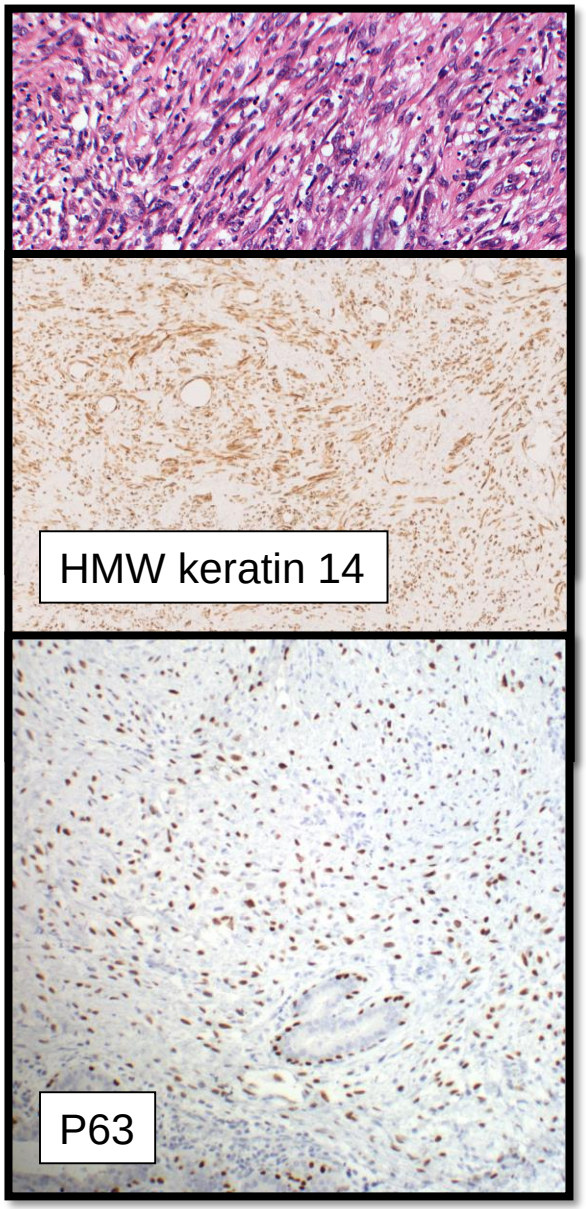
p63 (or p40) is a useful marker that will be positive in 1/3 to 2/3 of cases.

Some of these carcinomas will also be positive for other myoepithelial markers including muscle markers, CD10, and P-cadherin.

D2-40 (podoplanin) can be positive in myoepithelial cells, some triple negative carcinomas, and angiosarcomas.

Vimentin can be positive in carcinomas and is not useful.

Case received for consultation



Additional studies were performed:

Positive for HMW keratins.

Positive for p63.

Diagnosis: Spindle cell carcinoma

Spindle Cell Carcinoma of the Breast

Classified as a type of “metaplastic” carcinoma.

> Avoid “sarcomatoid carcinoma”, “carcinosarcoma”, and “carcinoma with pseudosarcomatous metaplasia” as these terms are confused with true sarcomas.

Heterologous mesenchymal differentiation can be present (e.g. osseous or rhabdomyoid). More common than true sarcomas.

Features can overlap with squamous cell carcinoma.

Epithelioid areas and DCIS may be present.

>95% are negative for hormone receptors and HER2 (“triple negative breast cancer”).

Carter MR, Hornick JL, Lester SC, Fletcher CD. Spindle cell carcinoma of the breast. Am J Surg Pathol 30:300-309, 2006.

Spindle Cell Carcinoma of the Breast

Rare: ≤ 1% of all invasive breast cancers.

Almost never metastasizes to lymph nodes.

However, distant metastases to lung and brain are common.

Response to chemotherapy is lower than that of other triple negative breast cancers.

Death rate is high: ~40% at <5 years.

Malignant Phyllodes Tumor

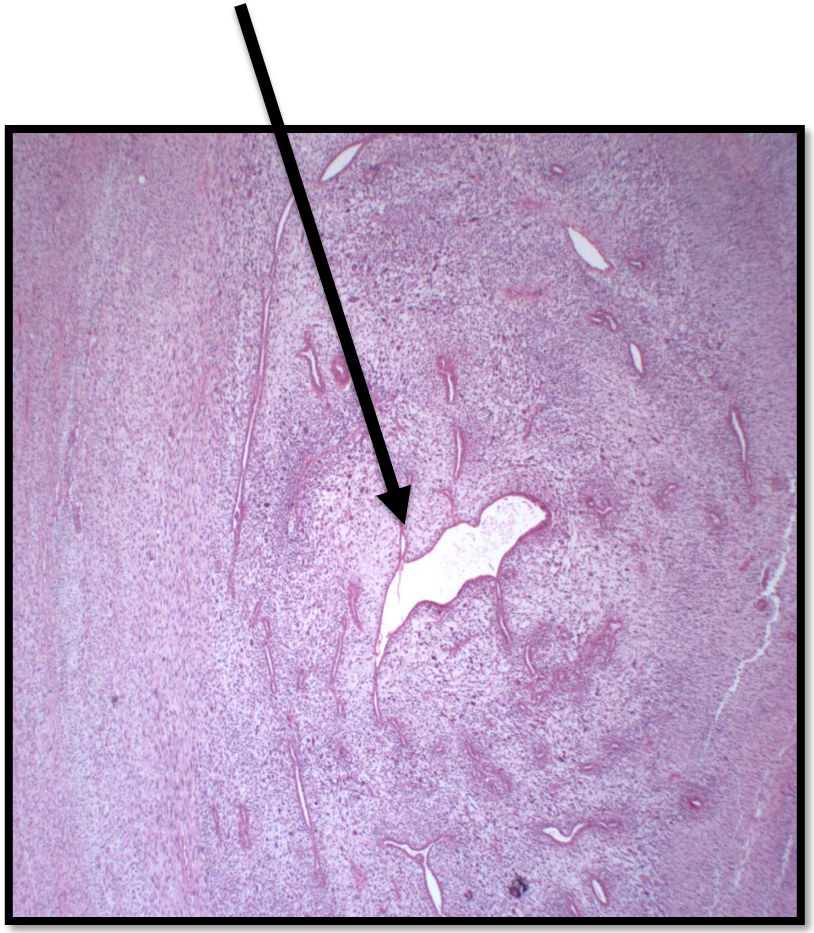
Second most common malignant spindle cell neoplasm of the breast.

Extensive sampling may be necessary to identify a benign epithelial component.

Malignant heterologous elements may be present (e.g. liposarcomatous or chondroid).

IHC is only helpful to exclude other possible diagnoses.

Rare lesions are focally keratin or p63 positive.



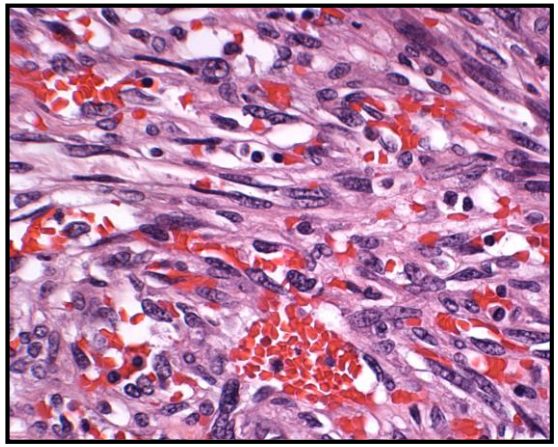
Chia, Y, et al, Stromal keratin expression in phyllodes tumours of the breast, J Clin Pathol 65:339-347, 2012.

Sarcoma

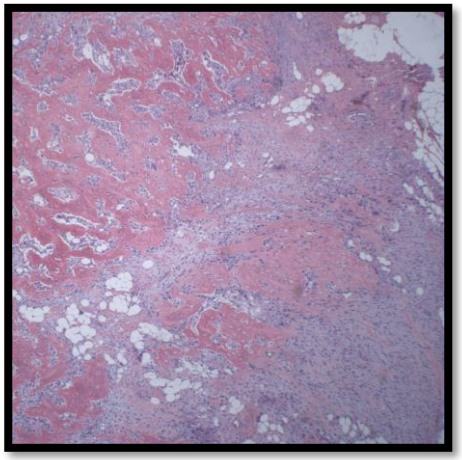
Rarely diagnosed unless a specific type of sarcoma can be recognized.

Often a diagnosis of exclusion.

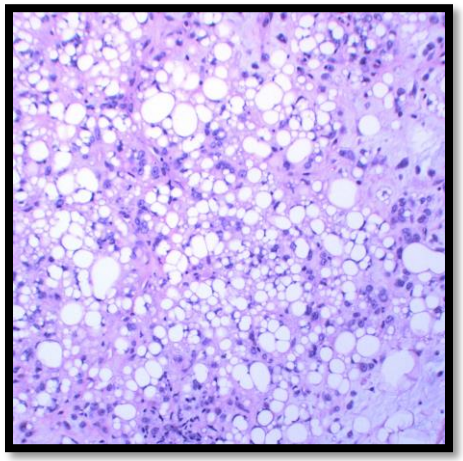
Angiosarcomas are the most common type (primary and secondary).



Angiosarcoma



Osteosarcoma



Liposarcoma

BREAST – (pure) spindle cell lesions

Learning Objectives:

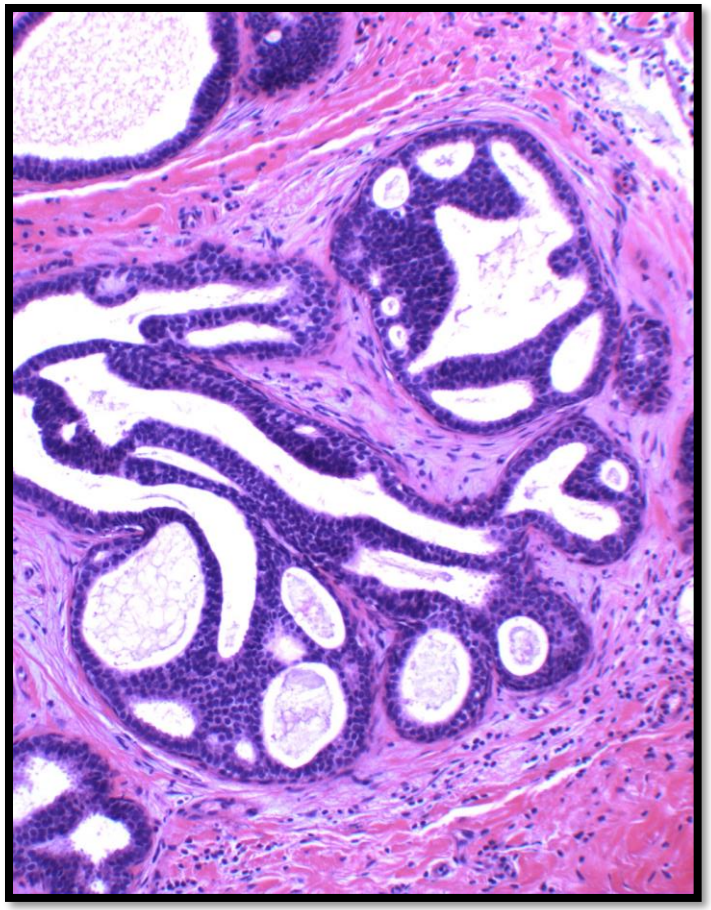
Malignant spindle cell lesions

Perilous pitfalls: benign lesions that mimic malignant lesions

Reactive spindle cell nodule vs sarcoma
PASH or PEH vs angiosarcoma
Myofibroblastoma vs invasive lobular carcinoma

Perilous pitfalls: malignant lesions that mimic benign lesions

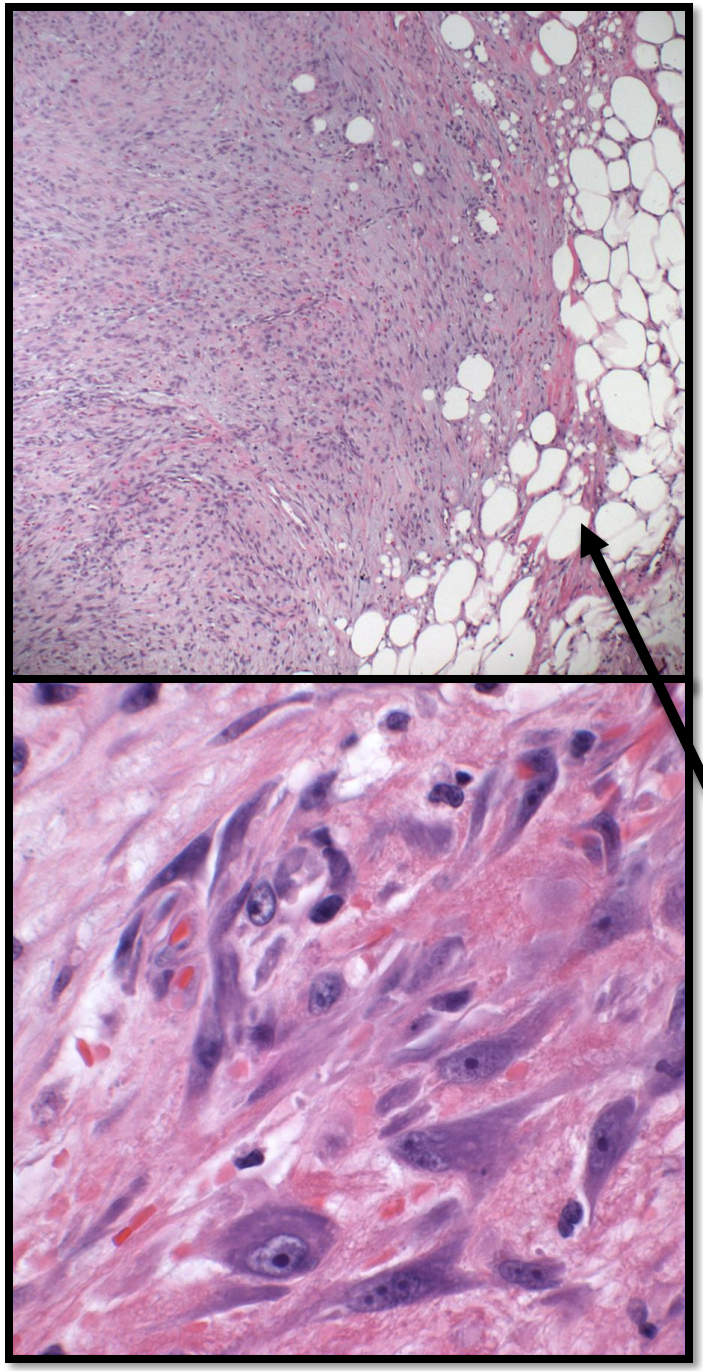
Mimic #1



A woman underwent a core needle biopsy for calcifications.

The biopsy showed atypical ductal hyperplasia (ADH) associated with calcifications.

Excision was recommended.



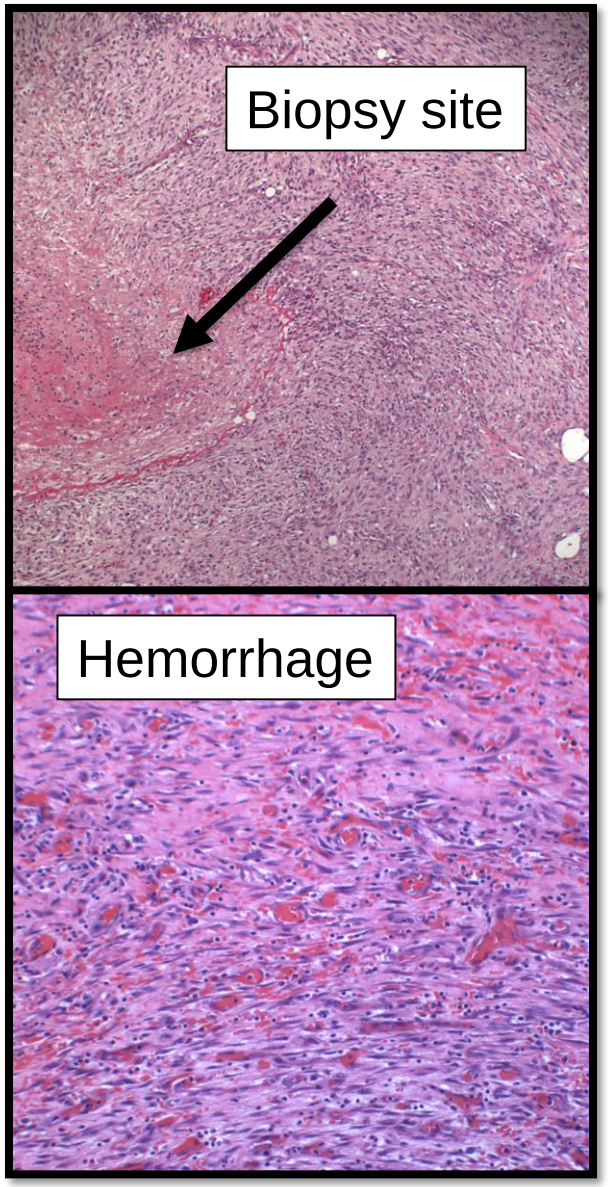
In the excision, a diagnosis of a “malignant fibroblastic tumor” was made.

There was a 0.9 cm spindle cell proliferation that extended into adjacent breast tissue.

Nuclear atypia and scattered mitoses were present.

Note the presence of adjacent fat necrosis.

Mimic #1: Reactive spindle cell nodule



An exuberant myofibroblastic reaction, usually 2-4 weeks after a biopsy.

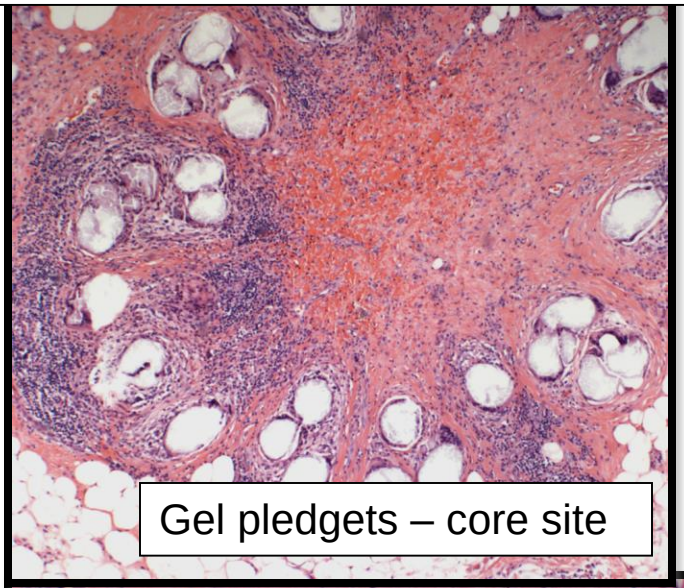
Hemorrhage, fat necrosis, inflammation, giant cells, and foreign material are usually present.

Majority are 0.1 to 1 cm in size – such a small size would be very unusual for a malignant spindle cell lesion.

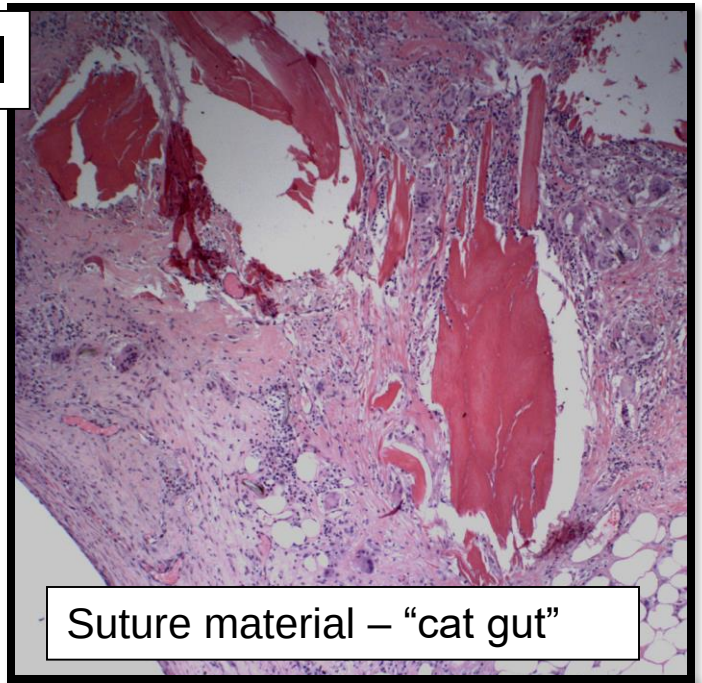
It is highly unlikely that a sarcoma would be clinically and radiologically occult.

Gobbi, H, et al. Reactive cell nodules of the breast after core biopsy or fine needle aspiration. Am J Clin Pathol 113:288-294, 2000.

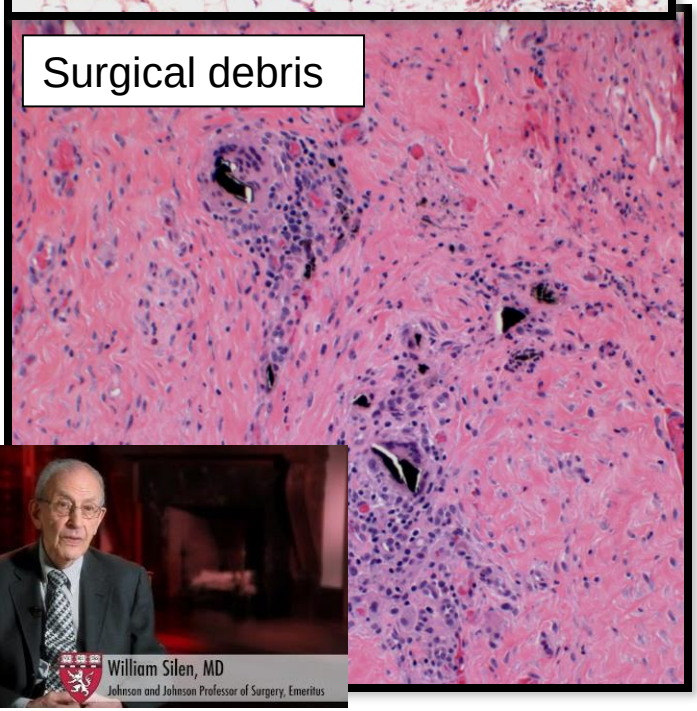
Biopsy sites – foreign material



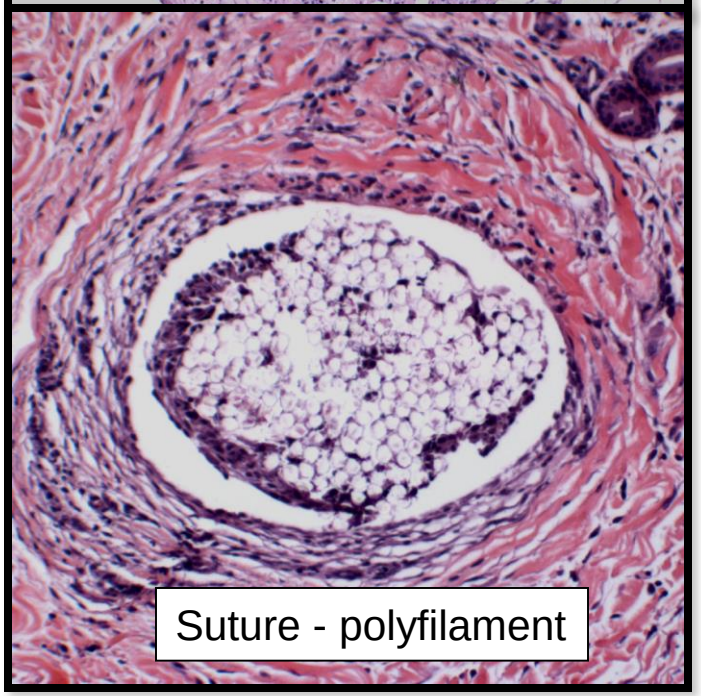
Gel pledgets – core site



Suture material – “cat gut”



