

Solitary Fibrous Tumor

Pleural pathology · morphology · molecular diagnosis · risk assessment

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Learning objectives

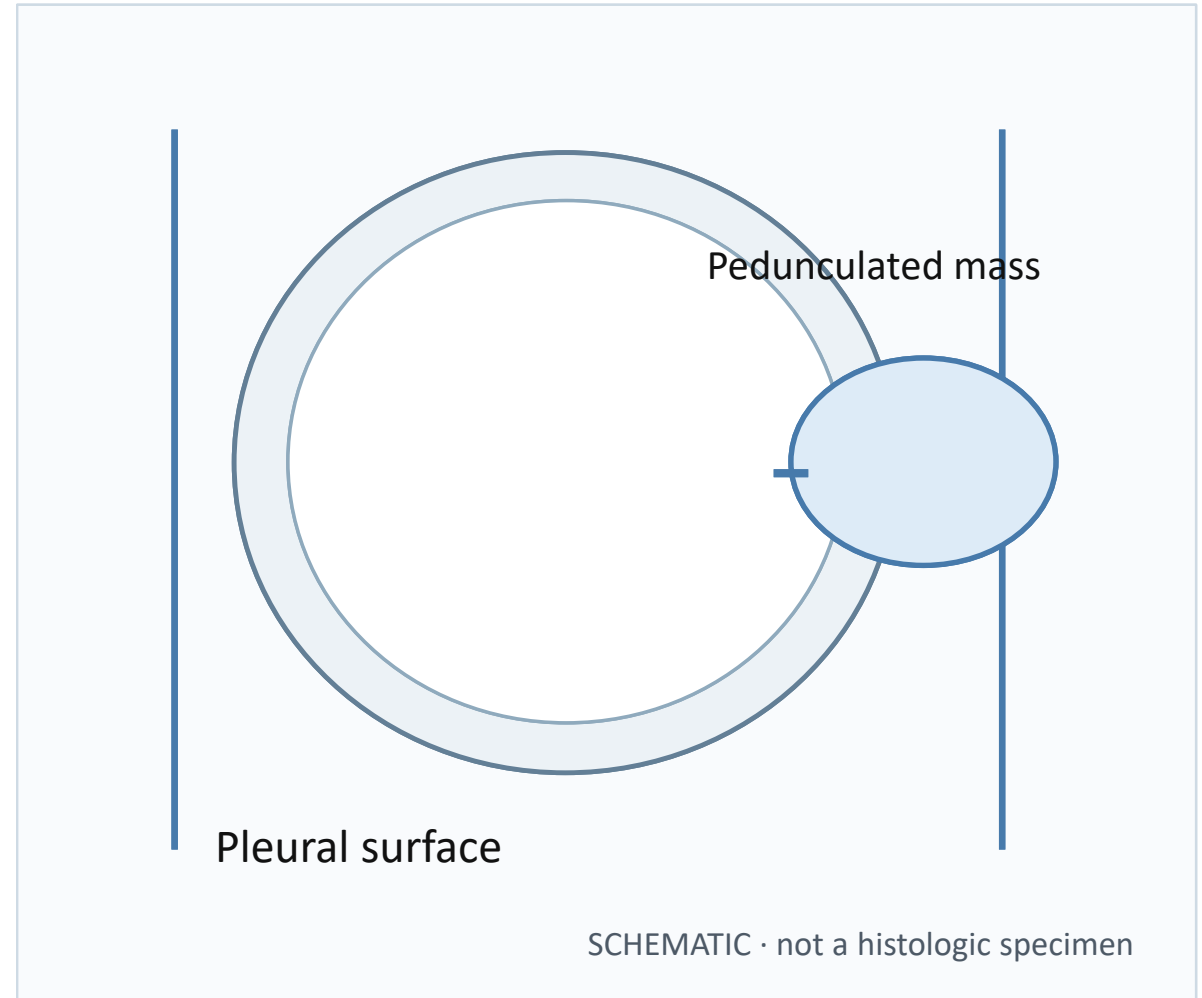
- Recognize the characteristic gross and spindle-cell morphology.
- Explain NAB2::STAT6 fusion and the diagnostic role of nuclear STAT6.
- Distinguish SFT from pleural epithelial and other spindle-cell tumors.
- Use morphology and validated risk factors without equating size with malignancy.

A fibroblastic neoplasm, not a pleural mesothelioma

- SFT is a mesenchymal soft-tissue neoplasm that commonly involves the pleura.
- It may also arise within lung or at many extrathoracic anatomic sites.
- Its defining molecular association is a NAB2::STAT6 fusion.
- Its biological behavior ranges from indolent to recurrent or metastatic.

Pleural location: Surface attachment matters

- A pleural SFT may form a localized mass projecting from the pleural surface.
- A pedicle may connect the lesion to visceral or parietal pleura.
- This differs anatomically from a diffuse pleural rind typical of mesothelioma.
- Location is an initial clue, not a stand-alone histologic diagnosis.



Anatomic spectrum of solitary fibrous tumor

- Pleura is a characteristic site but does not define the entity.
- Tumors also occur in deep soft tissue, abdominal/retroperitoneal sites and head–neck regions.
- Intrapulmonary SFT is less frequent than pleural SFT.
- A similar molecular signature connects tumors across these locations.

Pleural and intrapulmonary SFT are distinct locations

Pleural SFT is often attached to a serosal surface.