Surgical debris

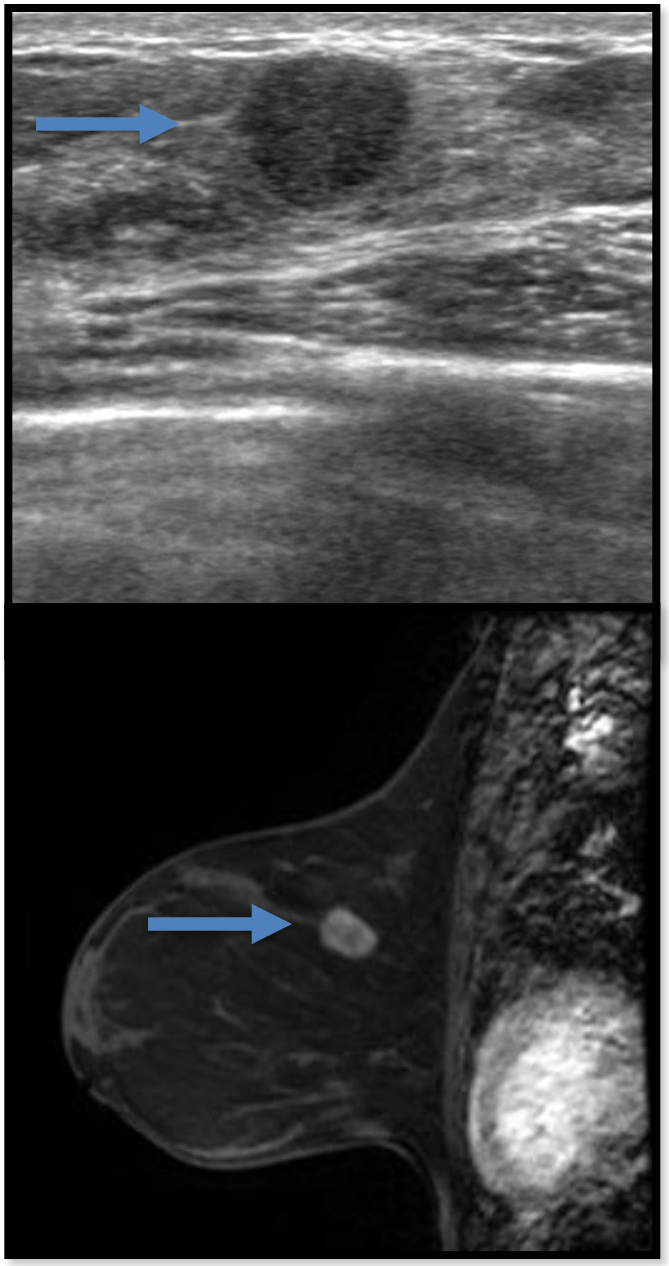


Suture - polyfilament

Reactive Spindle Cell Nodule vs Sarcoma

Feature	Reactive Spindle Cell Nodule	Sarcoma
Location	At prior biopsy site	Biopsy site may be present, but the lesion is much larger
Size	Small (usually <1 cm)	Usually large (>2 cm)
Incidental	Yes	Never
Biopsy site changes	Majority of lesion (hemosiderin, hemorrhage, foreign material)	May be focal
Involvement of normal breast tissue	Usually limited	Usually extensive
Mitoses	May be present – usually rare	Typically present – may be frequent
Muscle markers (SMA, desmin)	Usually positive	May be positive

Mimic #2



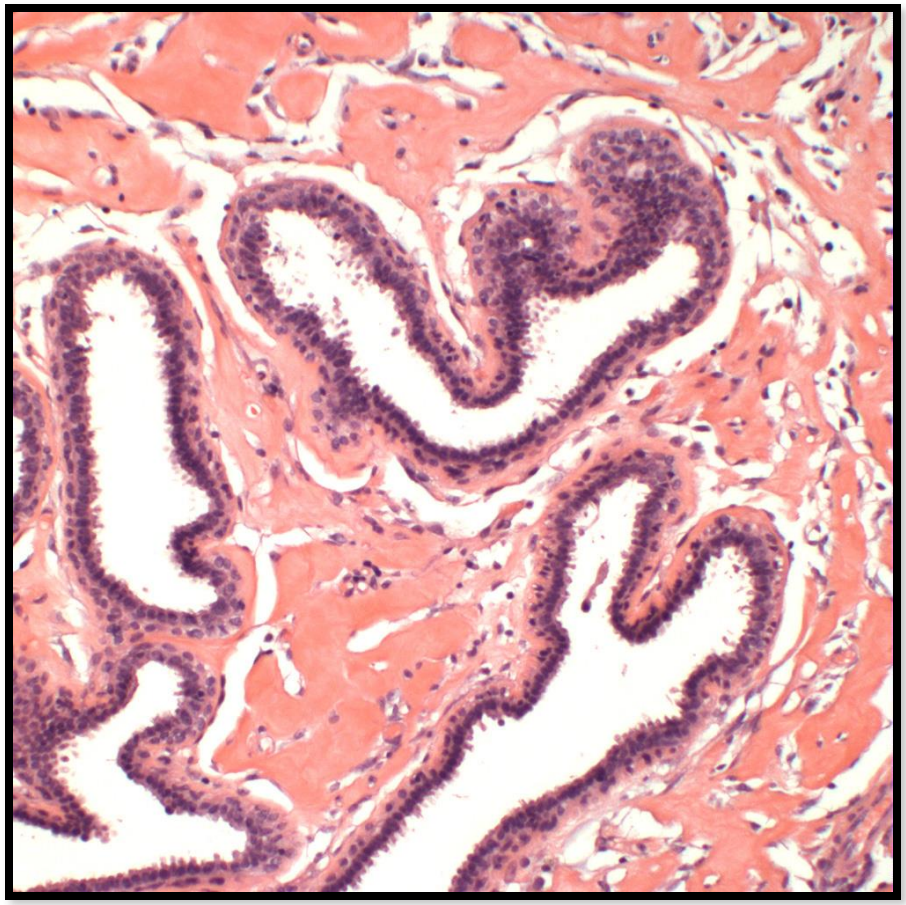
A 34 year old woman presented with a 1.4 cm palpable breast mass.

Ultrasound showed a mass with circumscribed margins.

MRI showed an enhancing mass with circumscribed margins.

A core needle biopsy was performed.

Mimic #2

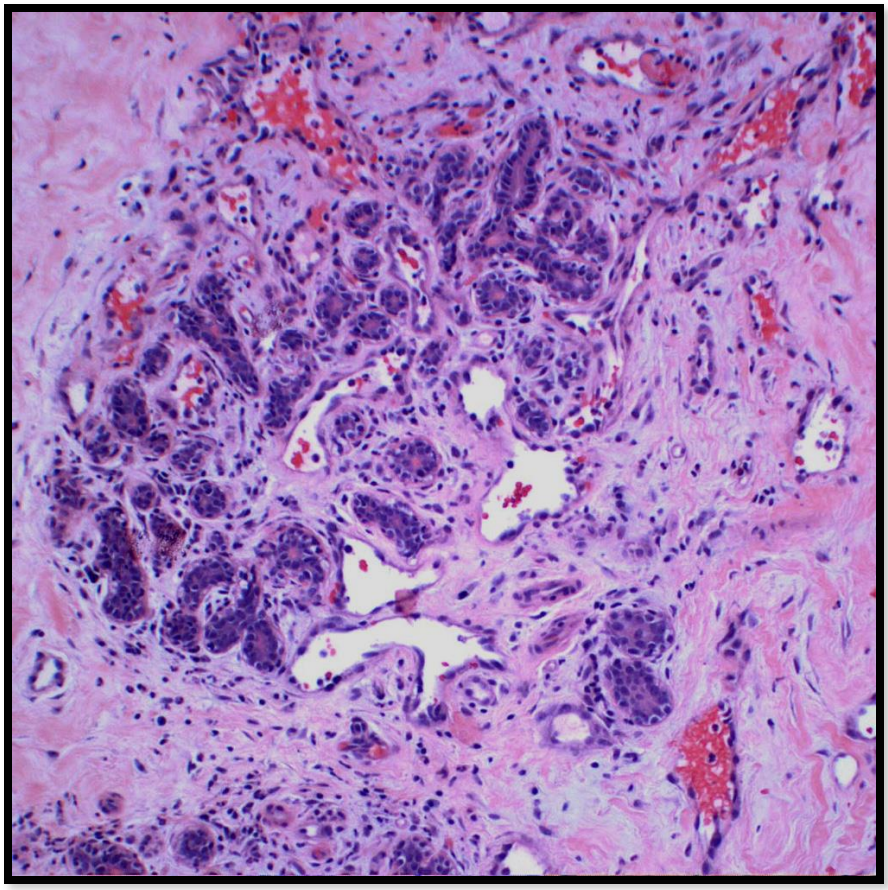


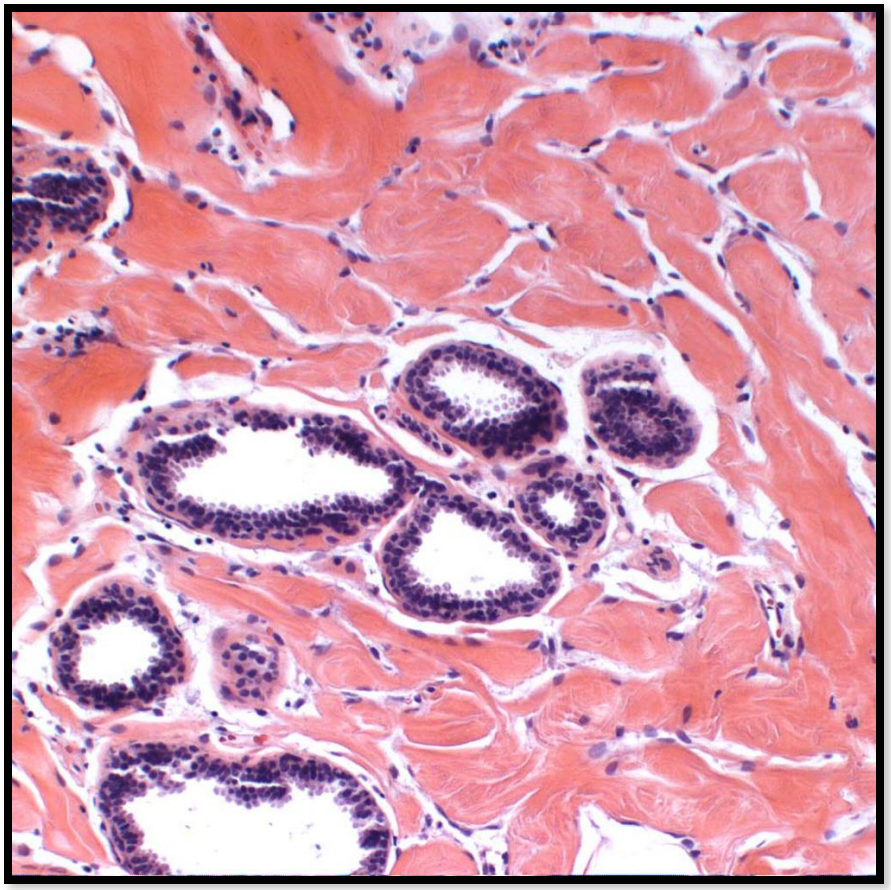
Anastomosing spaces are present dissecting stroma around epithelial structures.

Angiosarcoma or pseudoangiomatous stromal hyperplasia (PASH)?

PASH vs Angiosarcoma

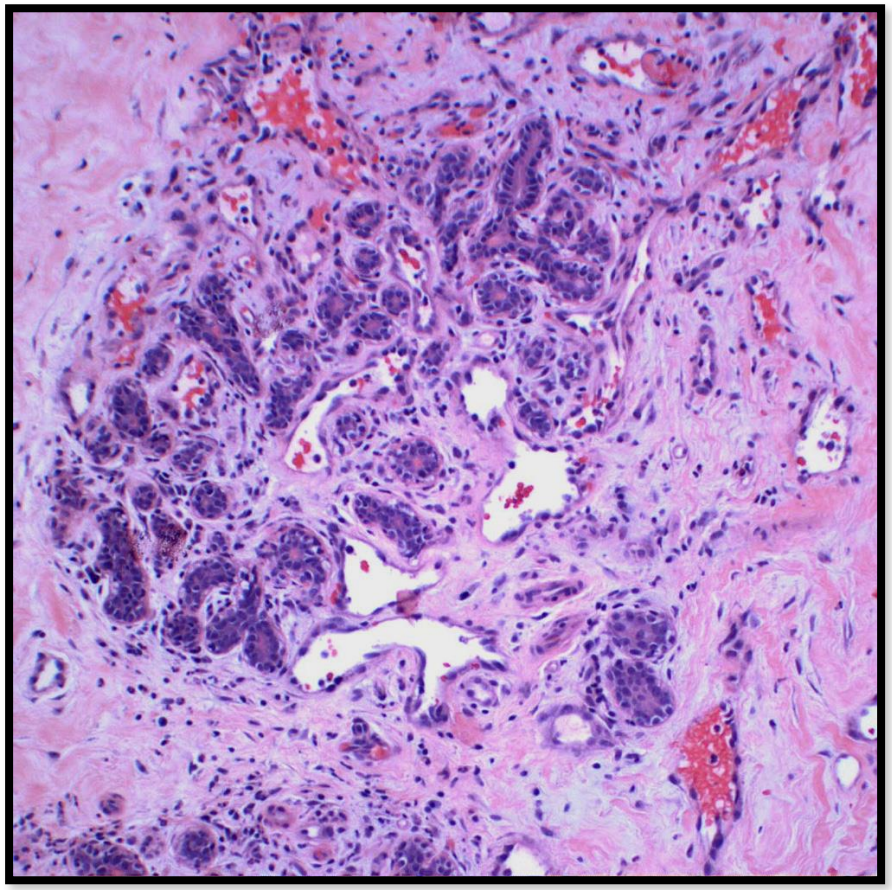
Which one is the angiosarcoma?

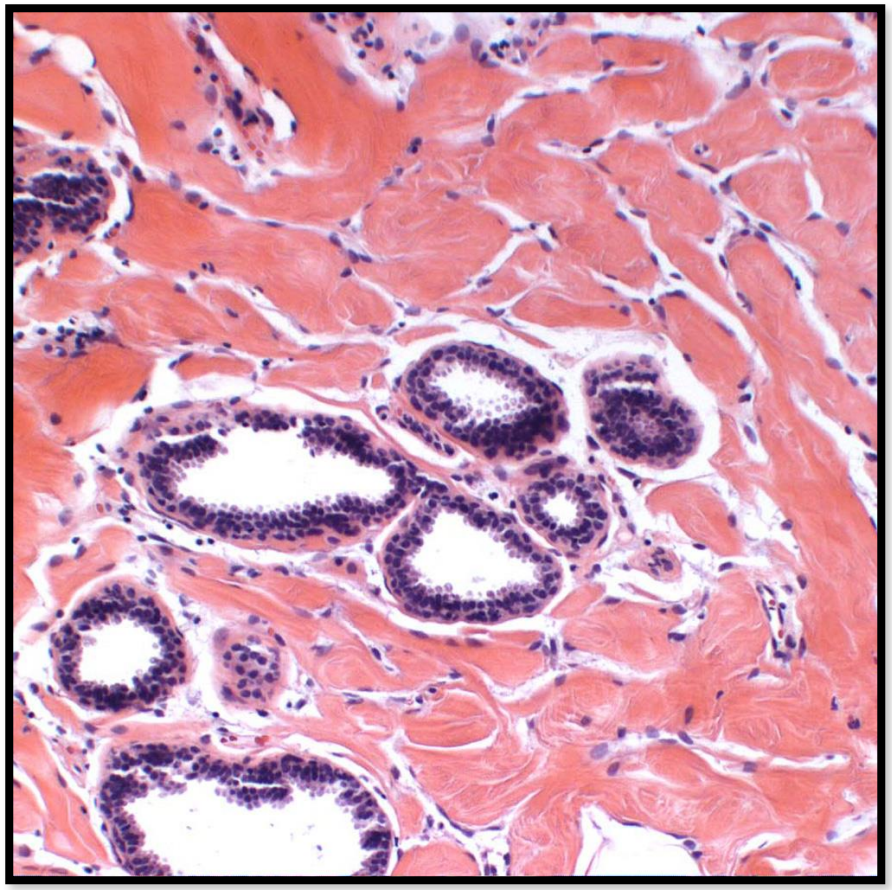




PASH vs Angiosarcoma

Which one is the angiosarcoma?





Angiosarcoma

PASH
Rarely mistaken for angiosarcoma

PASH – Clinical Features

Age: Premenopausal women or older women with hormone replacement therapy.

Presentation: Circumscribed or ill-defined mass – palpable or detected on imaging.

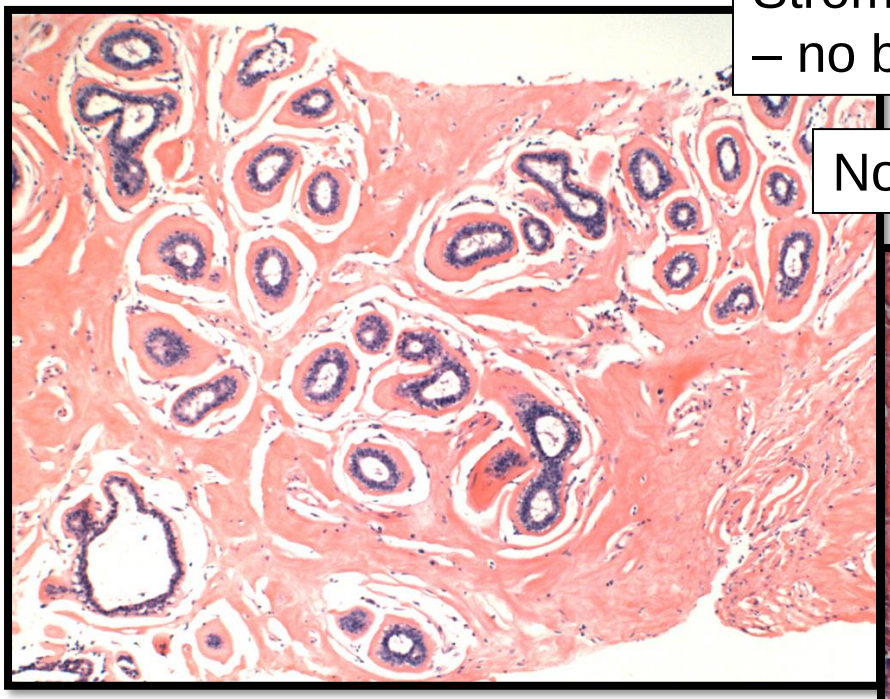
Common stromal change – incidental finding in at least 23% of biopsies.

Similar stromal changes occur in gynecomastia and juvenile hypertrophy.

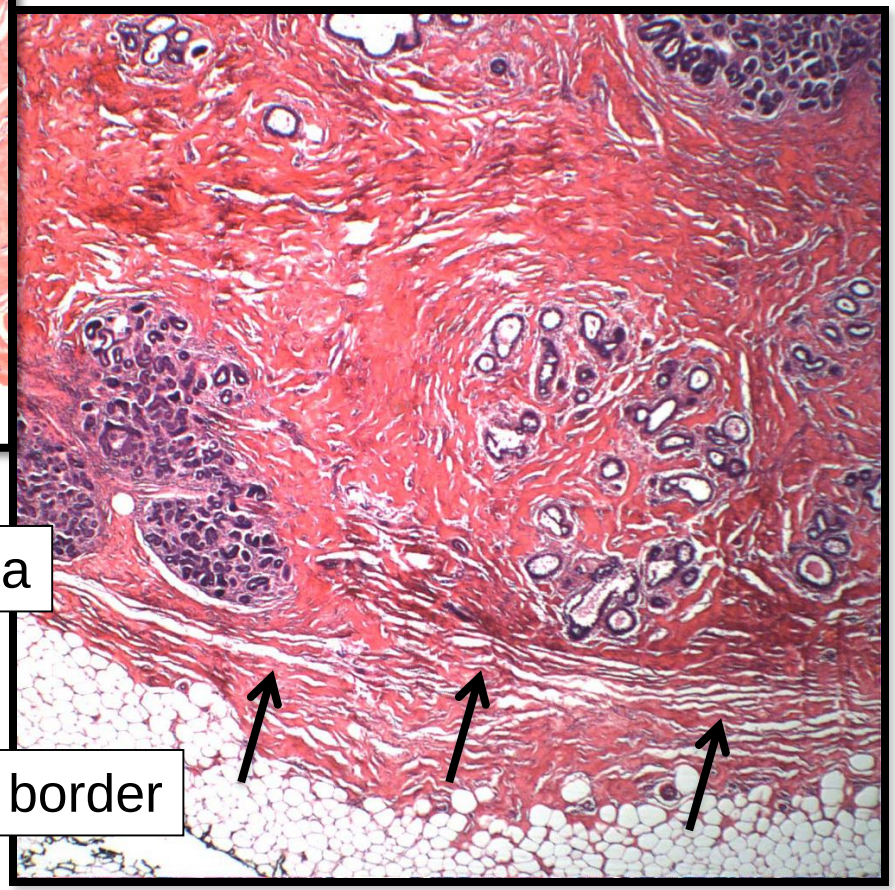
Outcome: Benign – no treatment necessary.

PASH – Pathologic Features

Stromal clefts lined by bland myofibroblasts – no blood is present.



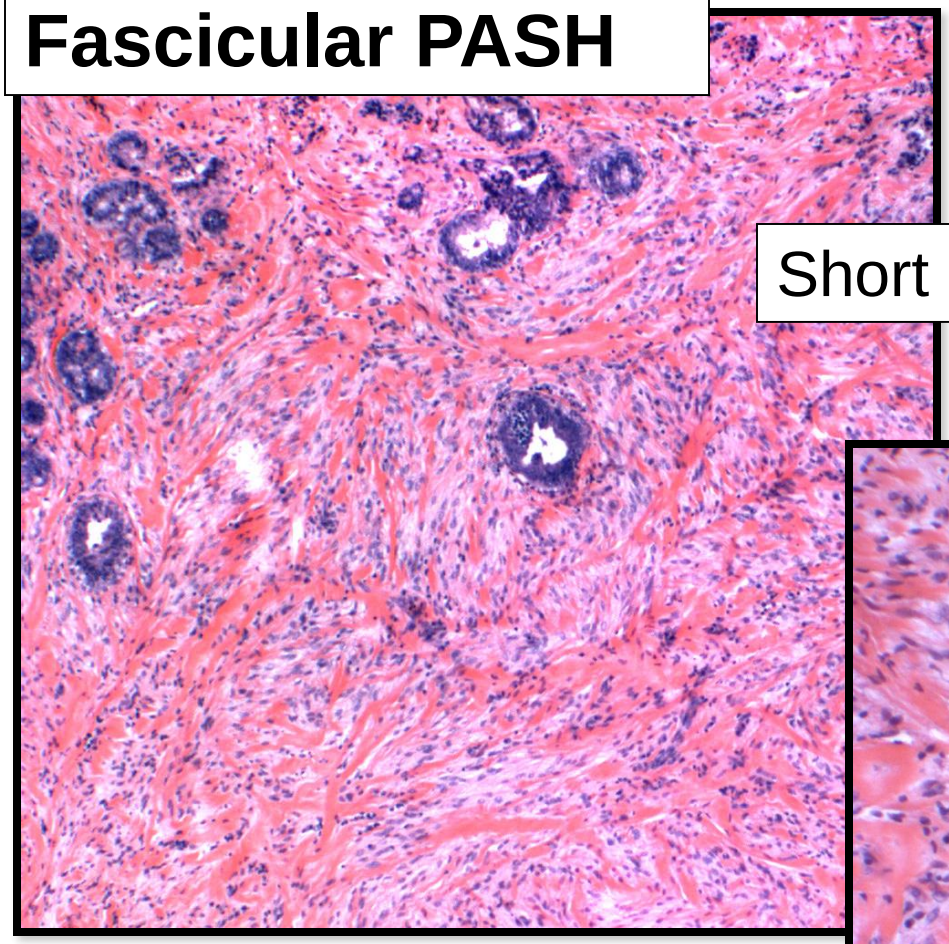
No nuclear atypia, tufting, or mitoses.