Feature	Pleural SFT	Intrapulmonary SFT
Origin	Pleural surface	Pulmonary parenchyma
Typical configuration	Surface-based ± pedicle	Intraparenchymal mass
Diagnostic implication	Mesothelioma differential	Spindle-cell lung tumors differential

Terminology reflects a changing concept

- Historic labels included localized fibrous pleural tumor and hemangiopericytoma.
- A branching “hemangiopericytoma-like” vascular pattern is not entity-specific.
- NAB2::STAT6 helps unify the variable morphologic appearances.
- Modern diagnosis uses the designation solitary fibrous tumor.

Asbestos exposure: A crucial negative association

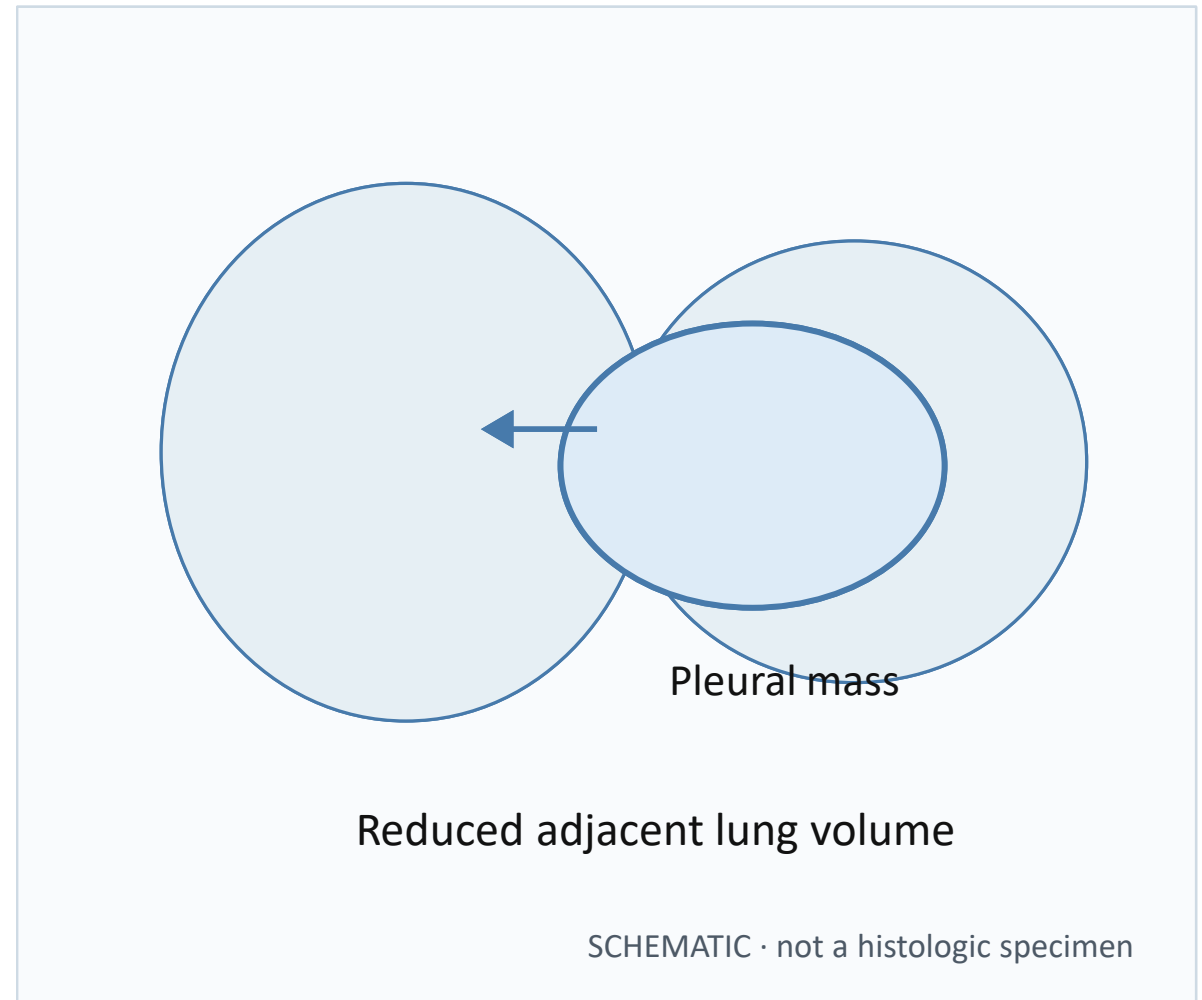
- SFT is not related to asbestos exposure.
- Malignant pleural mesothelioma has a strong established asbestos association.
- A history of asbestos exposure should not independently reclassify a spindle-cell lesion.
- Morphology and lineage immunostains remain decisive.

Clinical detection ranges from incidental to symptomatic

- An indolent, localized SFT may be detected incidentally on imaging.
- Large pleural tumors may produce breathlessness or discomfort through mass effect.
- Clinical symptoms do not reliably establish histologic grade.
- The relevant question is whether tumor compresses, invades or recurs.

Why a large pleural mass causes symptoms

- A growing mass occupies intrathoracic space.
- Compression reduces expansion of adjacent lung tissue.
- Displacement may cause dyspnea or chest discomfort.
- The mechanism is mechanical; It does not require epithelial differentiation.

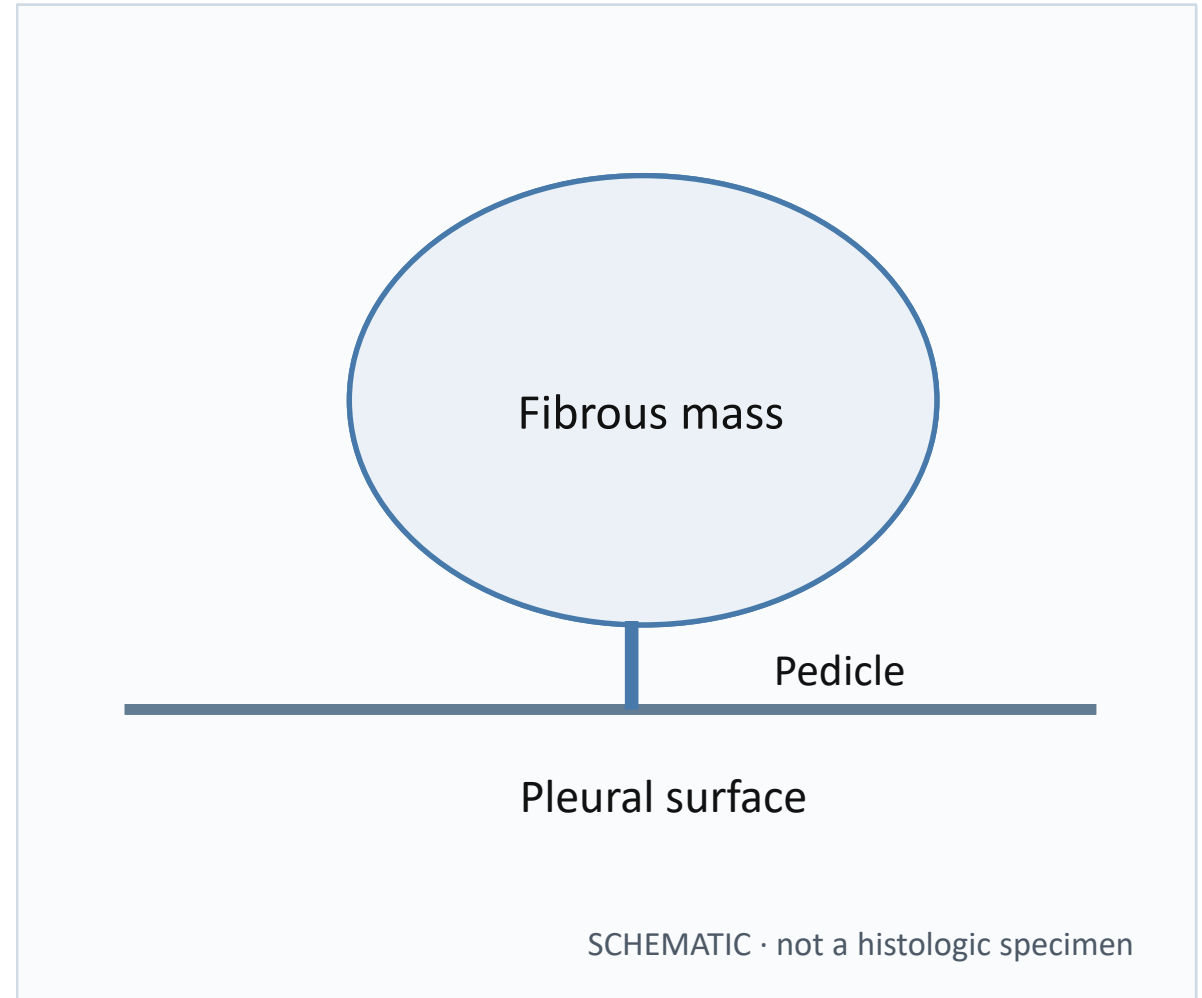


Radiology localizes but does not confirm SFT

- A circumscribed pleural-associated mass raises the possibility of SFT.
- Imaging assesses size, site, relationship to pleura and neighboring structures.
- Enhancement and vascularity may guide safe biopsy or operative planning.
- Tissue morphology plus immunophenotype establish the diagnosis.

Grossly: A firm, localized fibrous tumor

- The cut surface is typically solid, firm and whitish to tan.
- The prominence of fibrous stroma explains the firm consistency.
- A pedicle is frequently described in pleural lesions.
- Do not infer low metastatic risk from a well-circumscribed gross appearance alone.

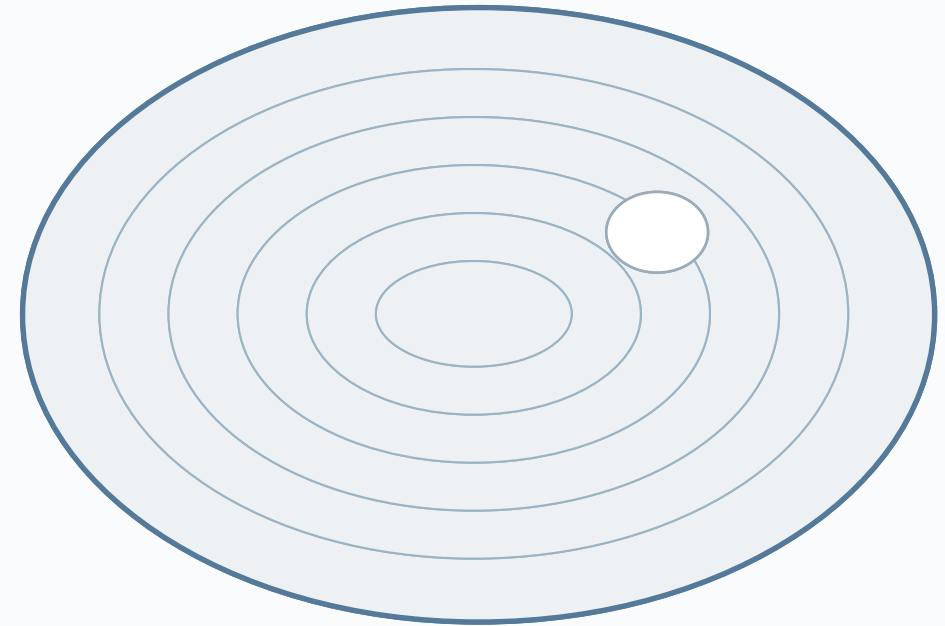


Tumor size spans a broad spectrum

- Examples only 1–2 cm in diameter.
- Other lesions may become very large before detection.
- Size influences pressure symptoms and validated risk assessments.
- Absolute size alone does not define malignancy or determine outcome.