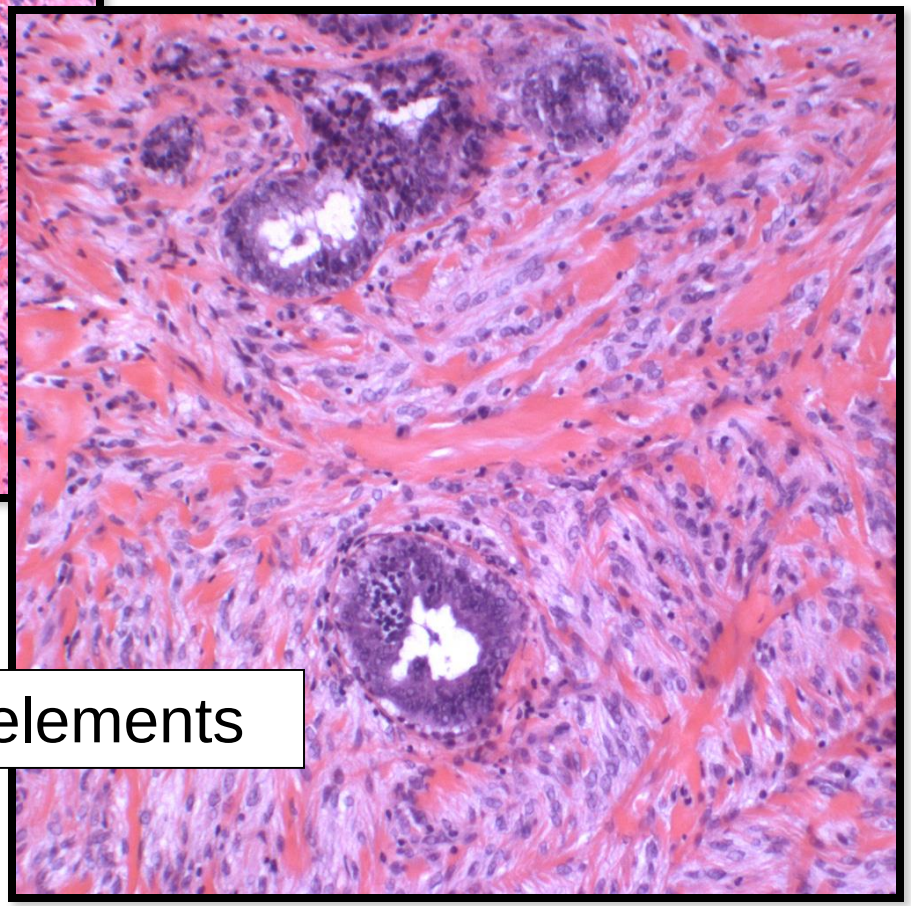
Involves inter and intralobular stroma

Circumscribed border

Fascicular PASH

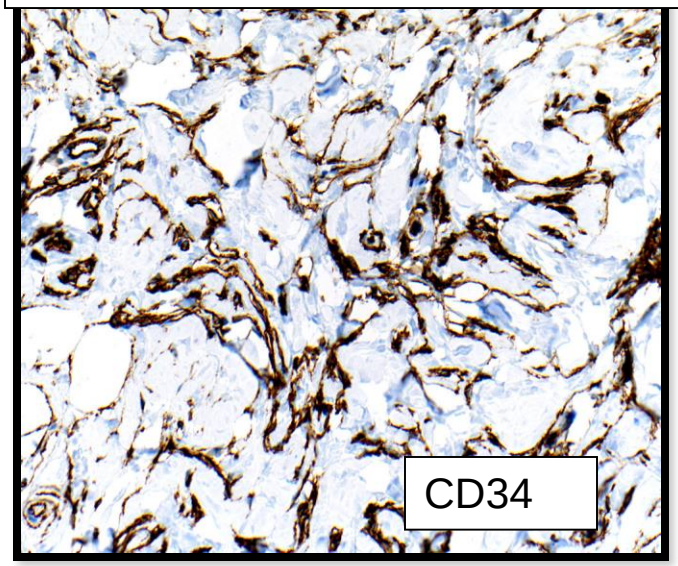


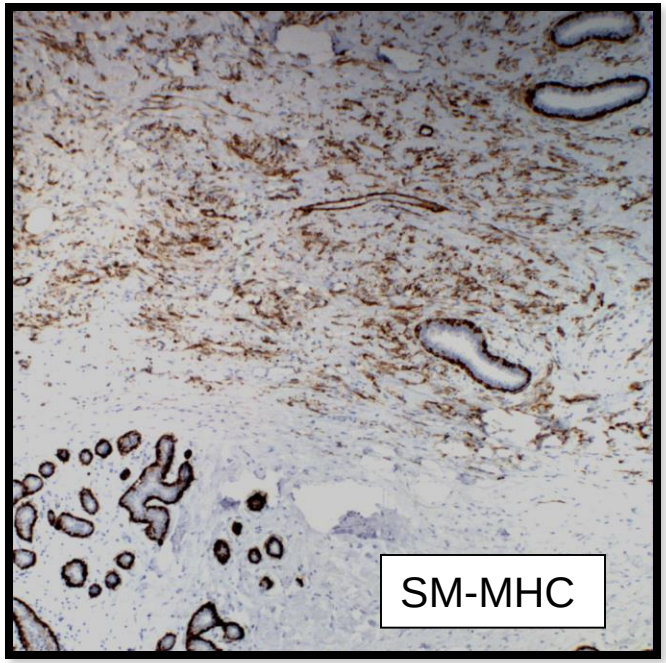
Short bundles of myofibroblasts



Surrounds normal epithelial elements

PASH - Immunohistochemistry



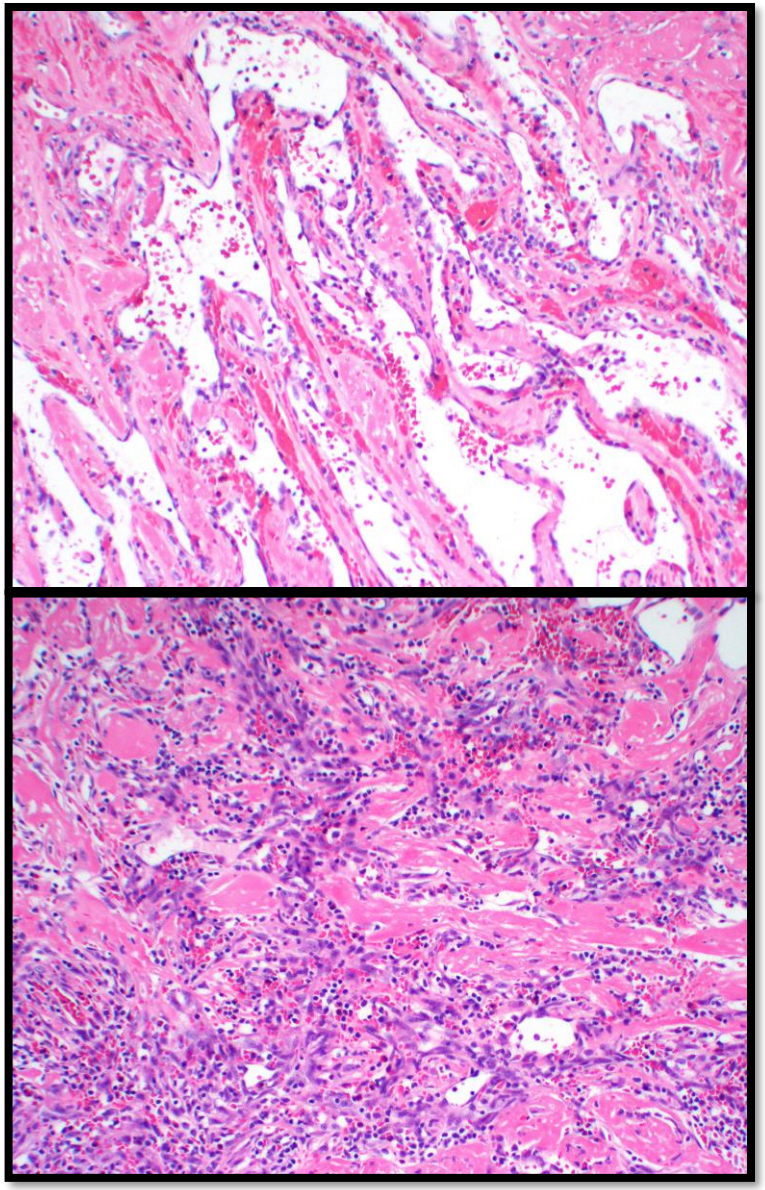


Positive for CD34 and muscle markers.

May be positive for progesterone receptor.

Lacks vascular markers (ERG, CD31, others)

Mimic #2 – Yet another lesion . . .



A 73 year old man was diagnosed with poorly differentiated breast cancer and underwent mastectomy and sentinel node biopsy. He did not receive radiation.

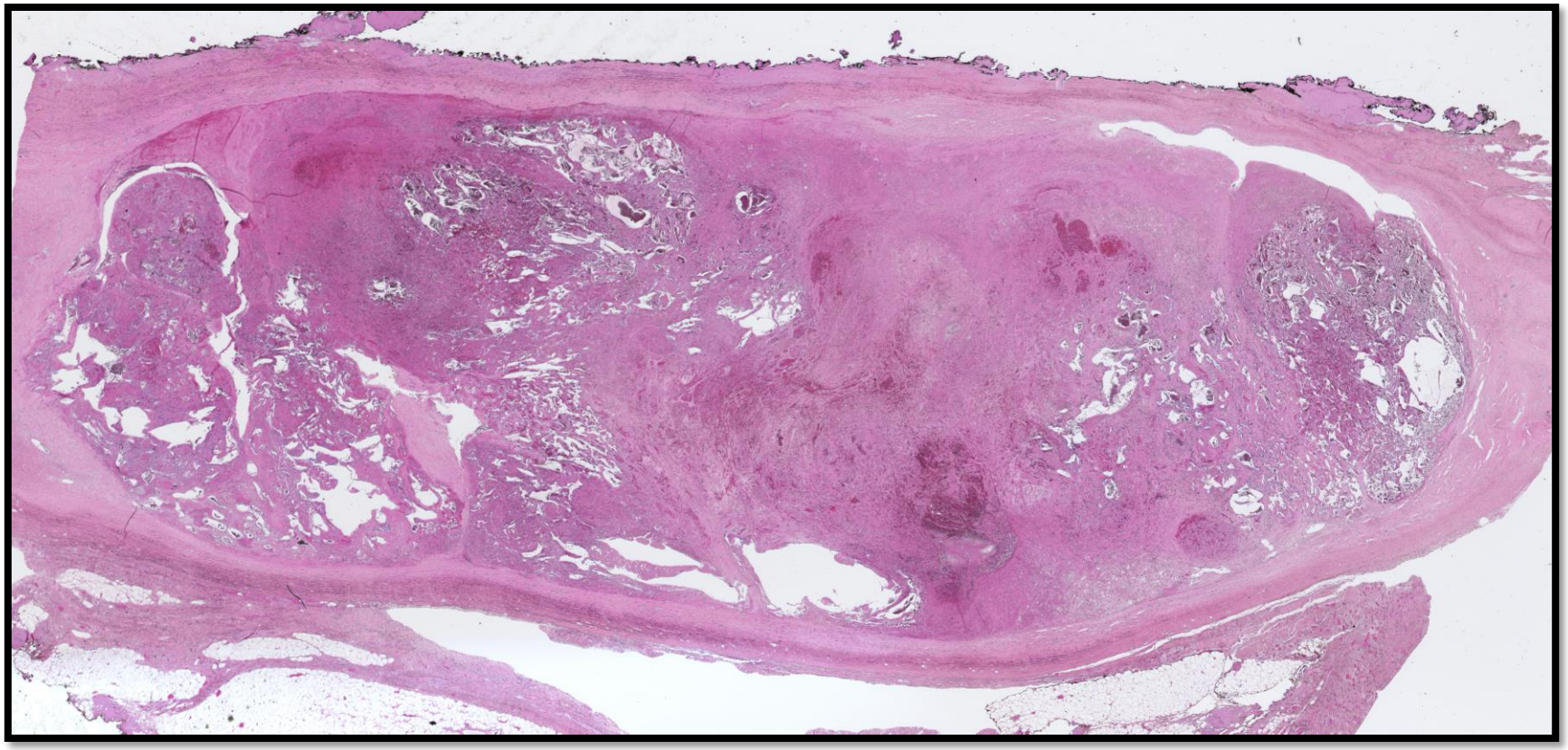
He presented with an enlarging palpable 5 cm axillary mass 2 years later.

He underwent excision and was diagnosed with angiosarcoma with extensive necrosis. Radiation was recommended.

Another mimic of Angiosarcoma . . . PEH

There was a large organizing hematoma within a fibrous capsule in the axilla.

The ”growth” in size was likely due to recent hemorrhage.



Papillary Endothelial Hyperplasia

Papillary endothelial hyperplasia is also called Masson's lesion and vegetant intravascular hemangioendothelioma.

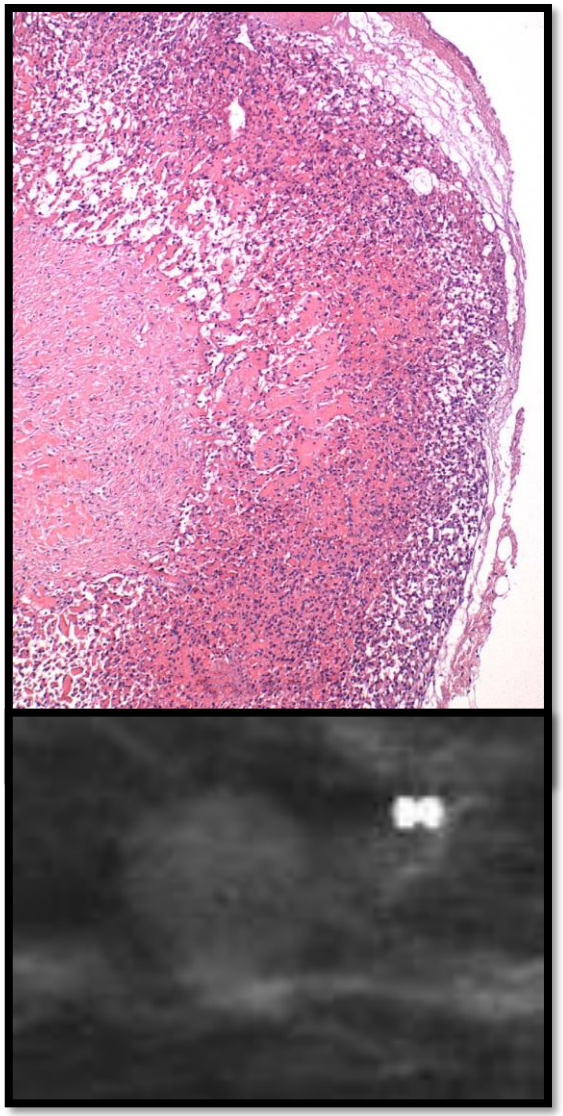
The lesion is due to an exuberant organization of hemorrhage and fibrin by endothelial cells.

The appearance can closely mimic angiosarcoma.

59% of cases of PEH sent to AFIP were due to a concern about angiosarcoma.

Branton PA, et al, Papillary endothelial hyperplasia of the breast: the great imposter for angiosarcoma, Int J Surg Pathol 11:83, 2003.

Papillary Endothelial Hyperplasia (PEH)



Usually small (~1 cm) but can be >2 cm in size.

Can occur at prior surgical sites.

Margins usually well circumscribed.

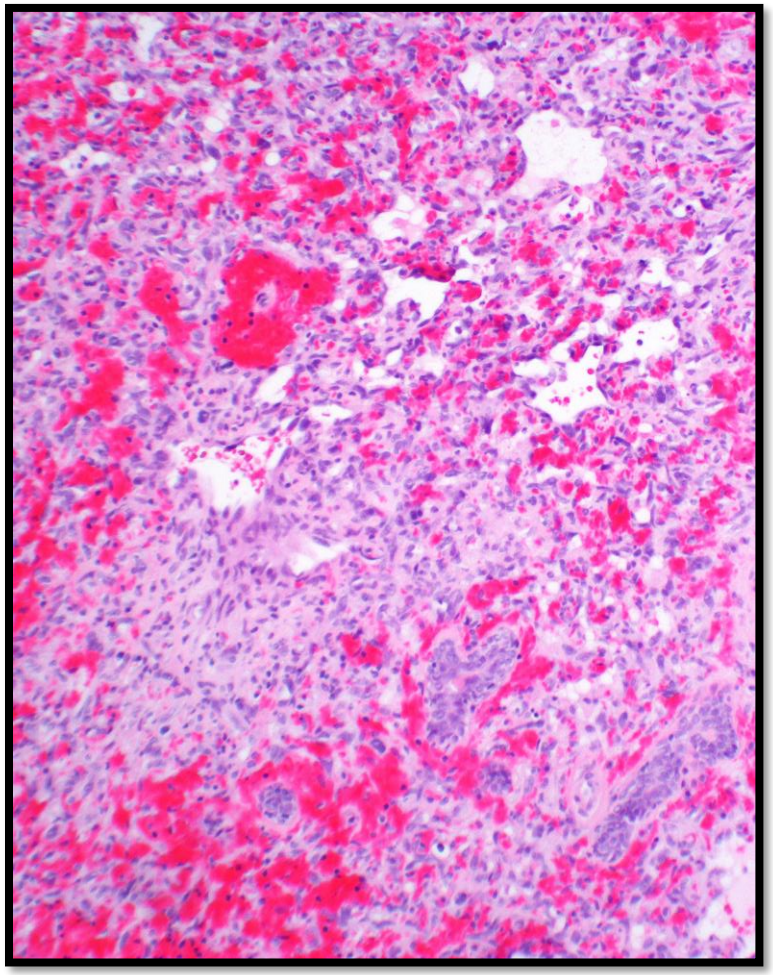
Does not involve adjacent breast tissue.

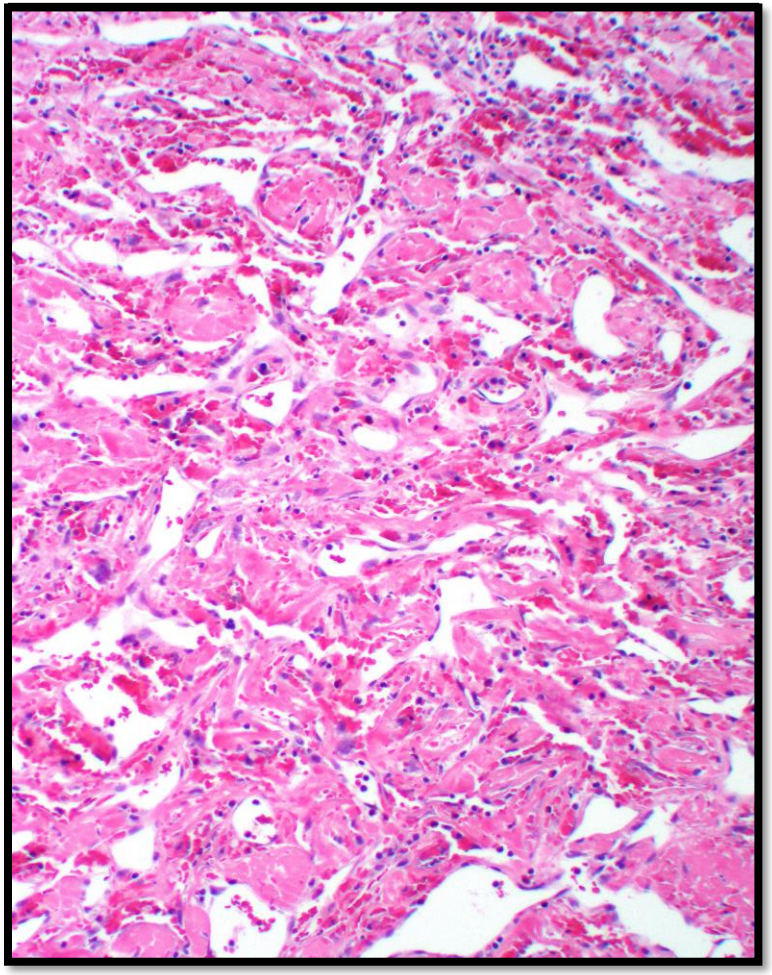
Lesion may disappear or become smaller after core needle biopsy.

Guilbert MD, Frost E, Brock JE, Lester SC. Distinguishing PEH and angiosarcoma on core needle biopsy. Breast J 24:487-492, 2018.

Papillary endothelial hyperplasia vs angiosarcoma

Which one is the angiosarcoma?





Papillary endothelial hyperplasia vs angiosarcoma

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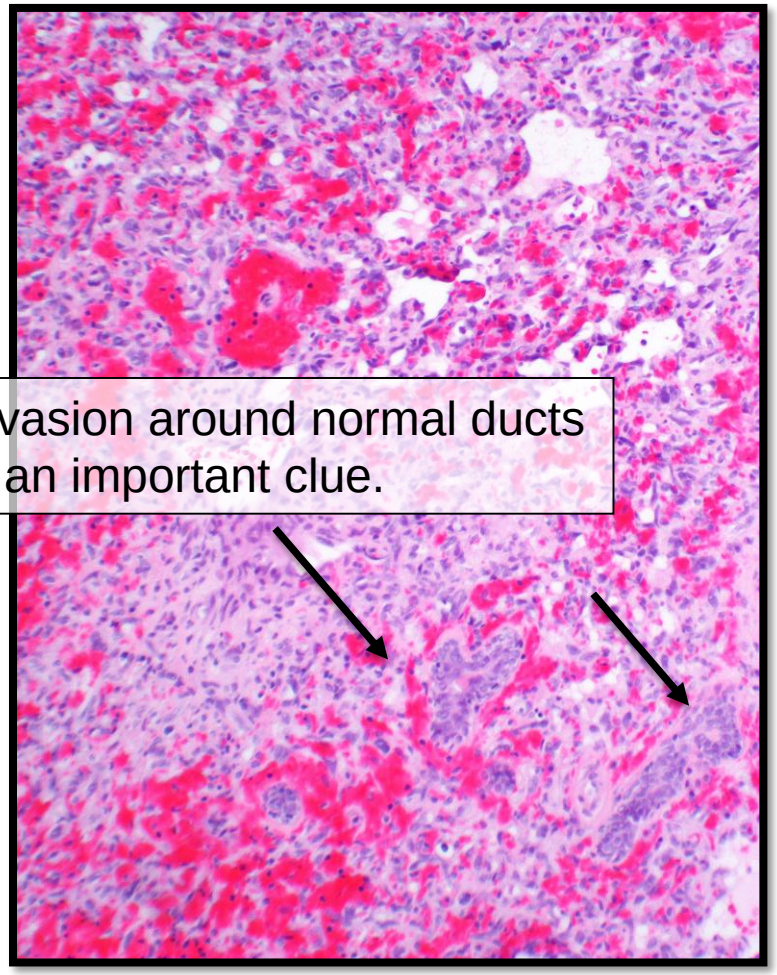
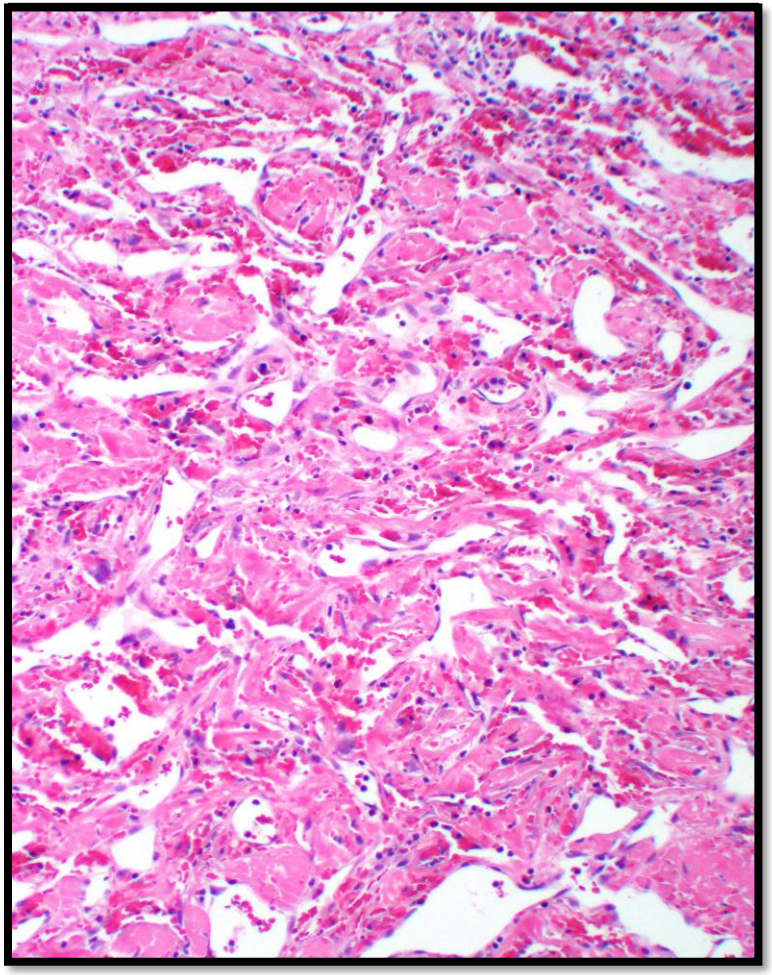


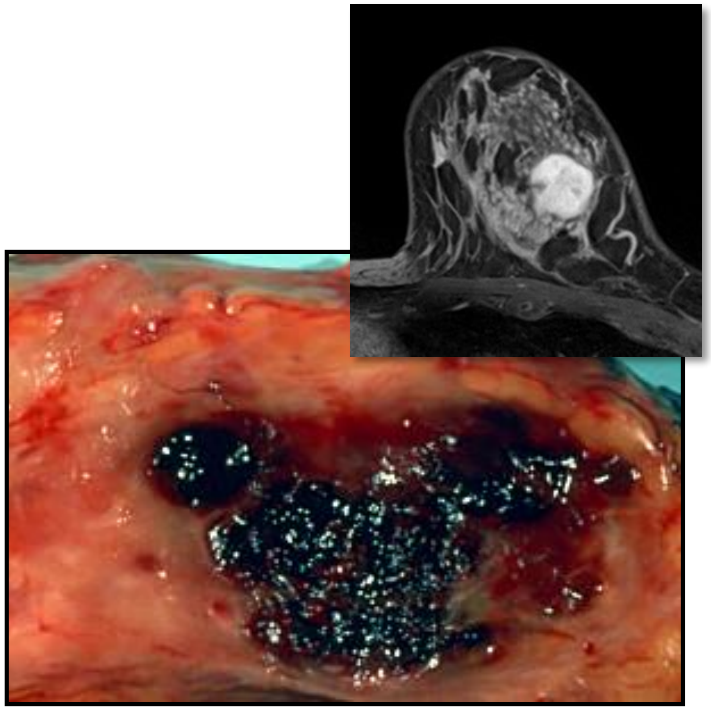
Angiosarcoma



PEH

Angiosarcoma

Most common type of breast sarcoma.