Whorled and occasionally cystic cut surfaces

- Intersecting collagen bundles can create a whorled cut-surface appearance.
- Occasional cysts may contain viscous material in the Robbins description.
- Hemorrhage, necrosis or irregular margins warrant additional sampling.
- Grossly heterogeneous regions should be separately documented.



Whorled collagen-rich cut surface

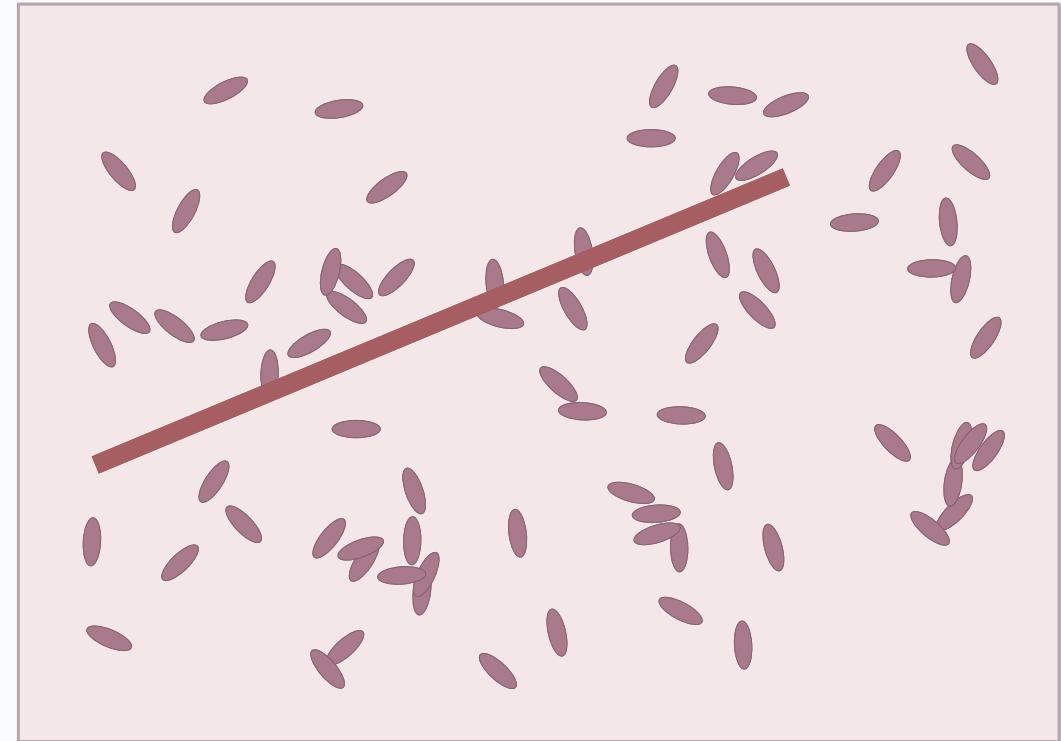
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Macroscopic sampling: What the pathologist seeks

- Record maximum dimension and relation to pleural attachment.
- Examine tumor–pleura and tumor–lung interfaces.
- Sample soft, hemorrhagic, necrotic or unusually cellular regions.
- Assess margins in a resection specimen and document heterogeneity.

The basic histologic triad

- Spindle or ovoid tumor cells are distributed in collagenous stroma.
- Cellularity is variable, even within a single tumor.
- Prominent branching blood vessels may be present.
- No single morphologic feature is by itself pathognomonic.



Cells + collagen + vessels

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Spindle cells: Restrained cytology in conventional SFT

- Conventional tumors often contain uniform elongated nuclei.
- Cytoplasm is usually inconspicuous relative to the dense stroma.
- The cells may form short, irregular fascicles or loose aggregates.
- Marked pleomorphism should prompt closer evaluation for aggressive change.