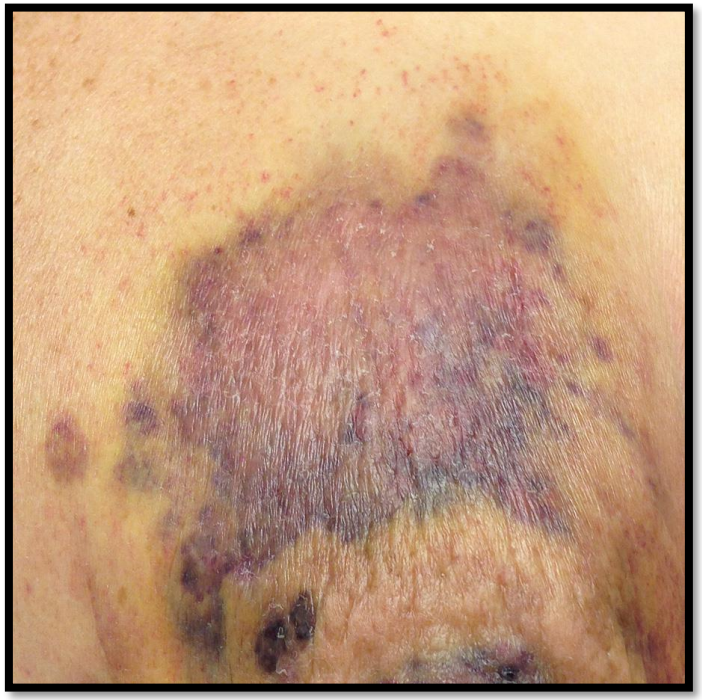
Primary

Younger women

Presents as palpable mass in breast.

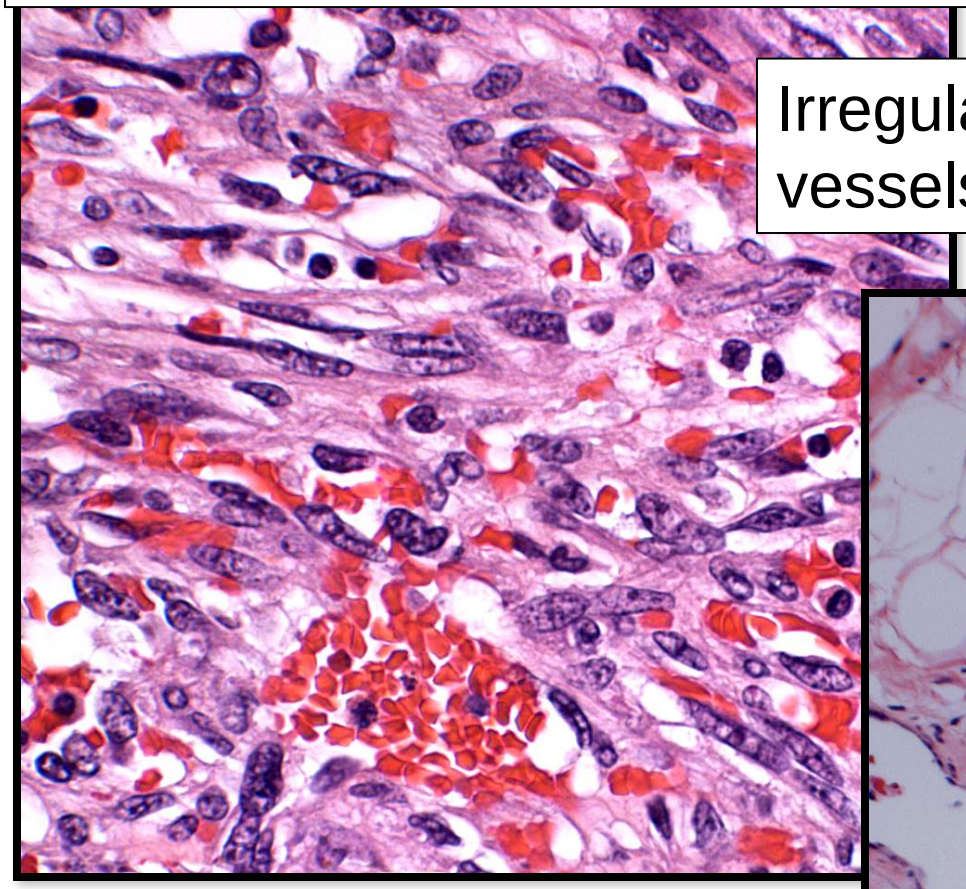
Irregular or ill-defined margins.

Secondary (radiation)

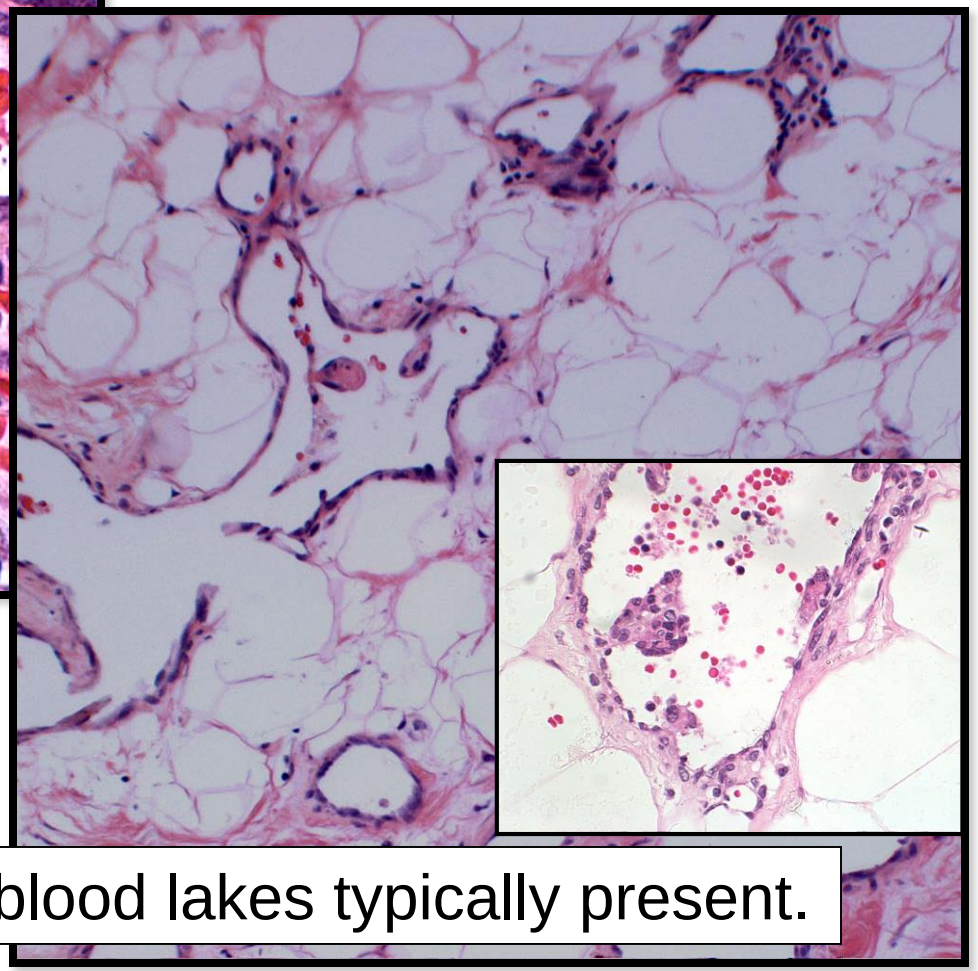


Older women after radiation for breast cancer.
Presents as hemorrhagic skin lesions.
Irregular or ill-defined margins.

Angiosarcoma – Pathologic features



Irregular anastomosing blood vessels. Invades into breast tissue.

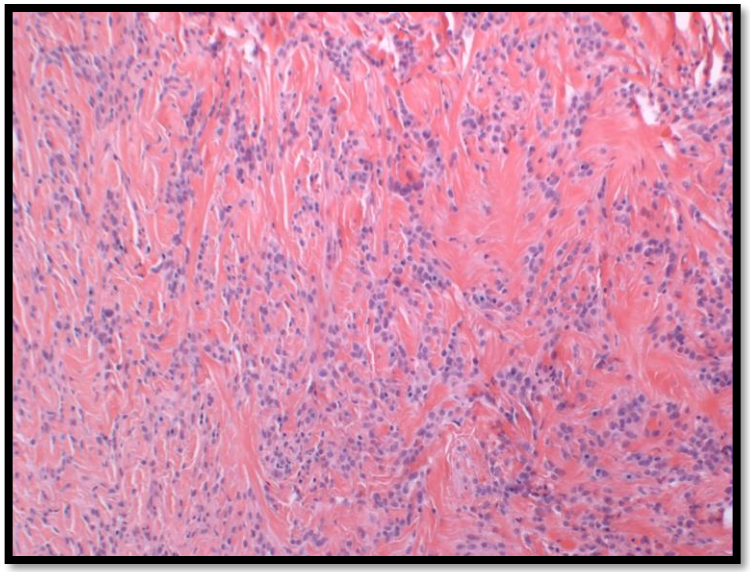


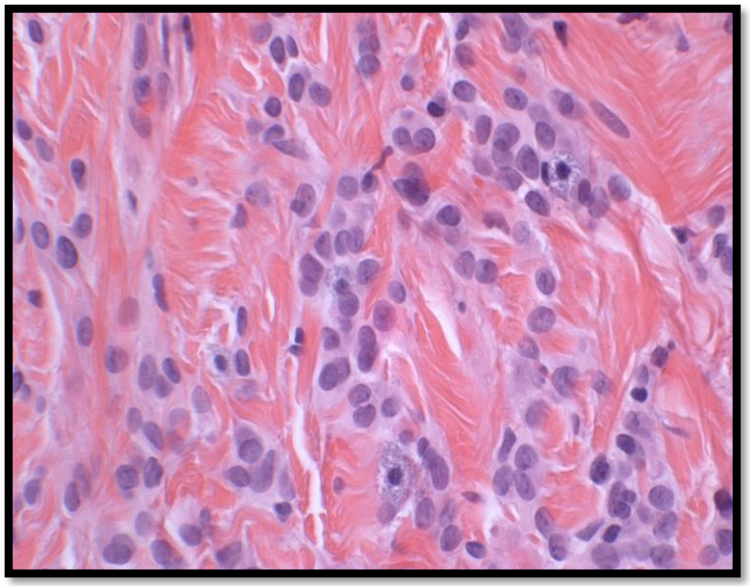
Nuclear atypia, tufting, and blood lakes typically present.

Angiosarcoma vs PASH vs PEH

Feature	Angiosarcoma	PASH	PEH
Lesion	Large palpable mass +/- skin involvement	Small circumscribed mass or incidental	Small circumscribed mass, rarely >2 cm
Cell type	Endothelial cell	Myofibroblast	Endothelial cell
Blood	In lumens and extravasated	Absent	In slit-shaped spaces and extravasated
Nuclear atypia/mitoses	Present	Absent	Absent
Involvement of normal breast epithelium	Yes	Yes	No
MYC amplification	Yes – if radiation associated	No	No

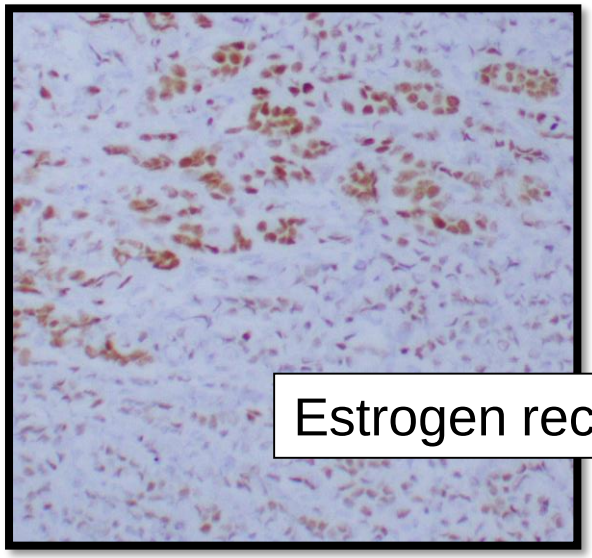
Mimic #3





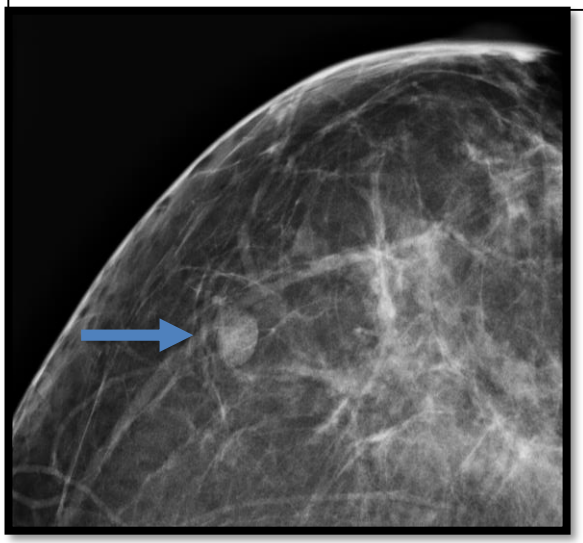
A pathologist arrived at her office in the evening after a long day of presenting at a breast course.

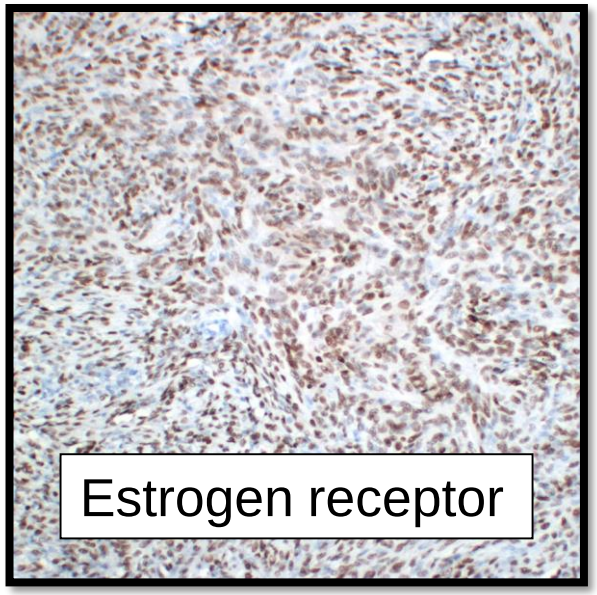
Our Fellow had written up a core needle biopsy as showing invasive lobular carcinoma that was positive for ER and PR.



Estrogen receptor

Mimic #3 – Epithelioid myofibroblastoma mimicking invasive lobular carcinoma





Red flags:

The lesion was a circumscribed mass. This would be unusual for a typical infiltrative lobular carcinoma.

On closer inspection, some spindle cells were present on the ER study.

A subsequent IHC study for keratin was negative.

Myofibroblastoma

Peak incidence: 50 to 75 years

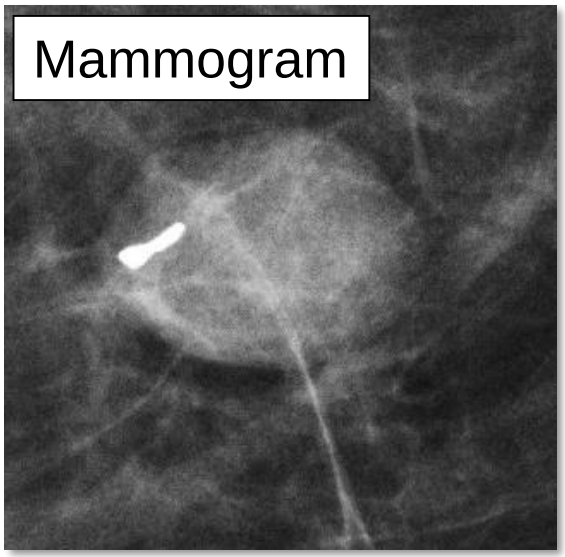
Gender: males = females

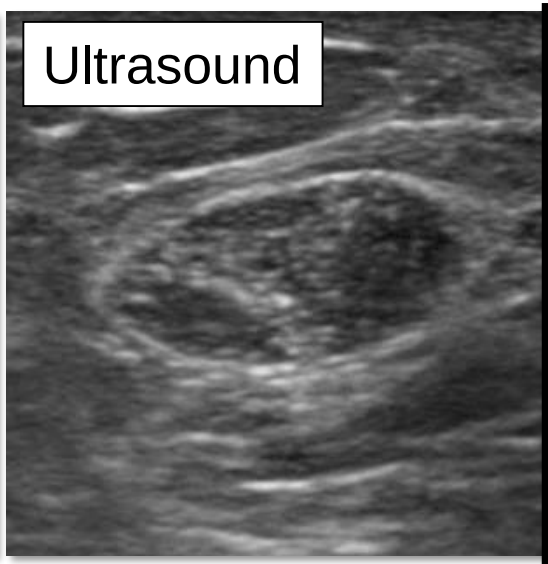
Etiology: Benign neoplasm of interlobular myofibroblasts associated with chromosome 13 rearrangements with loss of 13q14 (frequent loss of retinoblastoma (RB) and FOXO1A genes).

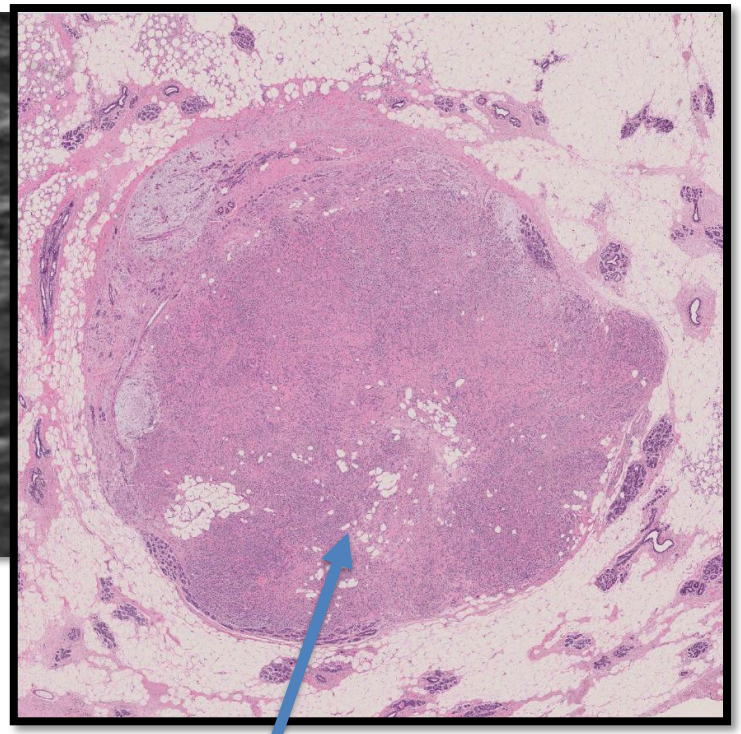
Likely the same lesion as spindle cell lipoma.

Outcome: Benign – no treatment necessary.

Myofibroblastoma – Presentation







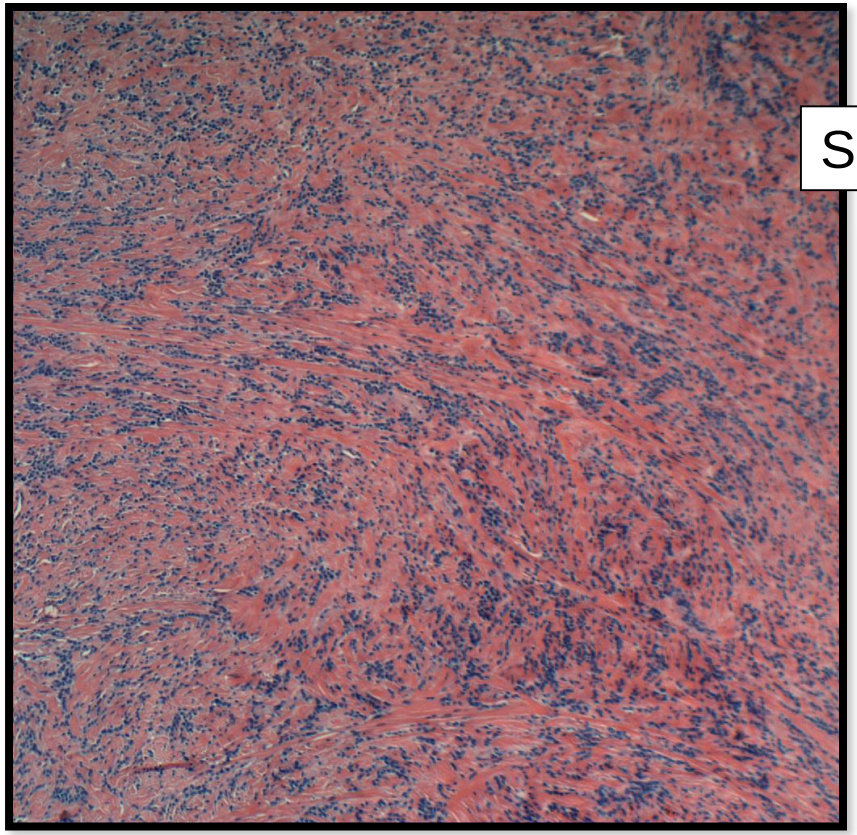
Most commonly presents as a slow growing palpable mass.

Forms a mass with circumscribed margins on imaging.

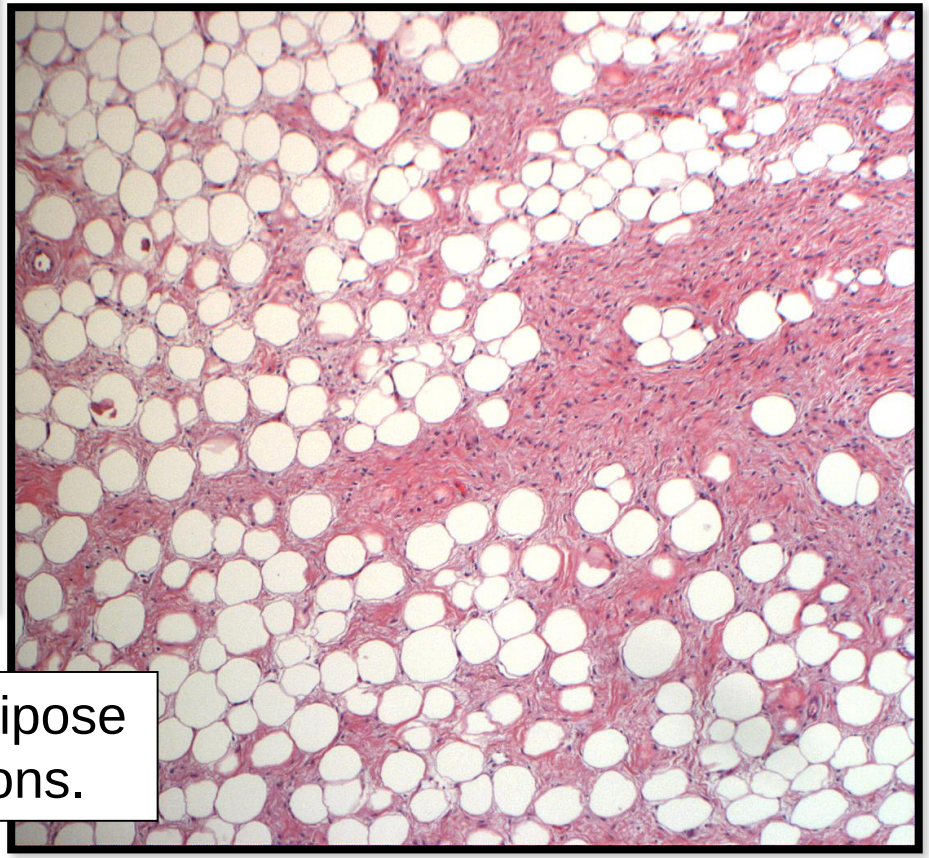
May be hyperechoic due to a component of adipose tissue.

Kuba MG, Giess CS, Wieczorek TJ, Lester SC. Hyperechoic malignancies of the breast: underlying pathologic features correlating with this unusual appearance on ultrasound. Breast J 2019 Sep 12.