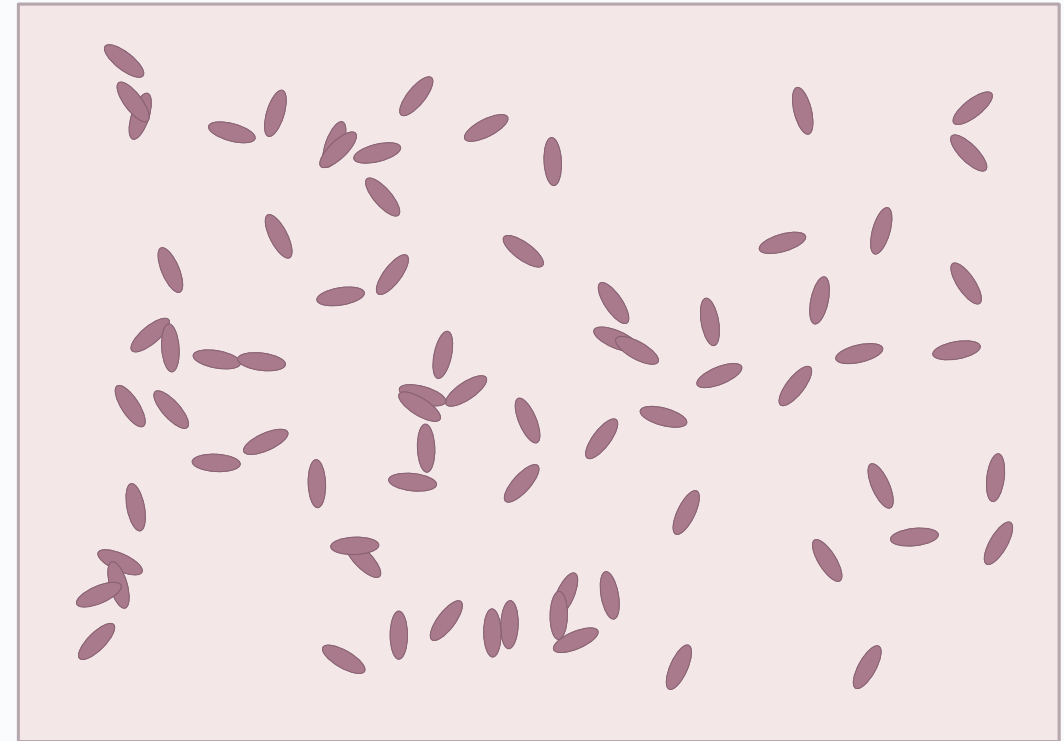


Elongated spindle cells

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Patternless architecture is a useful low-power clue

- Tumor cells may appear haphazard rather than arranged in parallel fascicles.
- Areas of relatively high and low cellularity can alternate.
- Collagen separates cells and cell clusters.
- Patternless architecture must be integrated with vessels and immunostains.



Haphazard cell arrangement

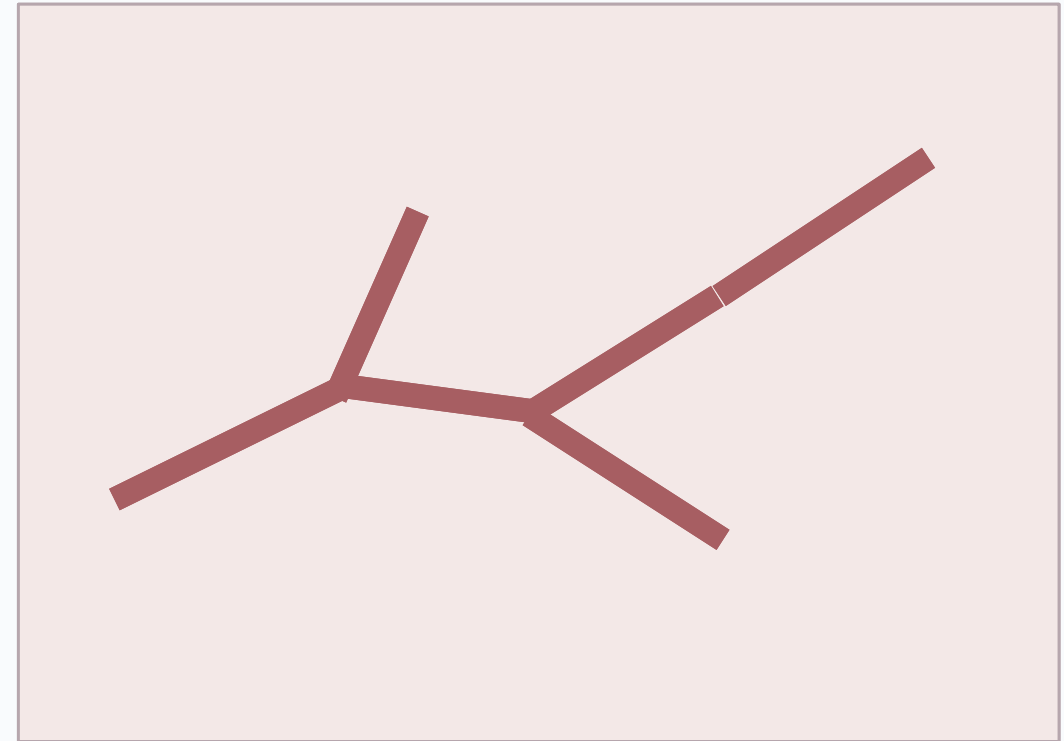
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Collagen and reticulin dominate the classic pattern

- Whorls of collagen and reticulin fibers.
- Variable fiber abundance produces fibrous and more cellular zones.
- Dense collagen may resemble keloidal bands or show tissue clefting.
- This stromal architecture helps explain the firm gross cut surface.

Branching vascular channels: “staghorn” pattern

- Dilated thin-walled vessels can branch at acute angles.
- This vascular configuration was historically called hemangiopericytoma-like.
- The pattern occurs in other mesenchymal neoplasms as well.
- A vascular pattern cannot substitute for lineage markers.