Myofibroblastoma



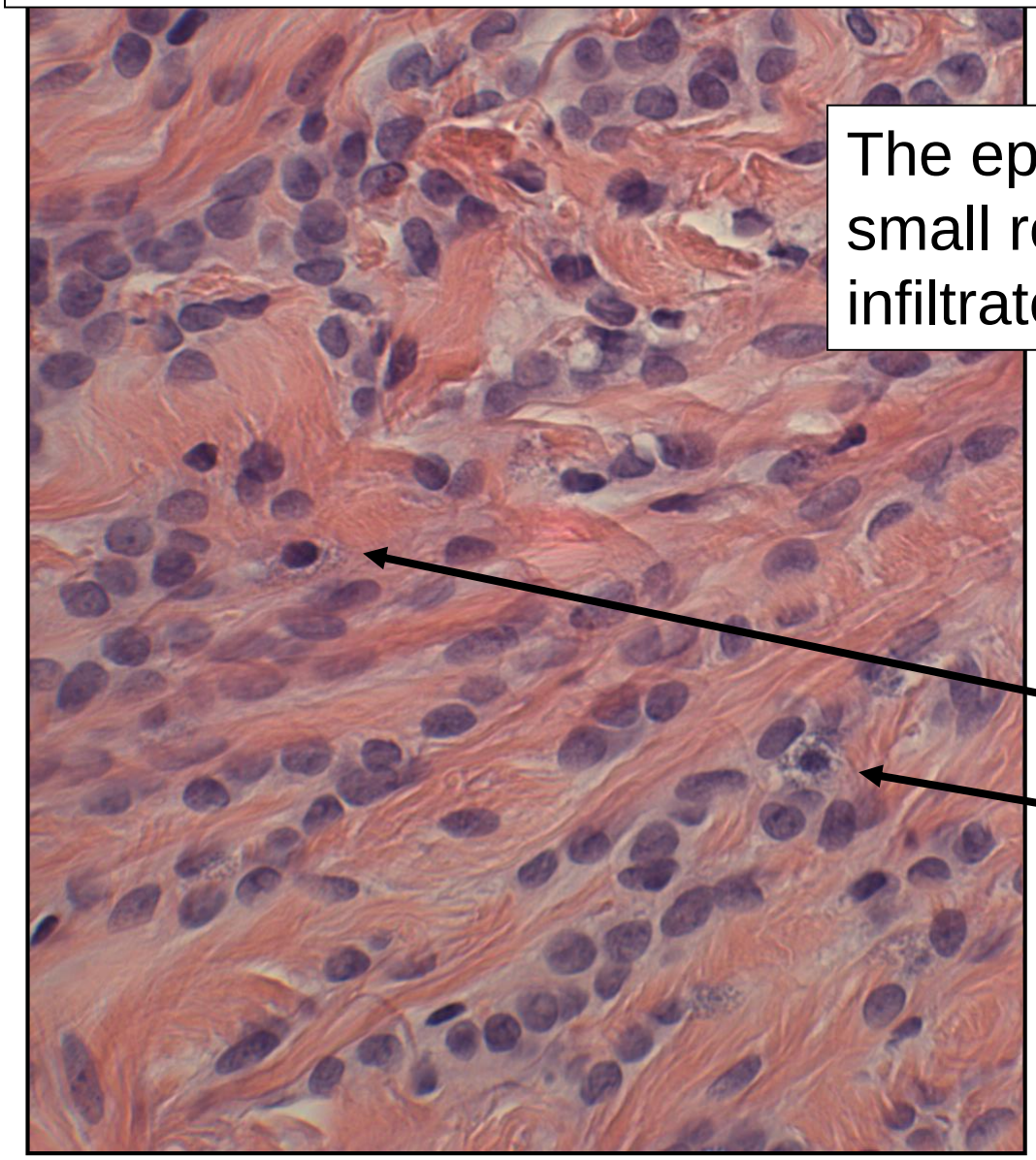
Solid proliferation of short spindle cells.



A prominent component of adipose tissue is present in some lesions.

Krings G, et al. Myofibroblastic, fibroblastic and myoid lesions of the breast. Sem Diagn Pathol 34:427-437, 2017.

Mimic #3 -Myofibroblastoma – epithelioid variant

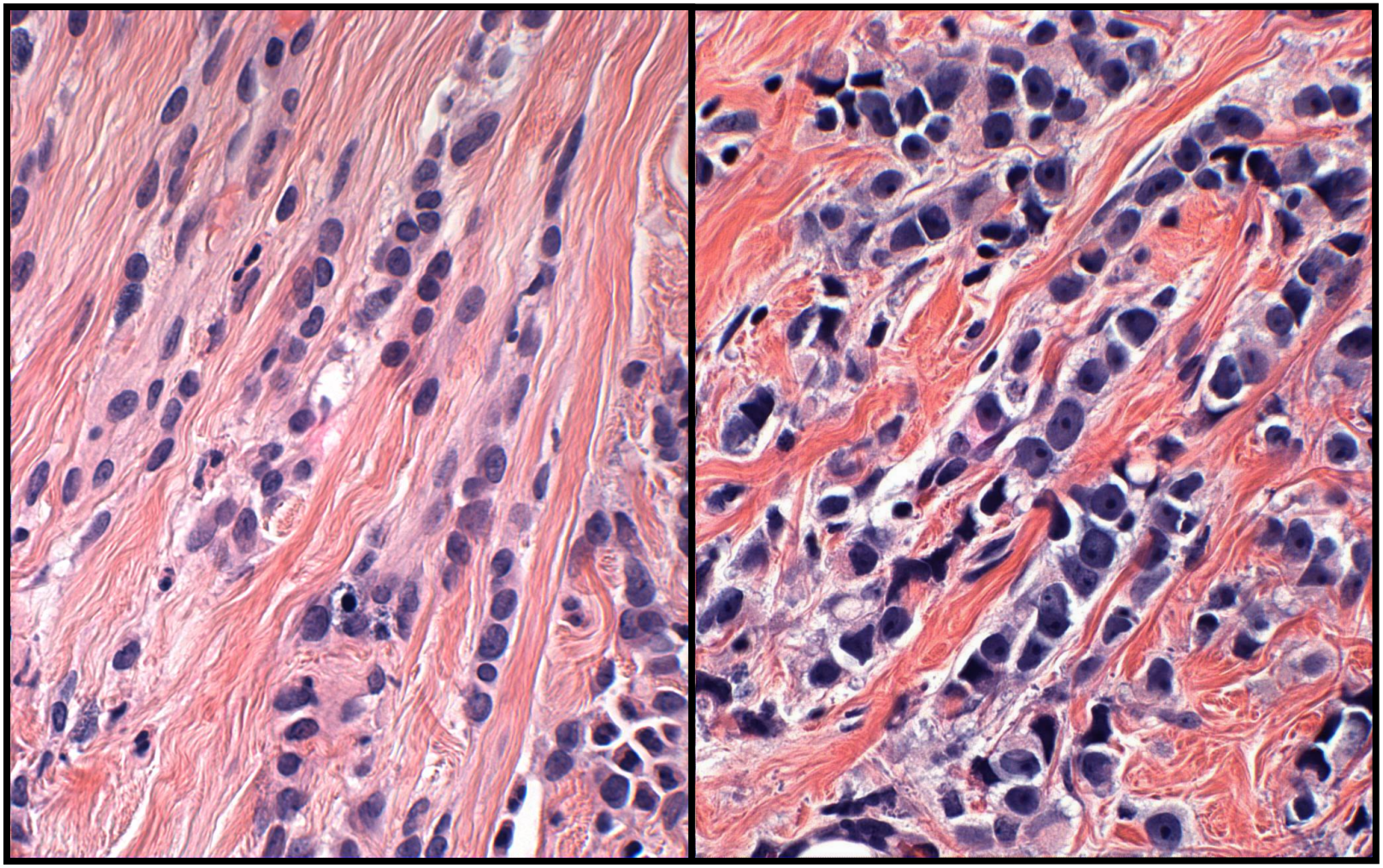


The epithelioid variant consists of small round cells and appears to infiltrate stroma in linear arrays.

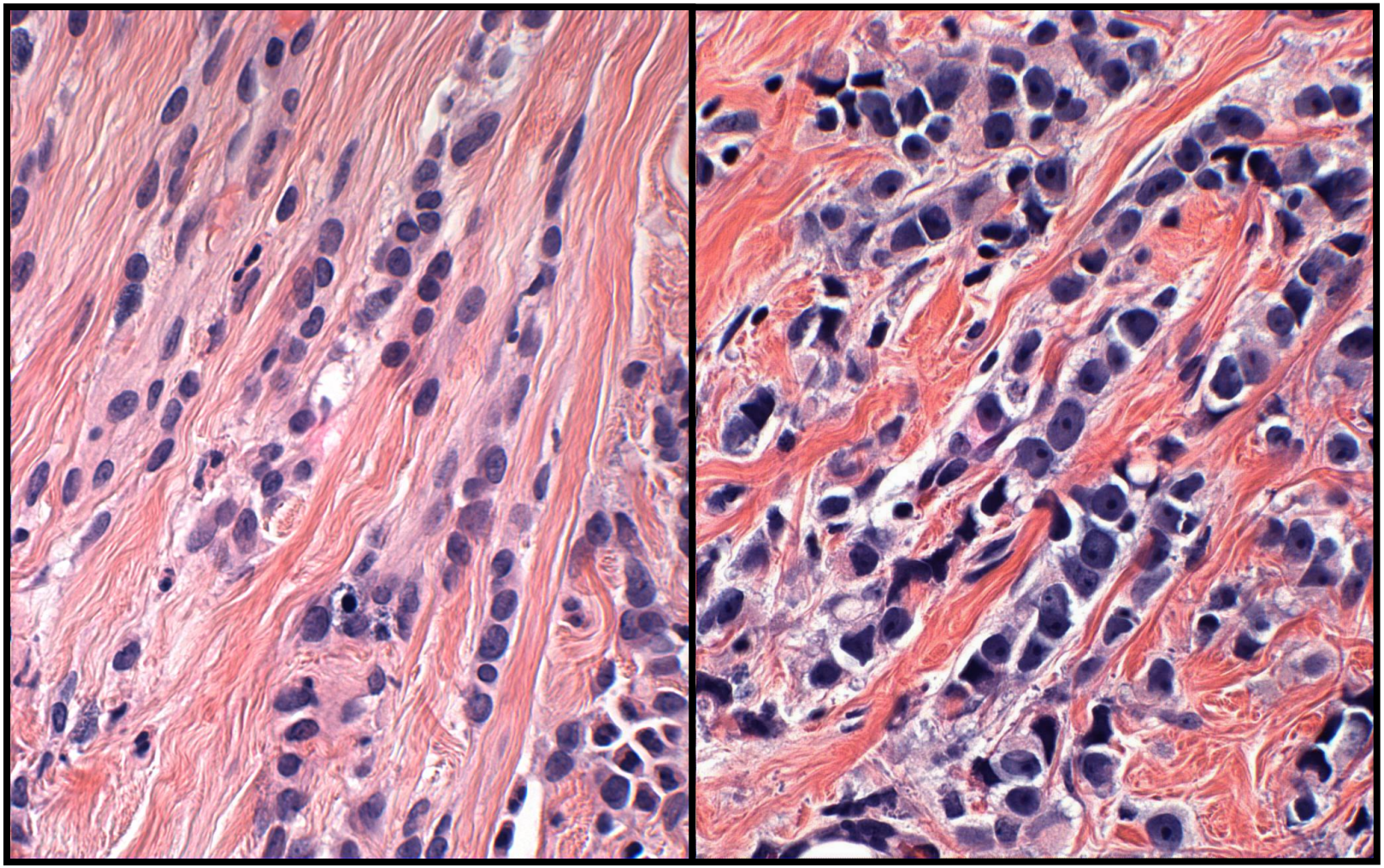
Cell borders are indistinct.

Numerous mast cells are often present.

Which one is the lobular carcinoma?



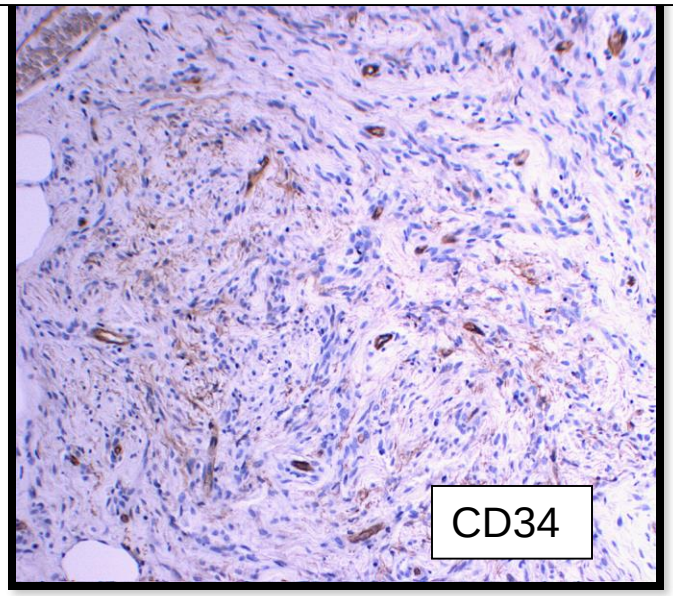
Which one is the lobular carcinoma?



Myofibroblastoma

Invasive lobular carcinoma

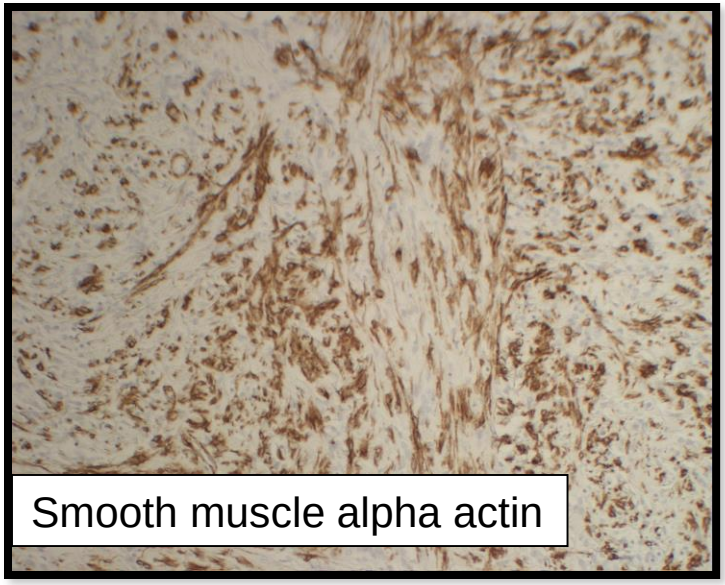
Myofibroblastoma – Immunohistochemistry

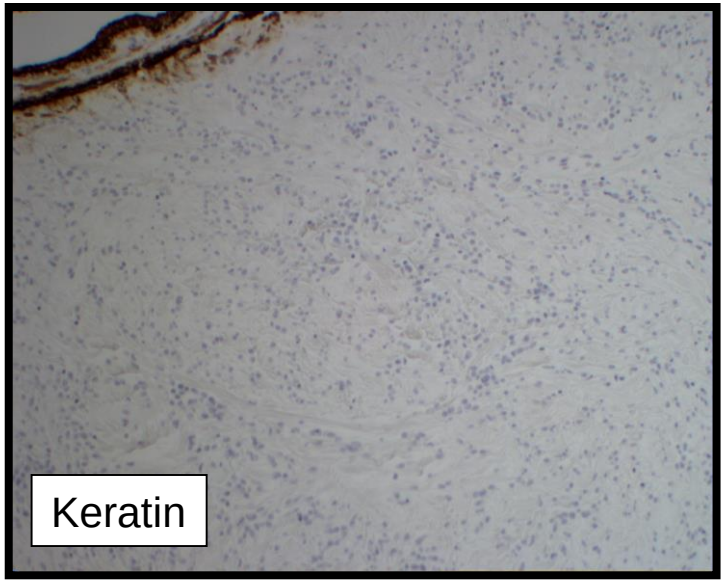


CD34 positive

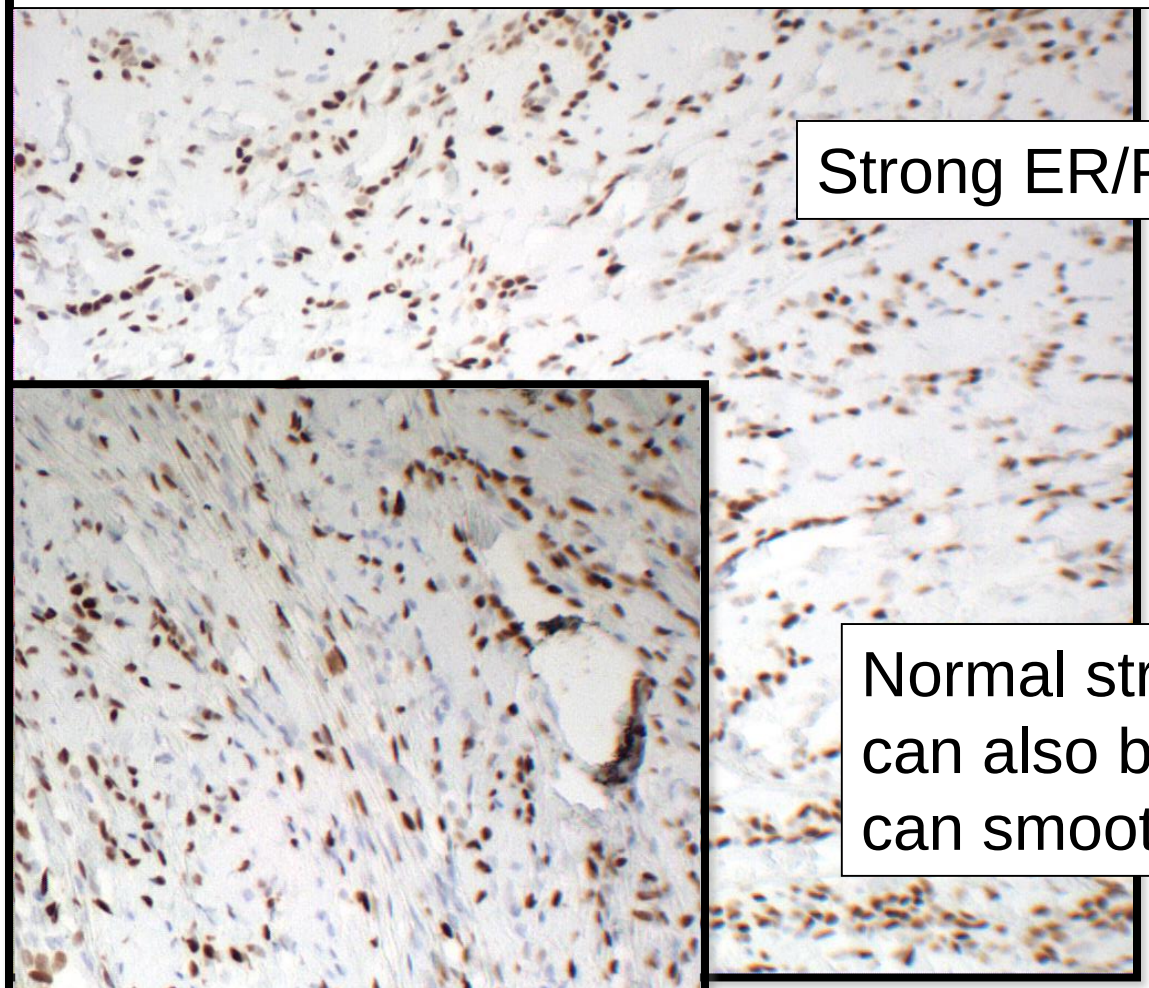
Muscle markers positive

Keratin negative





Myofibroblastoma – Hormone receptors



Strong ER/PR positivity is typical.

Normal stromal myofibroblasts can also be ER/PR positive as can smooth muscle.

A spindle cell pattern may be more obvious on ER/PR IHC.

Myofibroblastoma vs Invasive Lobular Carcinoma

Feature	Myofibroblastoma – epithelioid variant	Invasive Lobular Carcinoma
Shape/margins	Round mass with circumscribed margins	Irregular mass with spiculated margins (except solid variant)
Cells	Rounded with indistinct borders, some spindle shaped	Rounded with distinct borders, discohesive, not spindled
Hormone receptors	Positive (>50% of cases)	Positive (>95% of cases)
Broad spectrum keratin	Negative	Positive
Muscle markers (SMA, desmin, calponin)	Positive	Negative
Bcl-2	Positive (~80%)	Some positive (~30%)
Epithelial membrane antigen	Low (~11%)	Positive

BREAST – (pure) spindle cell lesions

Learning Objectives:

Malignant spindle cell lesions

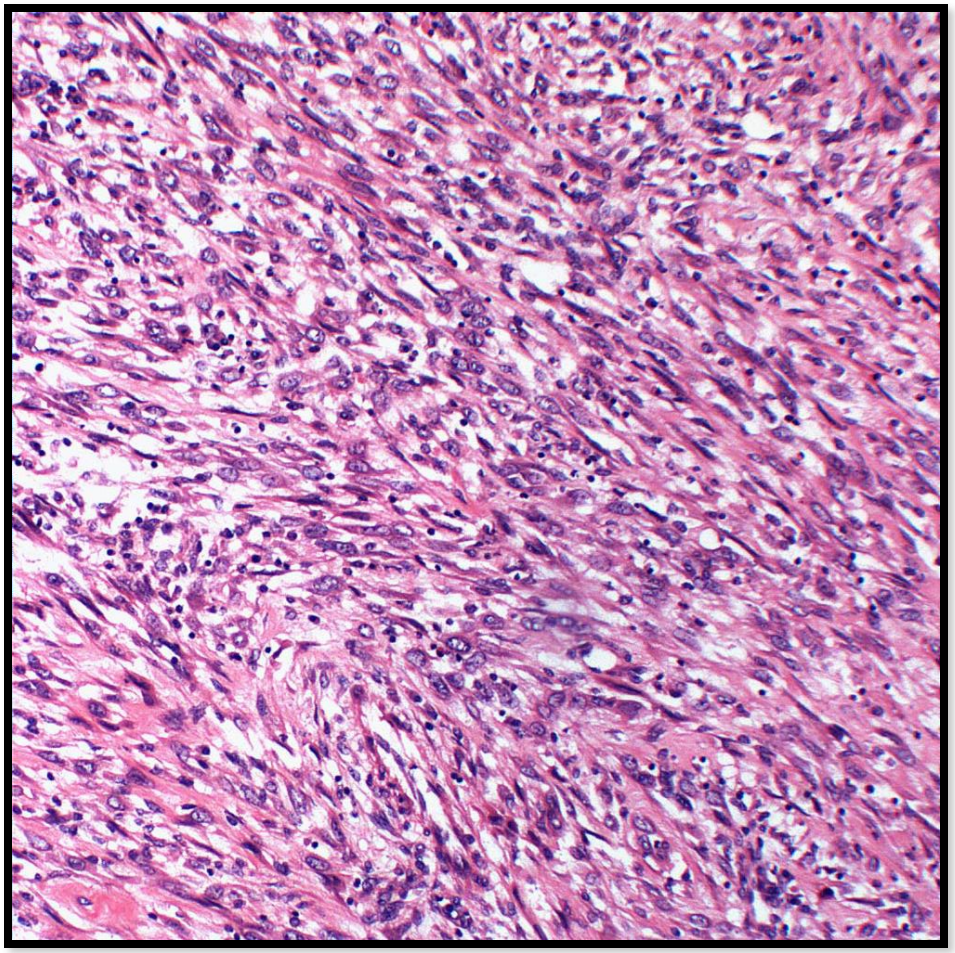
Perilous pitfalls: benign lesions that mimic malignant lesions

Perilous pitfalls: malignant lesions that mimic benign lesions

Spindle cell carcinomas arising in association with cystic lesions mimicking reactive stroma.

Fibromatosis-like carcinoma mimicking fibromatosis.