Branching thin-walled vessels

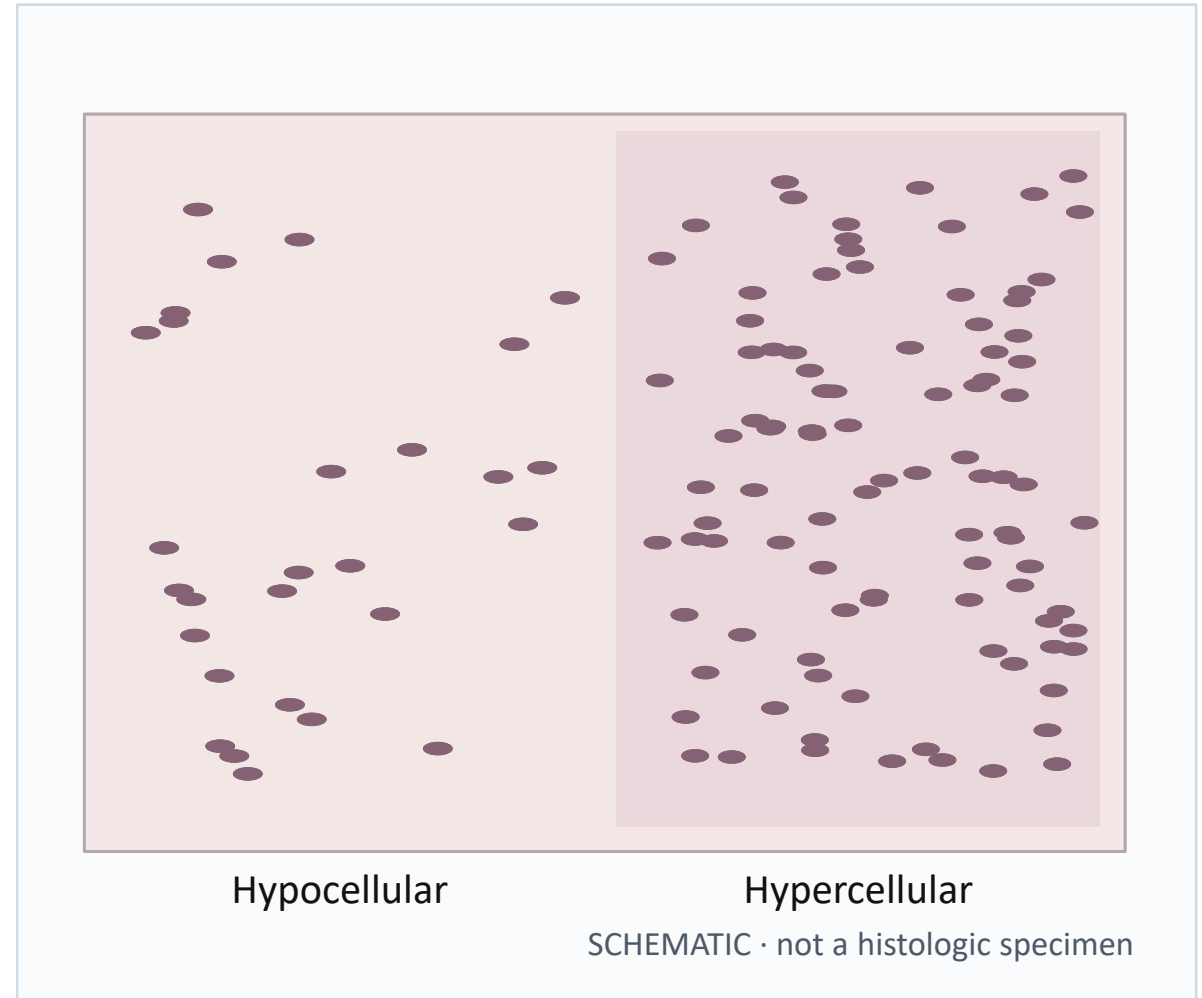
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Perivascular fibrosis modifies vessel appearance

- Concentric or irregular collagen may surround vascular channels.
- This can accentuate the boundary between vessel and tumor stroma.
- The finding complements the branching-vessel pattern.
- Interpret the feature as part of a broader SFT morphologic spectrum.

Cellularity varies within the same neoplasm

- Hypocellular zones may appear collagen-rich and deceptively scar-like.
- Cellular zones may appear densely packed and less obviously fibrous.
- Focal sampling can therefore misrepresent the whole lesion.
- Compare morphology across multiple blocks before judging risk.



Myxoid stromal change can obscure classic features

- Some SFTs show mucin-rich, pale or myxoid background matrix.
- The spindle-cell population may then appear more dispersed.
- A broad myxoid differential requires immunophenotypic correlation.
- Myxoid change alone is not proof of aggressive behavior.

Cellular SFT: Less conspicuous collagen

- Hypercellular tumors may have rounded-to-spindled cells.
- More closely packed nuclei can mask the characteristic fibrous stroma.
- A vascular hemangiopericytoma-like pattern may become prominent.
- Use STAT6, other immunostains and the sampled context for classification.

Fat-forming SFT: Mature fat within the lesion

A recognized variant contains admixed mature adipocytes.

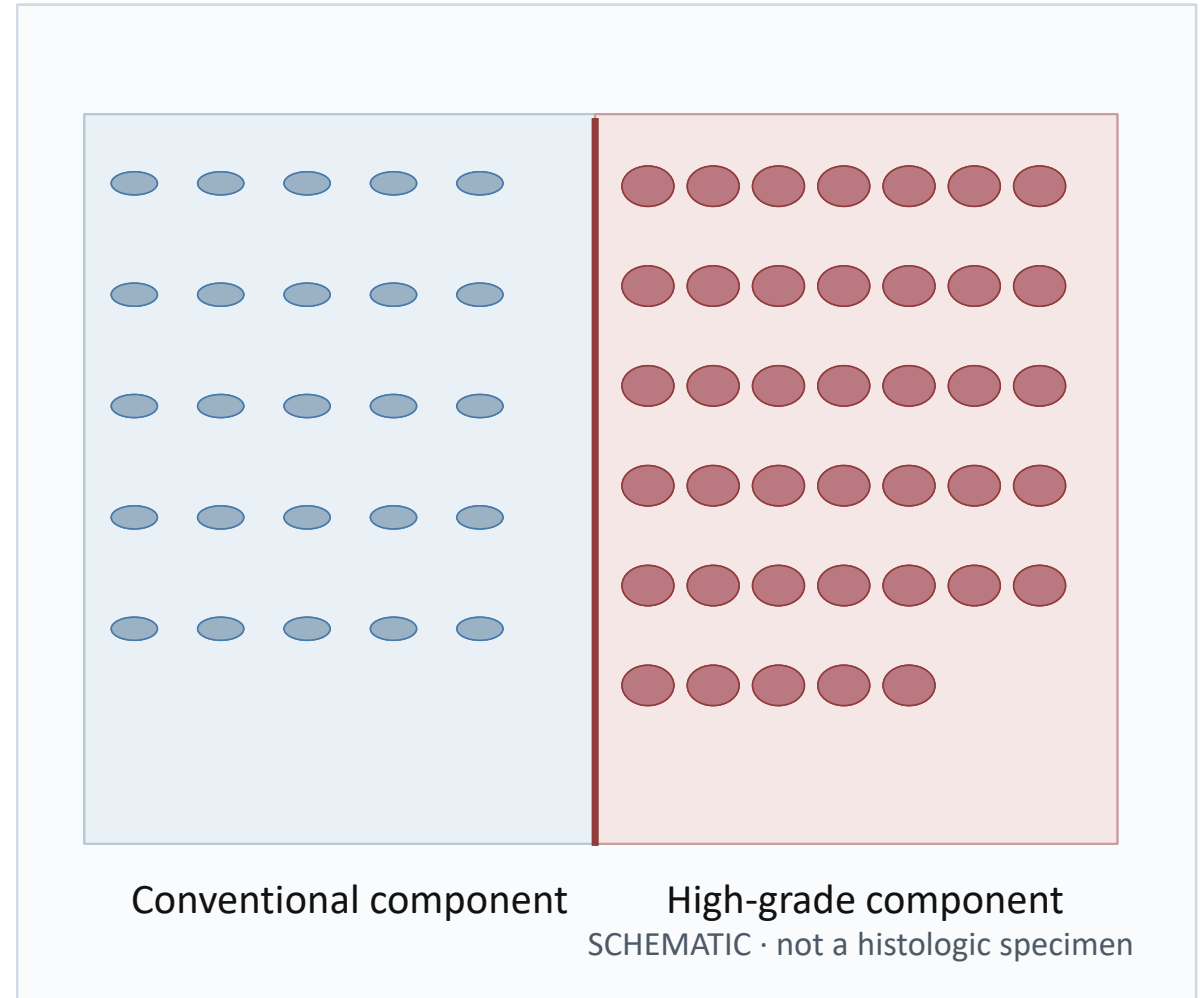
Clue	Fat-forming SFT	A possible mimic
Stroma	SFT-type spindle cells and collagen	Lipomatous tumor architecture
Molecular axis	NAB2::STAT6	Alternative entity-specific changes
Useful test	Nuclear STAT6 in context	Marker panel guided by morphology

Giant-cell-rich SFT: An established variant

- Multinucleated stromal giant cells may line pseudovascular spaces.
- This appearance overlaps with the historical “giant cell angiofibroma” term.
- Recognize the background SFT-like spindle cells and vasculature.
- Use nuclear STAT6 and a targeted differential panel.

Dedifferentiation: A sharp morphologic transition

- Some rare SFTs contain a conventional area adjoining high-grade sarcoma.
- The boundary between components may be abrupt.
- High-grade regions may show marked pleomorphism and brisk mitoses.
- Immunophenotypic markers may be reduced or lost in dedifferentiated areas.



Conventional and aggressive histology differ

Conventional SFT: Bland cells, limited atypia, often low mitotic activity.

Domain	Conventional morphology	Concerning morphology
Cytology	Often bland	Atypia / pleomorphism
Proliferation	Often low mitotic activity	Increased mitoses
Viability	Necrosis absent	Necrosis may be present
Interface	Often circumscribed	May be infiltrative

Necrosis: Distinguish true tumor necrosis

- Coagulative tumor necrosis is an adverse feature in risk models.
- Document the presence and extent of necrosis in the resection.
- Do not mistake biopsy-related injury for spontaneous tumor necrosis.
- Necrosis must be interpreted with age, size and mitotic rate.