Mimic #4



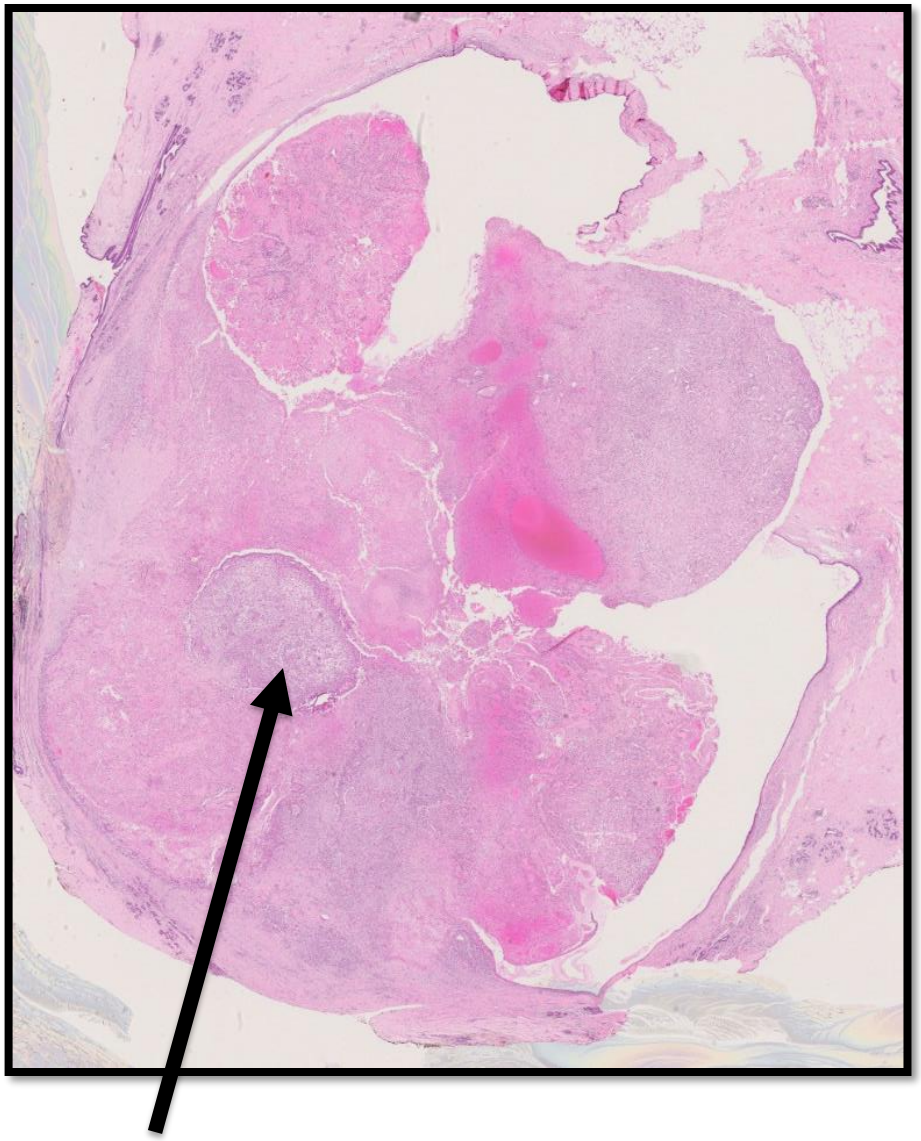
A woman with a history of melanoma was found to have a palpable breast mass.

A biopsy showed a malignant spindle cell neoplasm.

IHC was negative for melanoma and epithelial markers.

The case was shown at a departmental working meeting. The plan was to try additional IHC.

Mimic #4



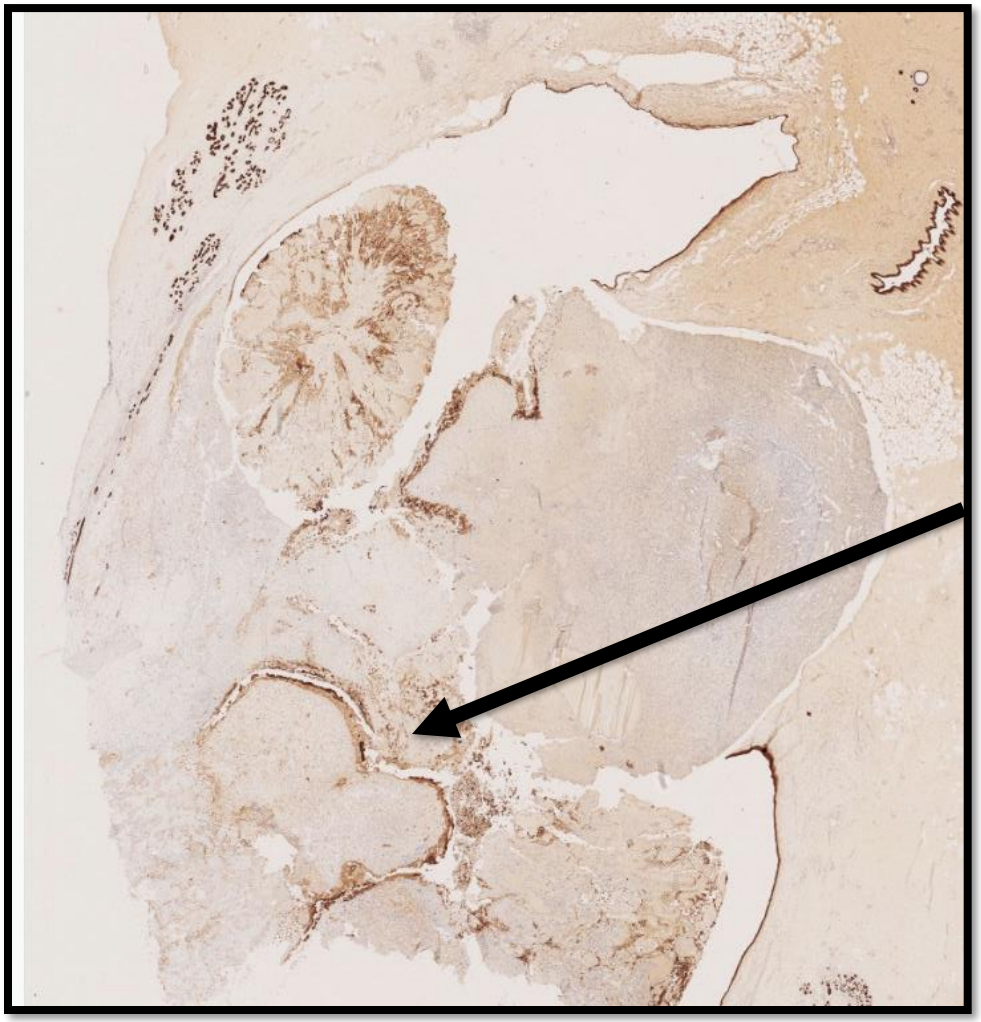
About 2 weeks later I looked up the case to see what the additional IHC had shown.

I was intrigued to find out that 6 months earlier she had undergone an excision for an intraductal papilloma. Another staff member had shown me this case.

The papilloma was extensively infarcted.

I was dismayed to note this area on a second look.

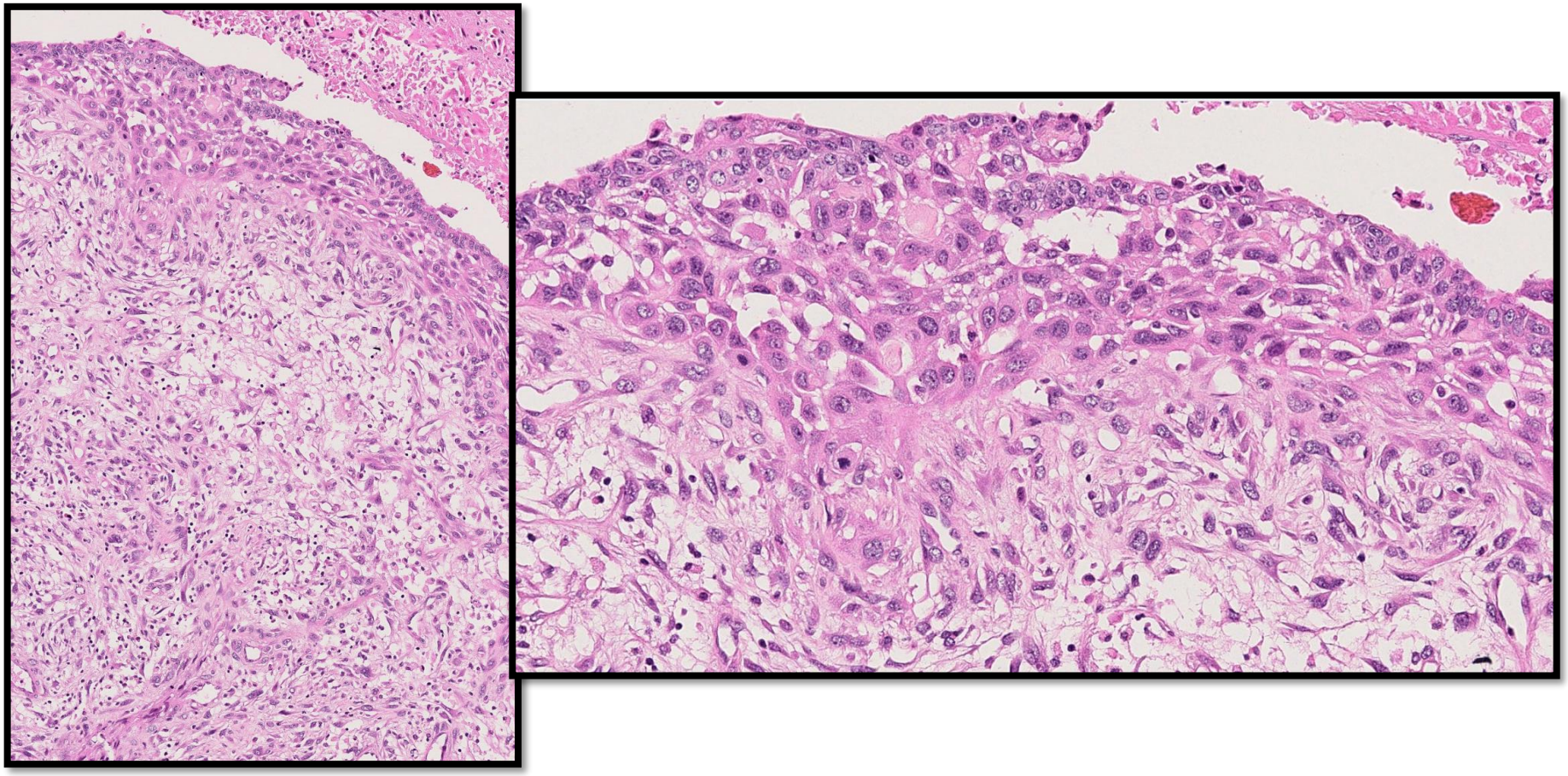
Mimic #4



I requested an immunohistochemical study for keratin.

Although the majority of the lesion showed a benign (but extensively infarcted) papilloma this focal area showed something different.

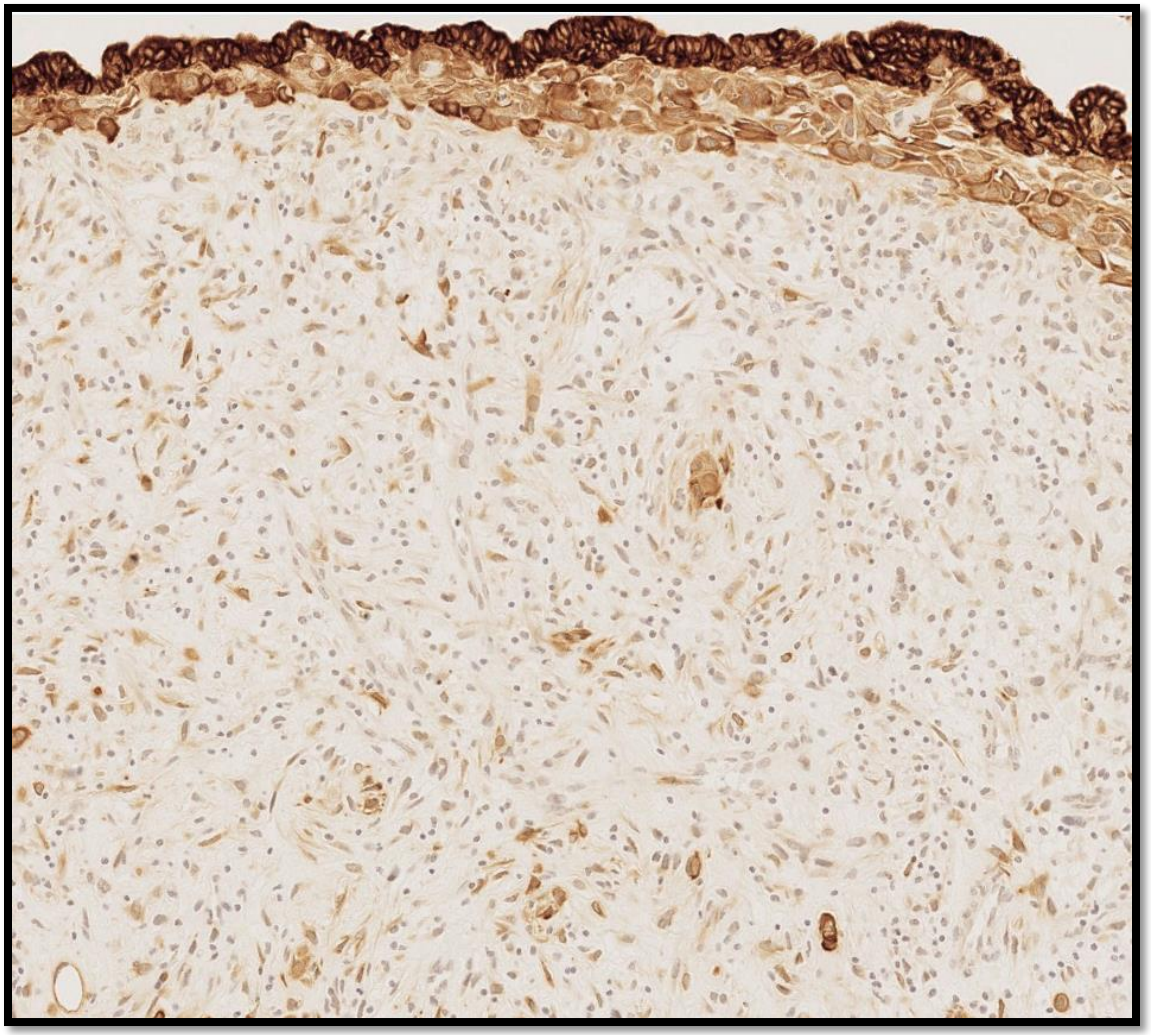
Mimic #4 – Spindle cell carcinoma arising in a cystic lesion



There was an area of squamous metaplasia.

The adjacent spindle cells that were originally interpreted as reactive stromal cells were actually a spindle cell carcinoma.

Mimic #4 – Spindle cell carcinoma arising in a cystic lesion



Keratin and p63 confirmed that this was a spindle cell carcinoma.

The keratin staining was weak.

Mimic #4: Spindle cell carcinoma mimicking reactive stroma associated with a cystic lesion

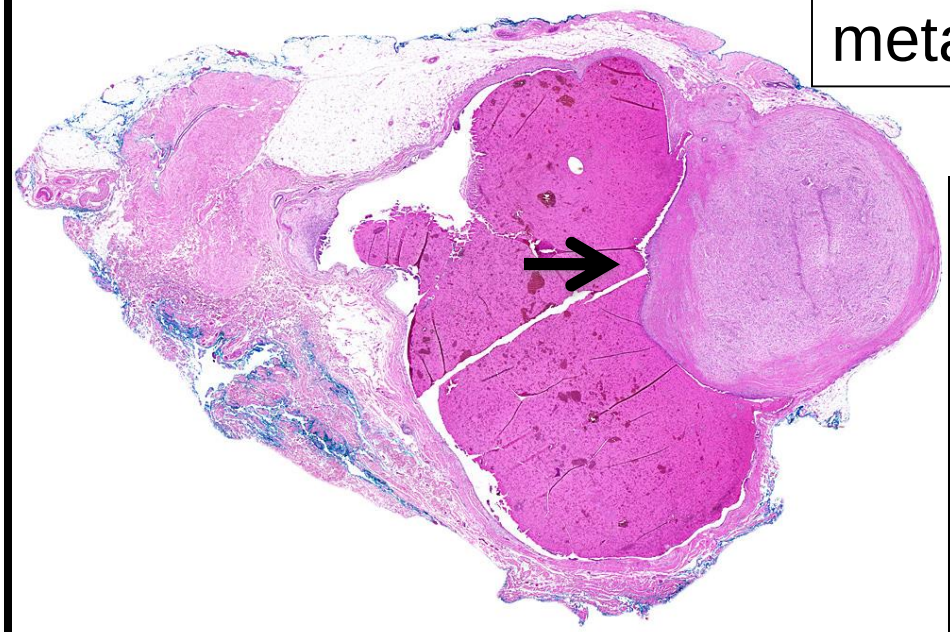
Therefore, this patient had recurred 6 months after the excision of a spindle cell carcinoma arising in association with an infarcted papilloma.

This prior lesion showed that the subsequent lesion was recurrent carcinoma and not stage 4 metastatic melanoma.

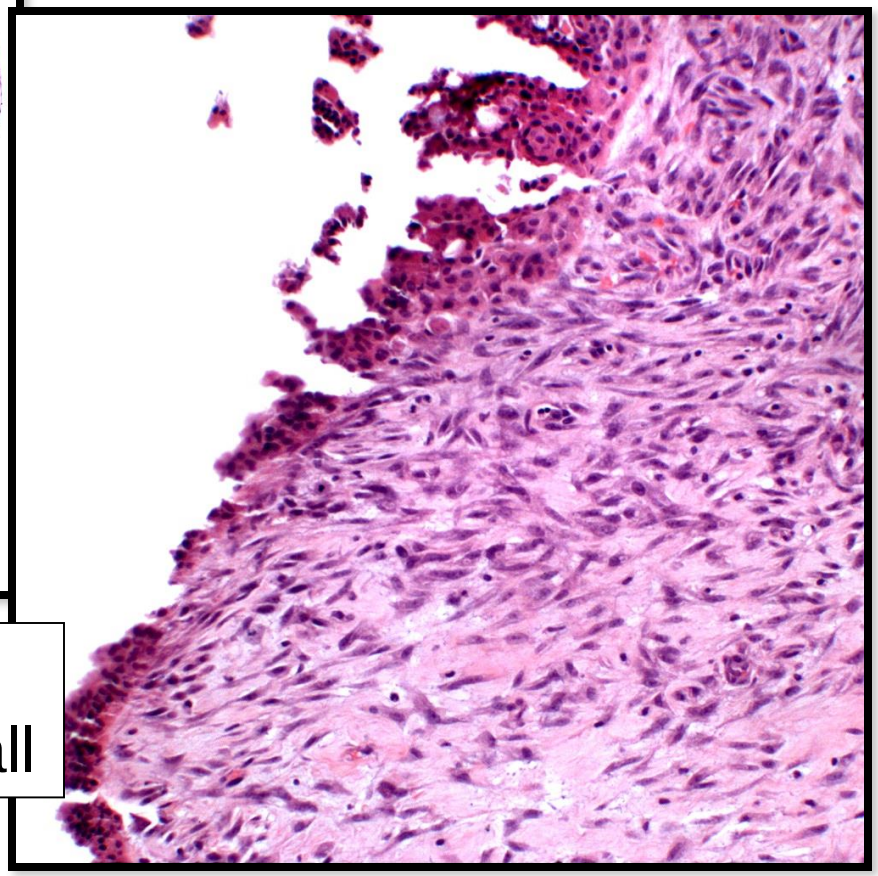
She was treated appropriately for an ER/PR/HER2 negative carcinoma.

I have been very respectful of “reactive” stromal cells ever since this case!

Spindle cell carcinoma associated with benign lesions



Can arise from squamous metaplasia in papillomas or cysts



Marked stromal cellularity with mitoses is present in this cyst wall

Gobbi, H, et al, Metaplastic spindle cell breast tumors arising within papillomas, complex sclerosing lesions, and nipple adenomas, Mod Pathol 16:893-901, 2003.

Reactive Stromal Cells vs Spindle Cell Carcinoma

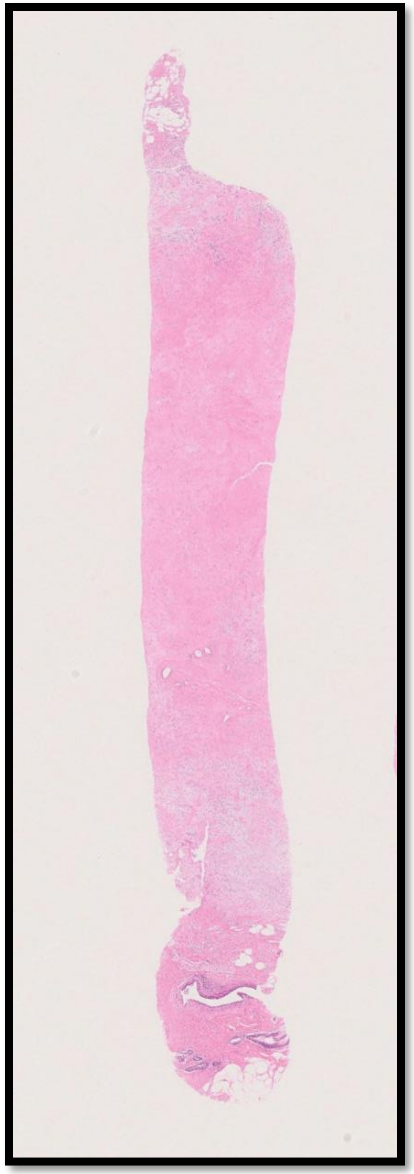
Feature	Reactive stromal cells	Spindle cell carcinoma
Location	Adjacent to cystic lesion – often near site of rupture	Adjacent to cystic lesion – often near area of squamous metaplasia
Nuclear atypia	May be present but not marked	Present and may be marked
Mitoses	May be present but sparse	May be present and frequent
Keratin	Negative	Positive (HMW>LMW)
P63	Negative	Often positive
CD34	May be positive	Negative
Muscle markers	Usually positive	May be positive

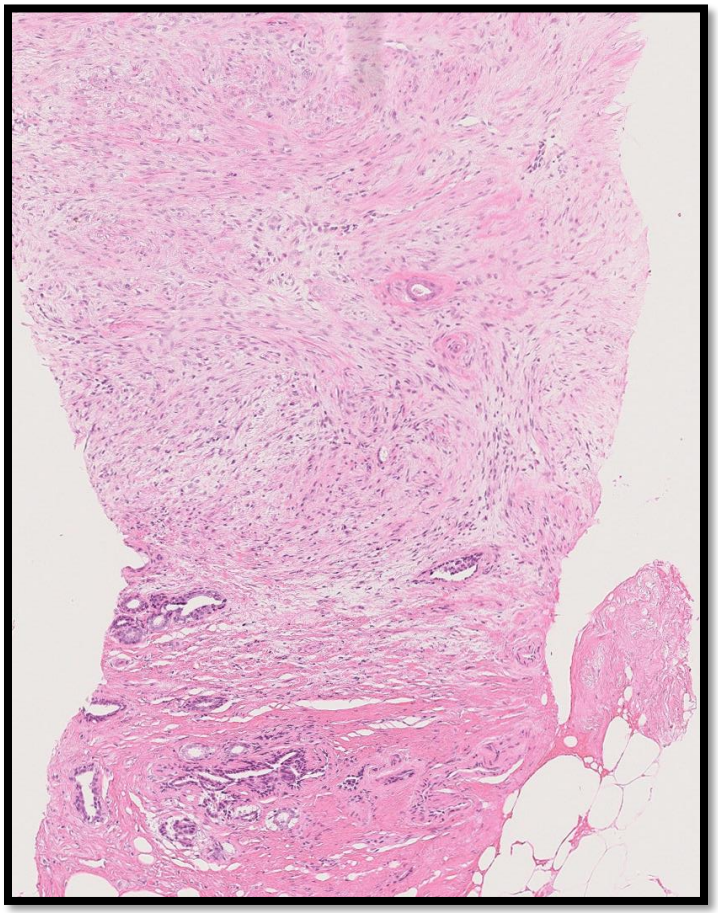
Carefully examine spindle cell proliferations associated with cystic lesions – especially when squamous metaplasia is present.

Mimic #5

A woman was found to have a 1.5 cm mass with spiculated margins on mammography.

Fibromatosis? Spindle cell carcinoma?





Very bland spindle cells.

No mitoses.

Infiltration into adjacent stroma.

Mimic #5 – Low grade fibromatosis-like carcinoma mimicking fibromatosis

The cells are positive for HMW keratin and p63, showing this is a low grade fibromatosis-like carcinoma.

Low grade fibromatosis-like carcinoma

Type of “metaplastic” carcinoma.

Older women: 60’s to 70’s. ~70% arise in left breast.

Metastasis to lymph nodes not observed.

Local recurrences in ~20%.

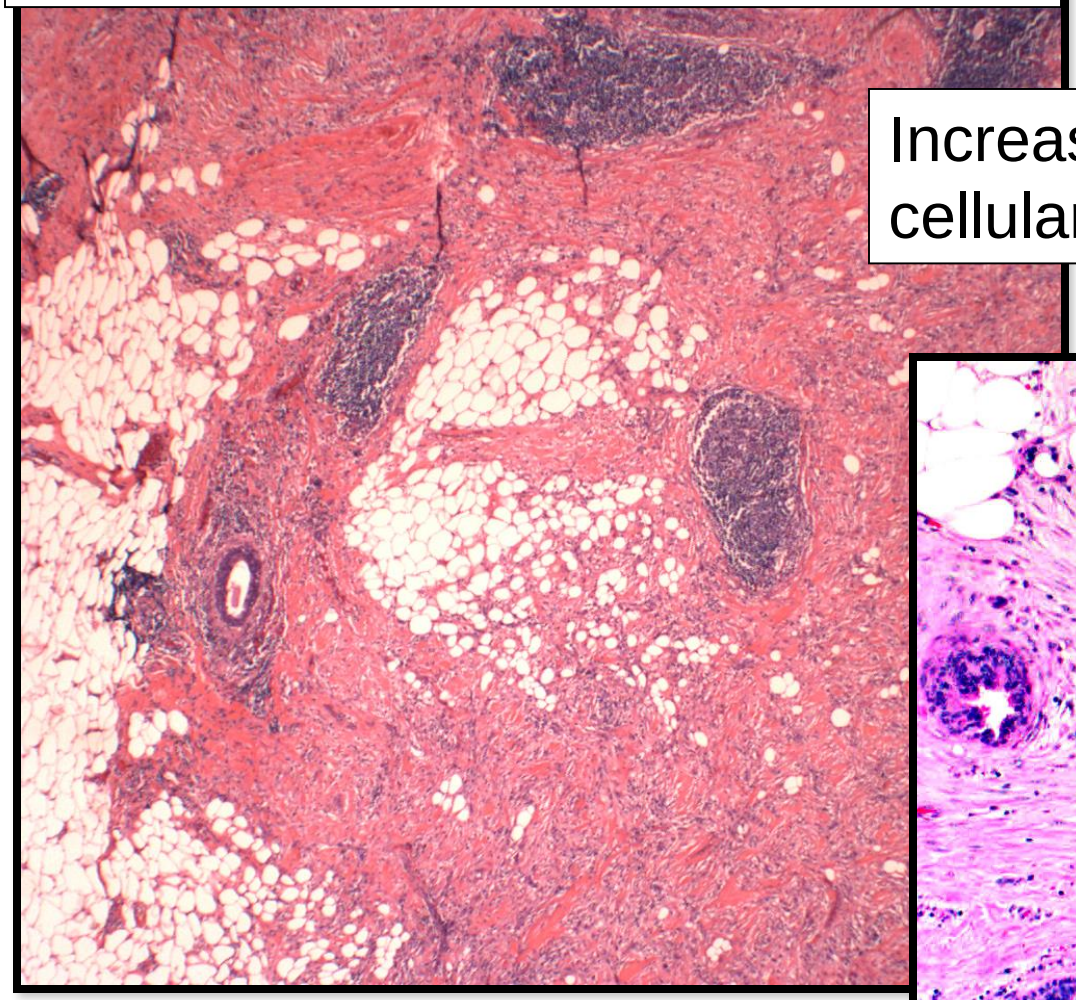
Prognosis is better than other metaplastic (and triple negative) carcinomas.

However, rare cases of distant metastasis and death have been reported. These are typically unusually large (>4 cm) cancers.

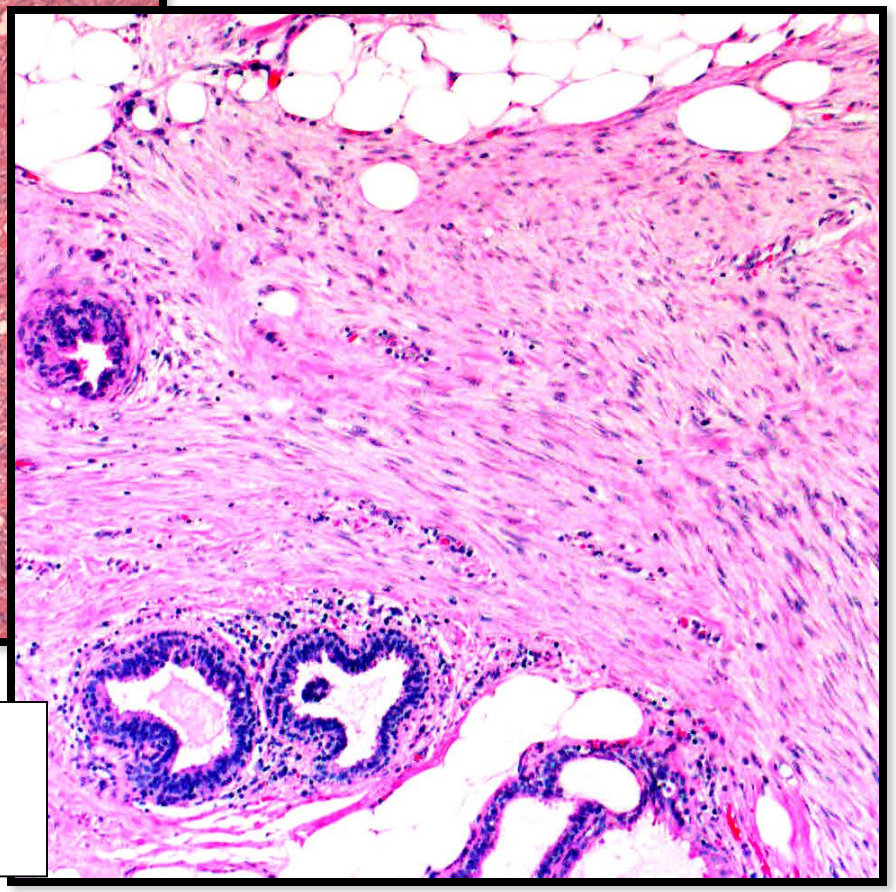
Gobbi H, et al. Metaplastic breast tumors with a dominant fibromatosis-like phenotype have a high risk of local recurrence. Cancer 85:2170-2185, 1999.

Sneige N, et al. Low-grade (fibromatosis-like) spindle cell carcinoma of the breas. Am J Surg Pathol 25:1009-1016, 2001.

Fibromatosis-like carcinoma

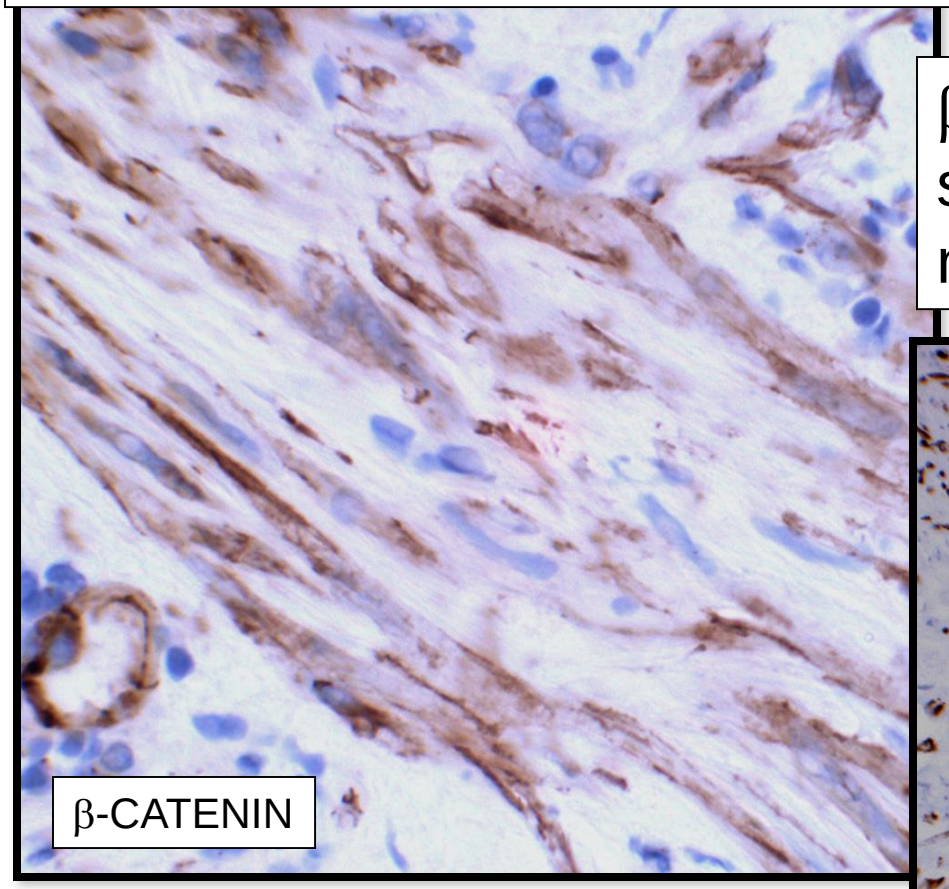


Increased mild stromal cellularity with infiltrative pattern

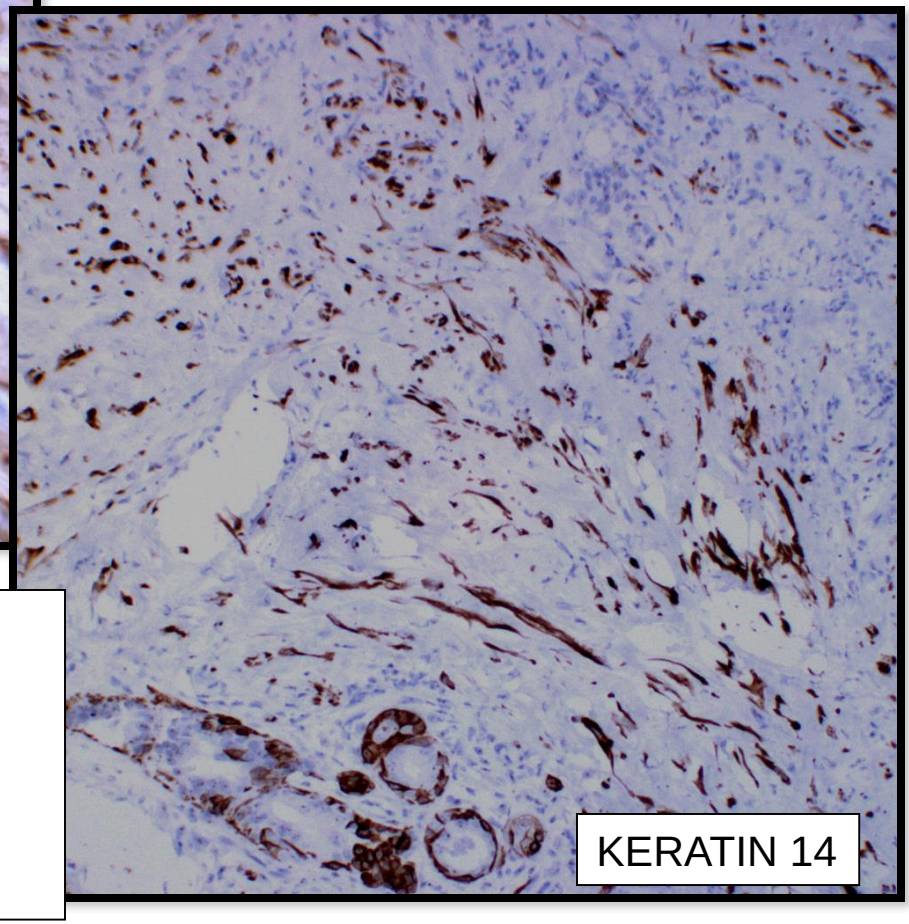


Cells have bland nuclei and resemble fibroblasts

Fibromatosis-like carcinoma



β-catenin is not very useful as some carcinomas also have nuclear positivity



Keratin positivity identifies the lesion as a carcinoma.

Majority are p63 positive.

Fibromatosis of breast– Clinical features

Age: Women in 40's (rarely men) – but occurs over wide age range.

Presentation: Palpable mass or irregular mass on imaging. Can be fixed to pectoralis muscle or skin.

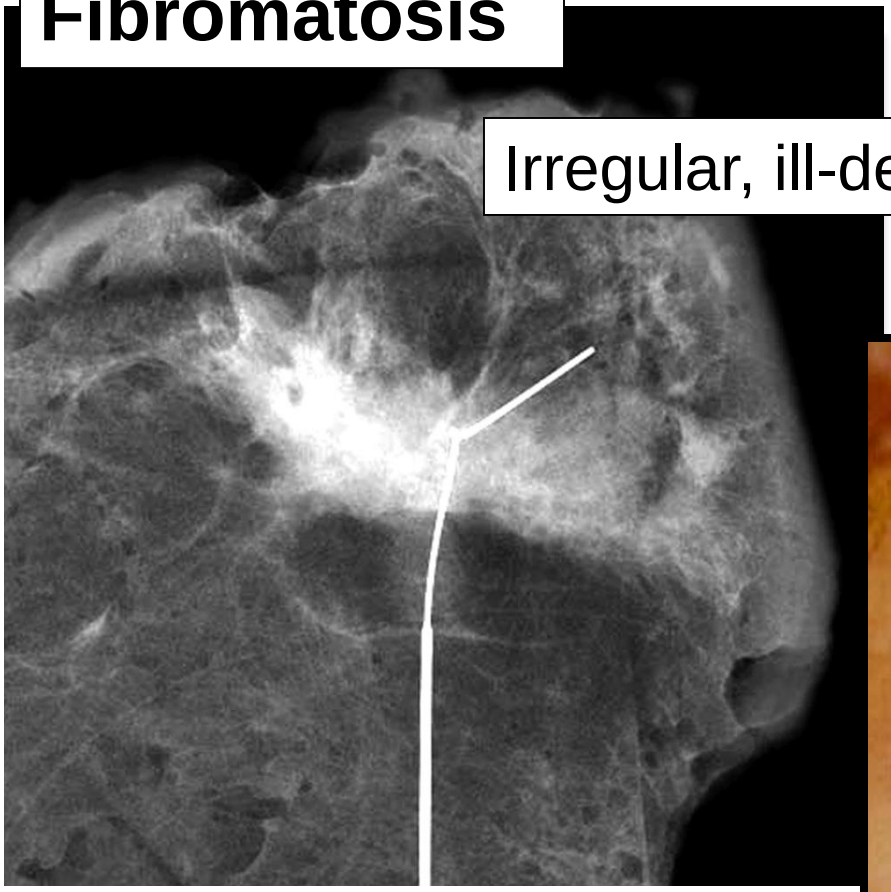
Risk factors:

Surgery: ~50% have a history of surgery.

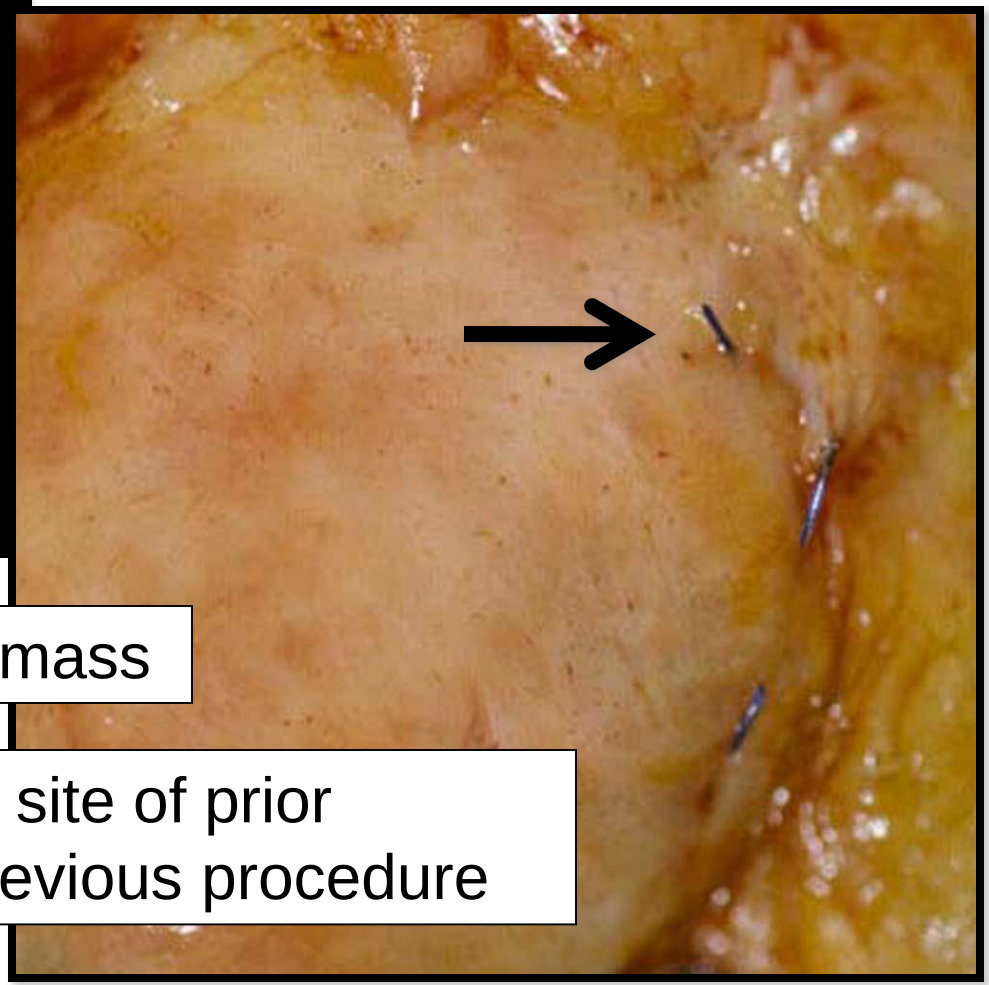
Pregnancy and oral contraceptive use. However, tumor cells are negative for ER and PR.

Germline *APC* mutation (familial adenomatous polyposis (FAP), Gardner syndrome and Turcot syndrome). ~5-15% of affected people develop fibromatosis. APC protein plays a role in phosphorylation and degradation of β-catenin.

Fibromatosis



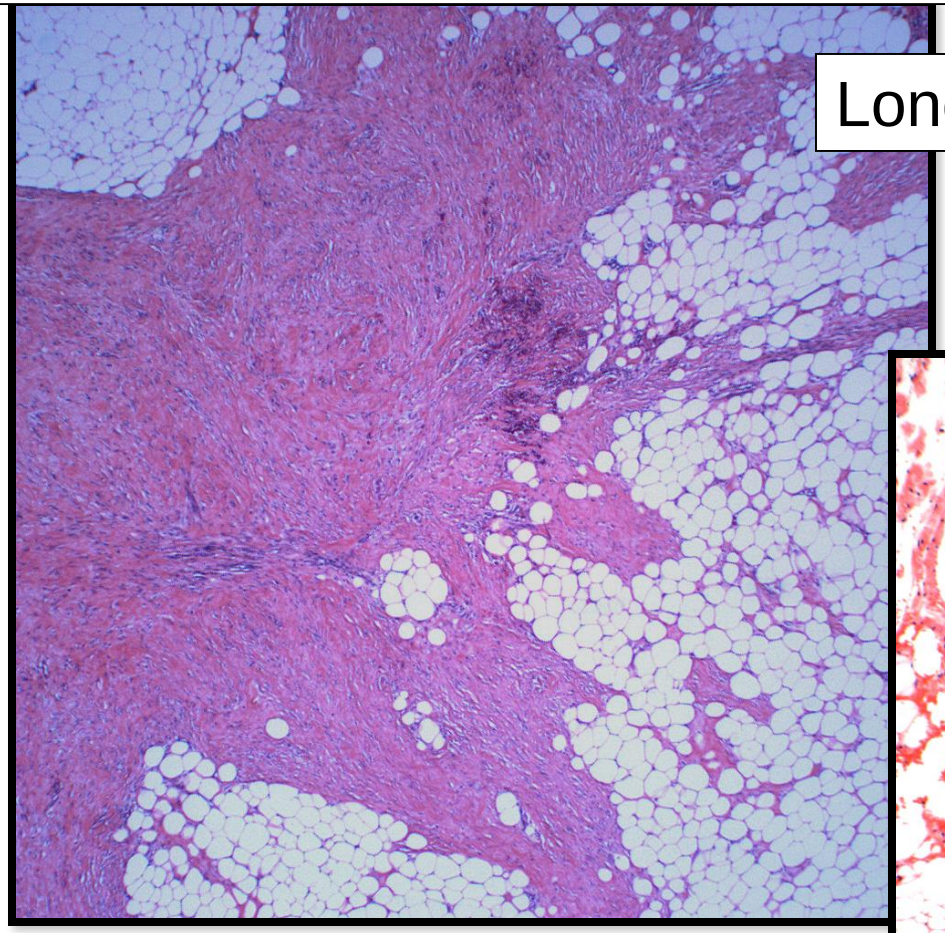
Irregular, ill-defined, or circumscribed mass.



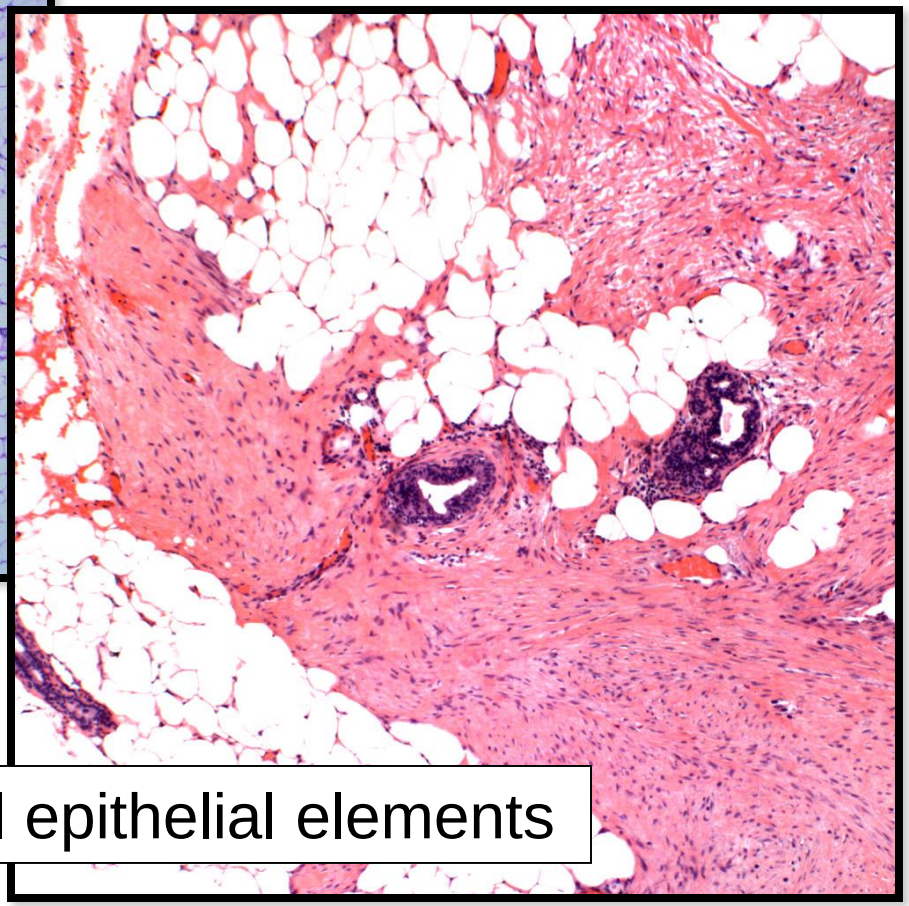
Firm to rubbery white mass

This tumor occurred at the site of prior surgery – suture is from previous procedure

Fibromatosis – Pathologic features

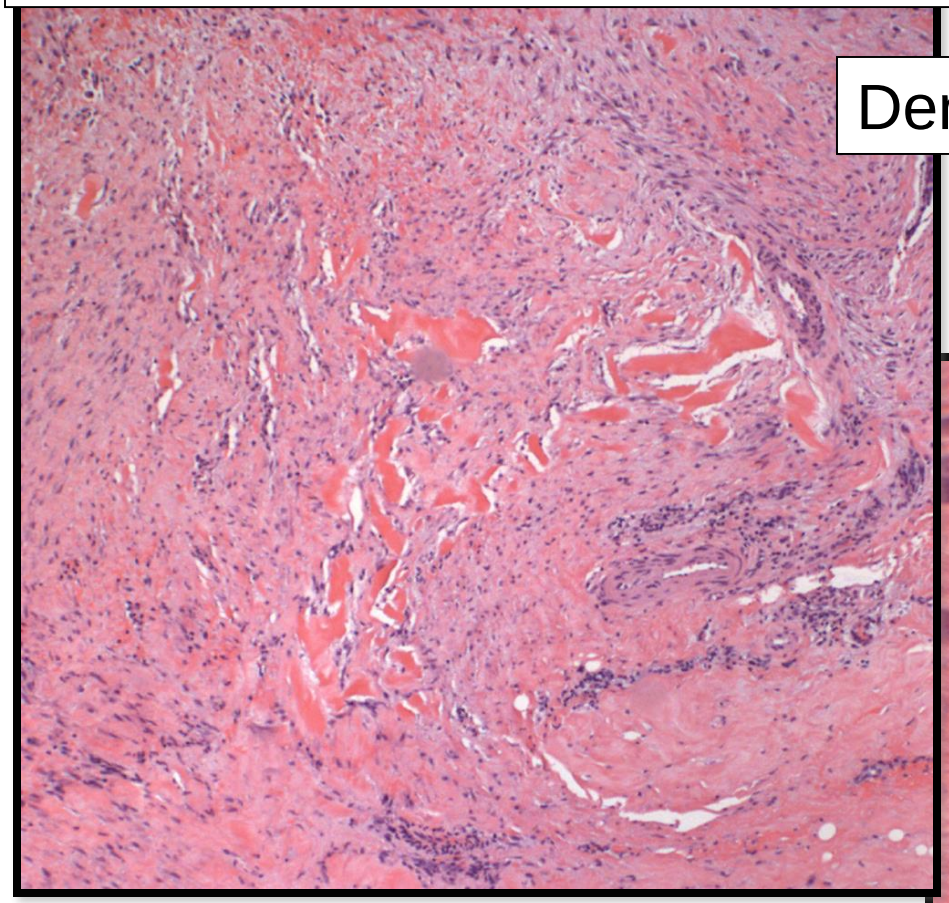


Long sweeping fascicles

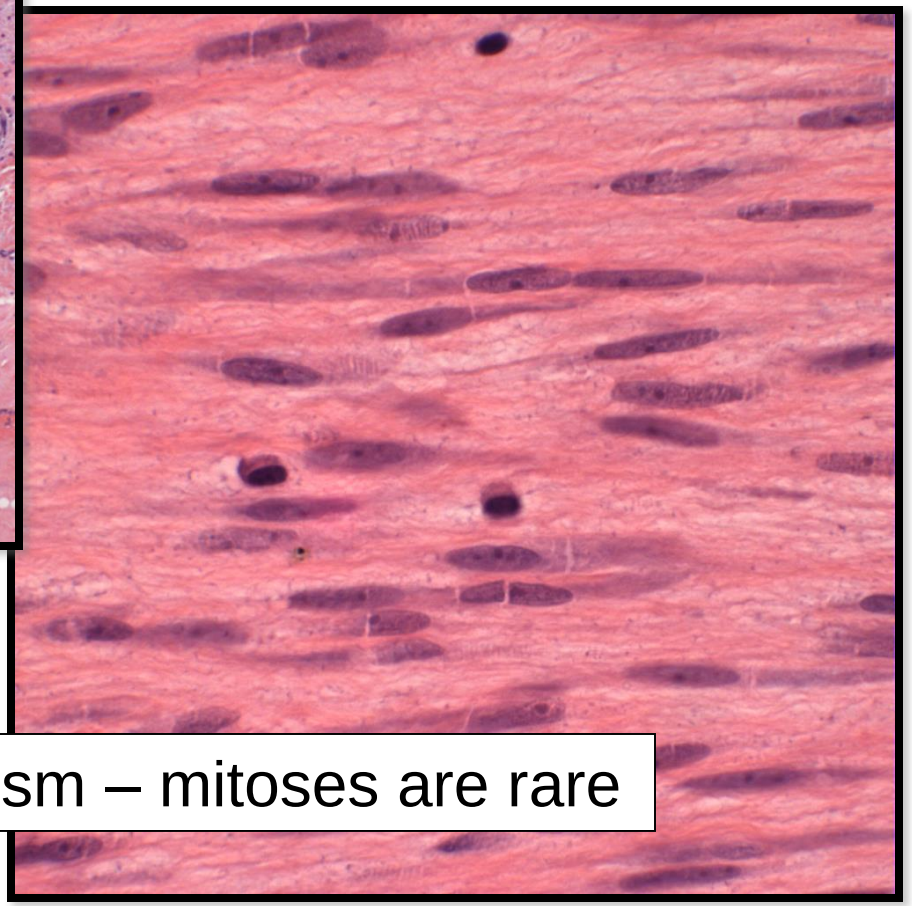


The cells surround normal epithelial elements

Fibromatosis – Pathologic features

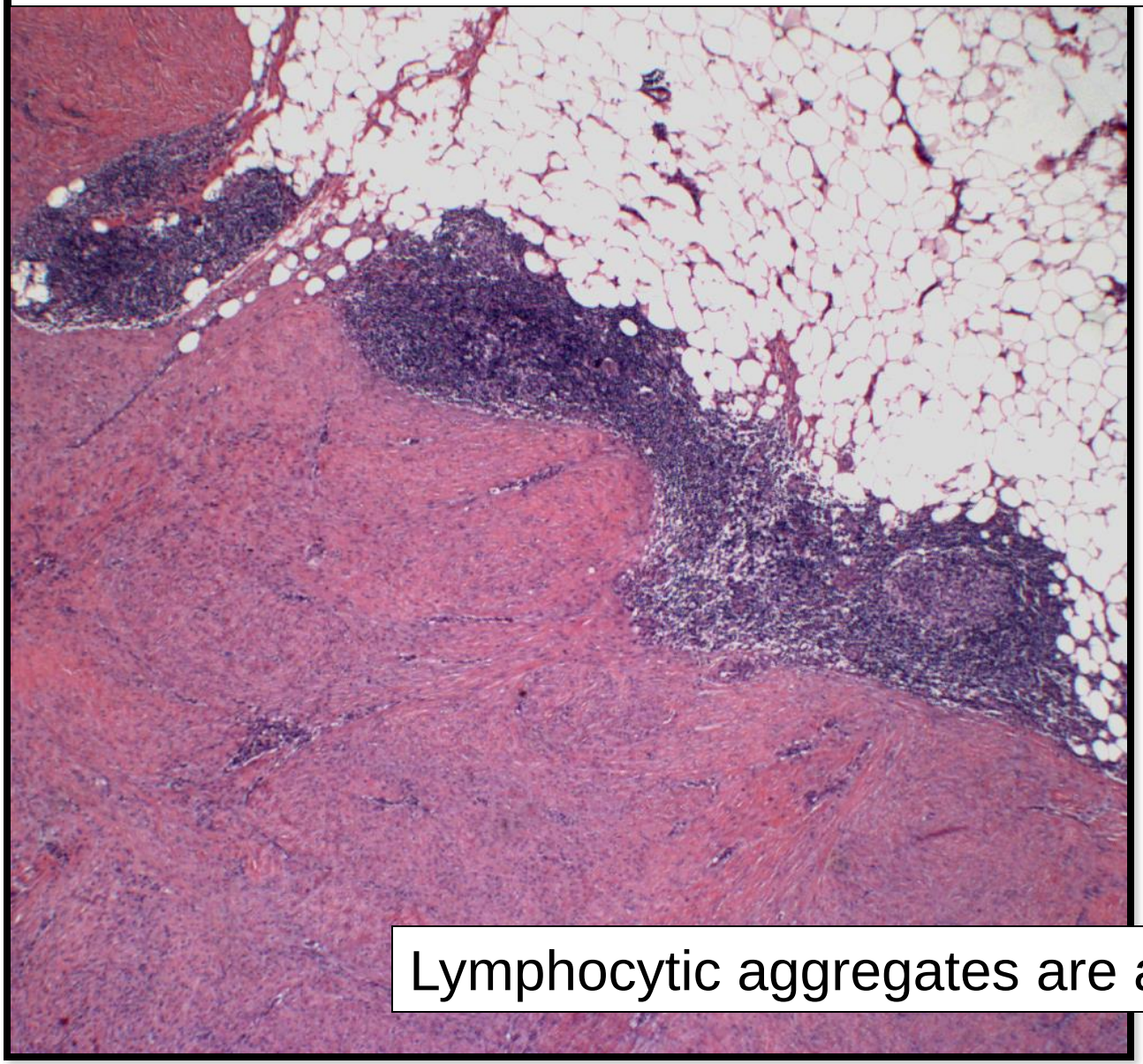


Dense collagen bands



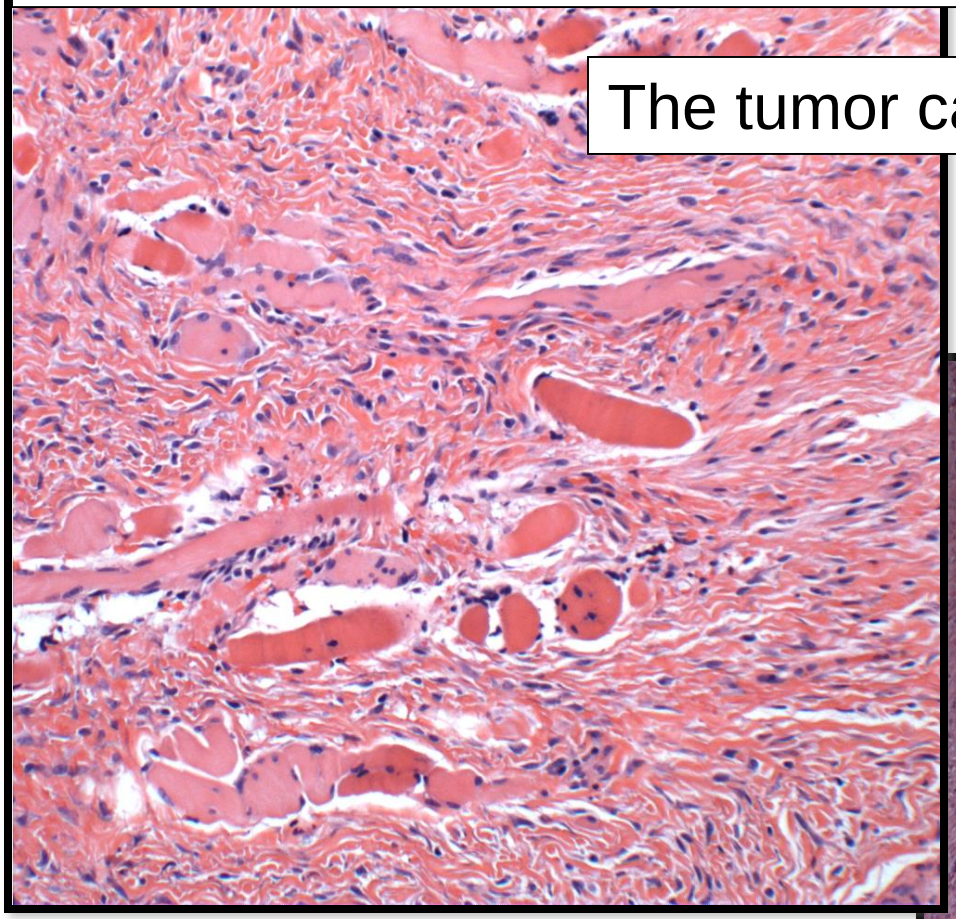
Minimal nuclear pleomorphism – mitoses are rare

Fibromatosis – Pathologic features

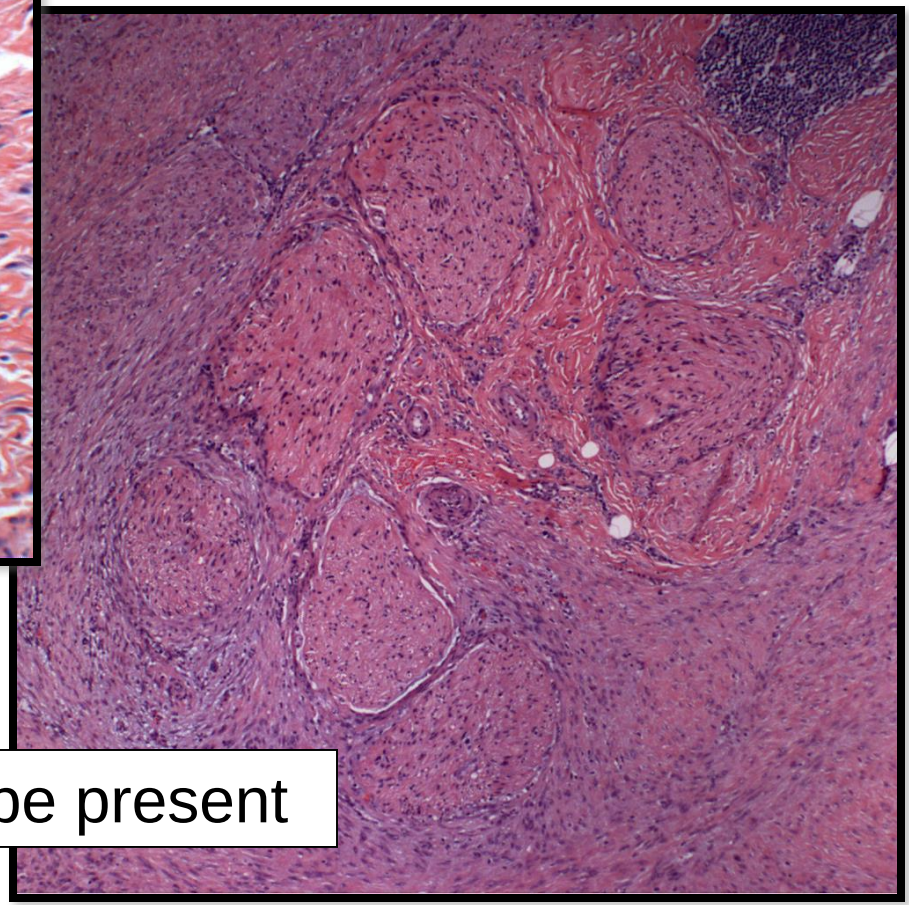


Lymphocytic aggregates are at the periphery

Fibromatosis – Pathologic features

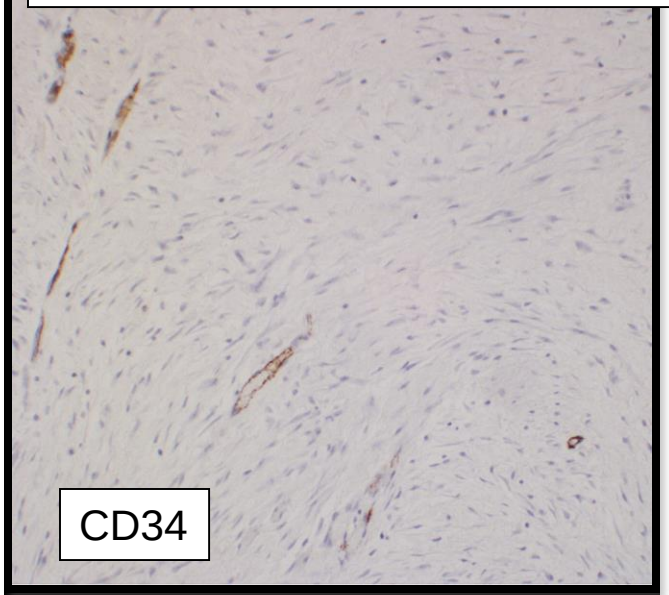


The tumor can invade into skeletal muscle

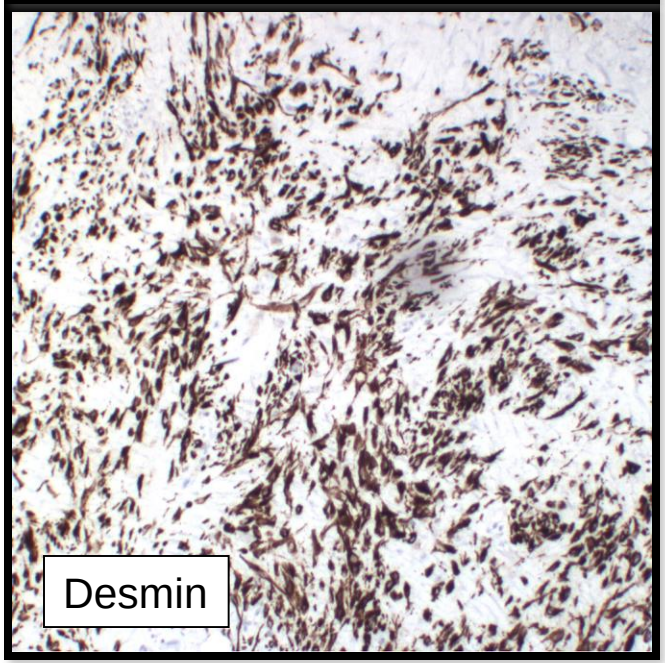


Perineural invasion may be present

Fibromatosis – Immunohistochemistry

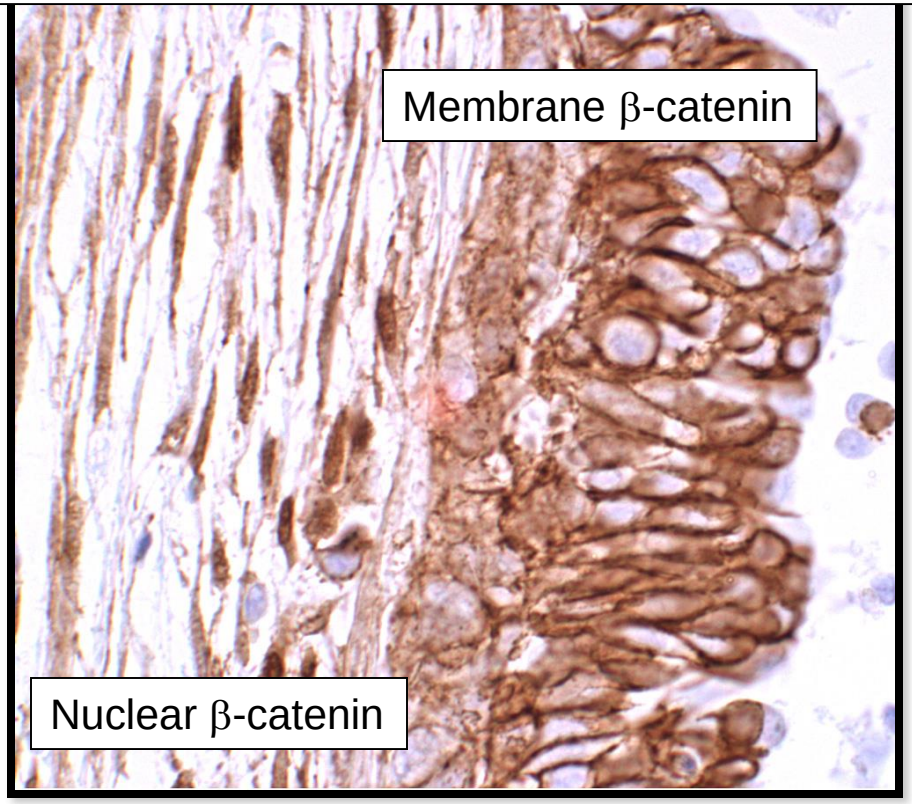


CD34 negative



Muscle markers positive

Fibromatosis – Nuclear β-catenin



β-catenin links cadherins to the actin cytoskeleton and is normally found in the membrane.

Abnormal regulation by *APC* can lead to accumulation in the nucleus as well as in the cytoplasm.

Aberrant nuclear β-catenin is found in 60-80% of cases but is not specific for fibromatosis. Also seen in some carcinomas (especially triple negative carcinoma ~25-30%) and sarcomas.

Fibromatosis – Nuclear β-catenin

The majority of sporadic cases (~85%) have mutations in the β-catenin gene (*CTNNB1*). Results in activation of Wnt pathway.

Specific mutations may be predictive of the likelihood of recurrence and/or response to treatment.

Non-surgical approaches to treatment are being evaluated:

Wnt/ β-catenin pathway inhibitors

Tyrosine kinase inhibitors

Fibromatosis-like carcinoma vs Fibromatosis

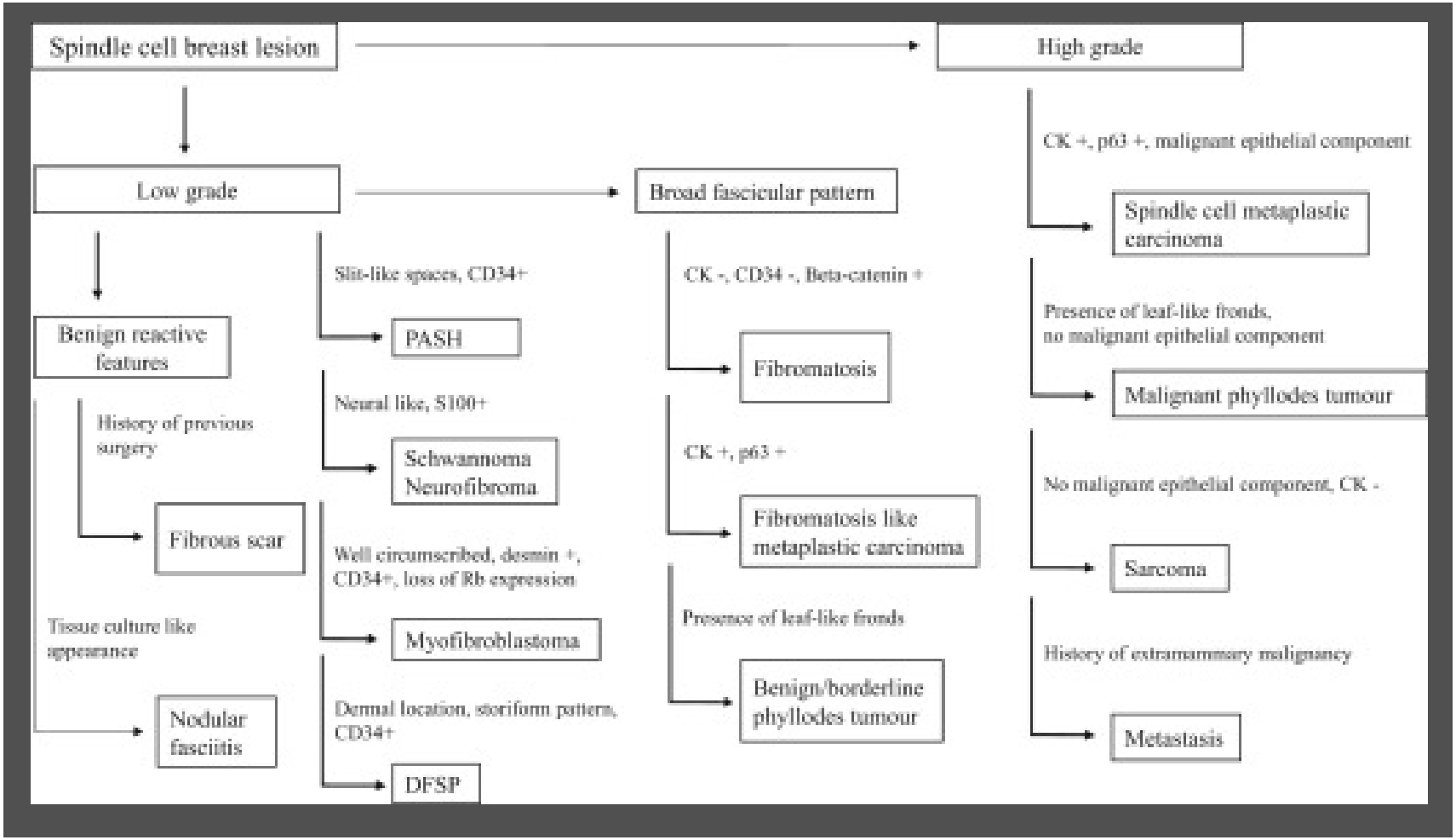
Feature	Fibromatosis-like carcinoma	Fibromatosis
Epithelioid areas	May be present	Absent
Mitoses	May be present – rare	Usually absent
Keratin	Positive (HMW>LMW)	Negative
P63	Positive (majority)	Negative
Nuclear β-catenin	Some positive	Majority positive
CD34	Negative	Negative
Muscle markers	May be positive	Usually positive (SMA, desmin)
ER/PR	Negative	Negative
Outcome	Can recur locally; metastasis rare	Can recur locally; does not metastasize
Treatment	Surgery, radiation, possible chemotherapy	Surgery Experimental treatment without surgery

Because not all cases cases of suspected fibromatosis will undergo surgery, it is important to be as confident in this diagnosis on core biopsy.

Spindle Cell Lesions of the Breast - Summary

	CD34	Muscle markers	β-catenin nuclear	ER/PR	Keratin HMW	p63
Reactive (scar)	Pos	Pos	neg	neg	neg	neg
Fibroadenoma/ Phyllodes	Pos	neg/Pos	Pos 60-90%	ER neg/PR occ pos	neg/rare *	neg*
PASH/Fibrous	Pos	Pos	??	Pos/neg	neg	neg
Myofibroblastoma	Pos	Pos	neg	Pos	neg	neg
Fibromatosis	neg	Pos	Pos 80%	neg	neg	neg
Nodular fasciitis	neg	Pos	neg	??	neg	neg
Sarcoma	neg/Pos	Pos/neg	Pos 30%	neg	neg	neg
Spindle cell carcinoma	neg	Pos/neg	Pos ~25-30%	neg	Pos	1/3 Pos

Muscle = smooth muscle actin, desmin, smooth muscle myosin heavy chain
Keratin = HMW keratin, MNF116, 34BE12, Ck 14
* p63 positive in some high grade (malignant) phyllodes tumors, focal patchy keratin in some



Tay TKY, Tan PH, Spindle cell lesions of the breast – an approach to diagnosis. Sem Diagn Pathol 34:400-409, 2017.

Spindle Cell Lesions – Key Points

Situational awareness –

- **How large was the mass?**
- **What was the shape (circumscribed or irregular)?**
- **Was there a prior history of surgery?**

Immunohistochemical studies – often necessary

Be aware of the perilous pitfalls!

Stonehenge, Salisbury Plain, England?


Final Mimic: Cheesehenge, West Roxbury, MA
Thank you for your attention!