Mitotic activity requires systematic assessment

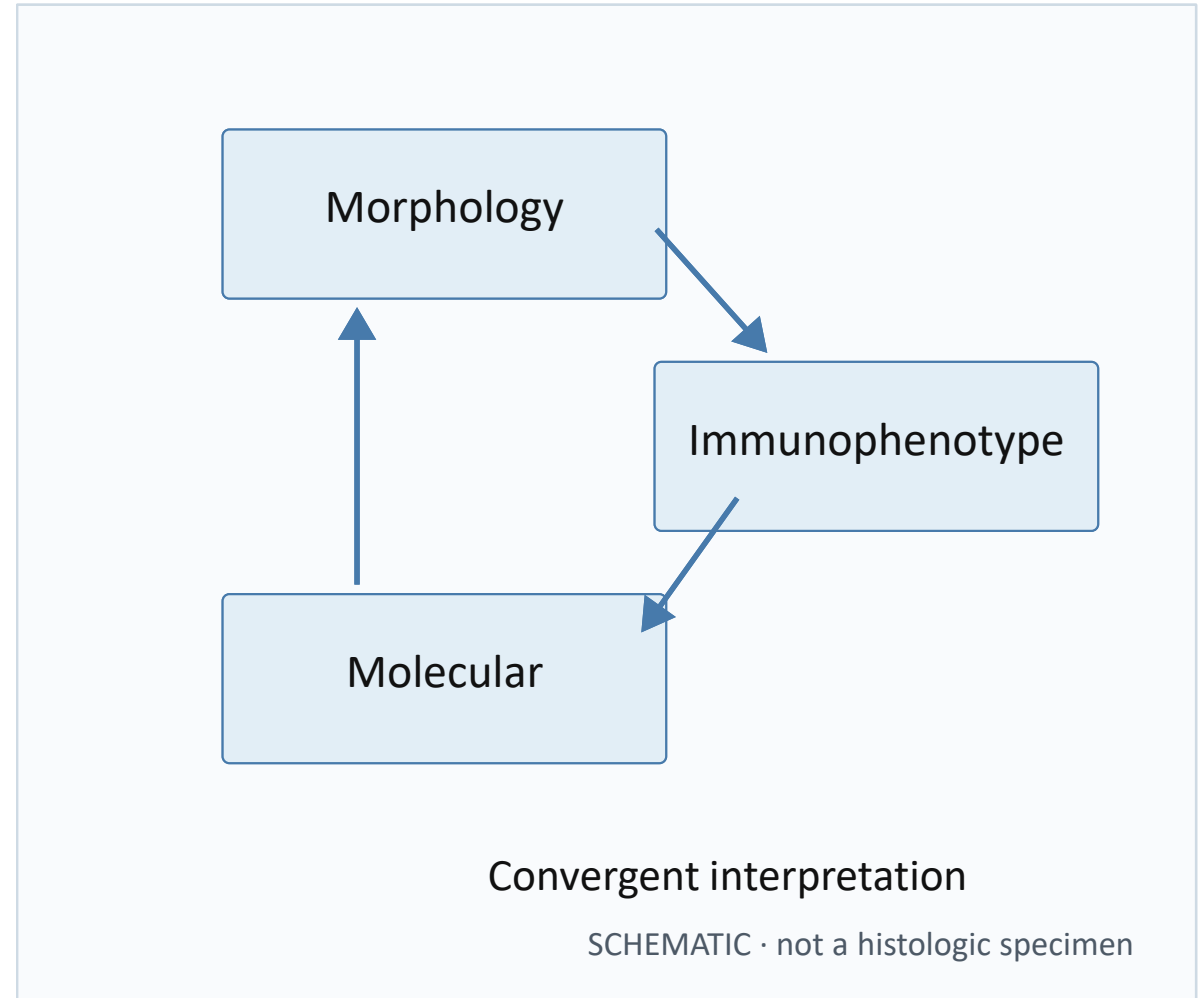
- Evaluate representative viable, cellular tumor regions.
- Count mitoses with a standardized area rather than relying on vague adjectives.
- The Demicco model explicitly includes mitotic activity.
- A small biopsy may underrepresent the highest proliferative focus.

Infiltrative borders raise concern but are not a stage

- SFT may appear sharply delineated in gross sections.
- An infiltrative interface can accompany locally aggressive biology.
- Document involvement of adjacent tissue and margin status.
- Do not confuse infiltrative growth with proven distant metastasis.

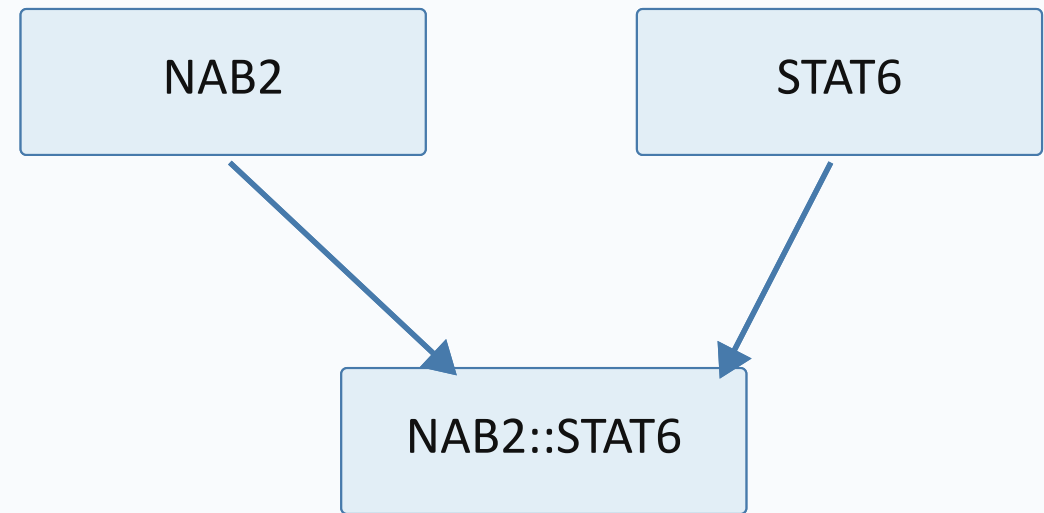
The diagnostic synthesis has three complementary axes

- Morphology suggests a spindle-cell fibroblastic neoplasm.
- Nuclear STAT6 strongly supports the NAB2::STAT6-linked entity.
- CD34 and exclusionary markers refine the lineage differential.
- Clinical site and tissue sampling resolve discordant cases.



Chromosome 12 rearrangement defines the molecular axis

- NAB2 and STAT6 are neighboring genes on chromosome 12q13.
- A recurrent intrachromosomal rearrangement generates NAB2::STAT6.
- The alteration as a cryptic inversion.
- A fusion transcript encodes a chimeric transcriptional regulator.

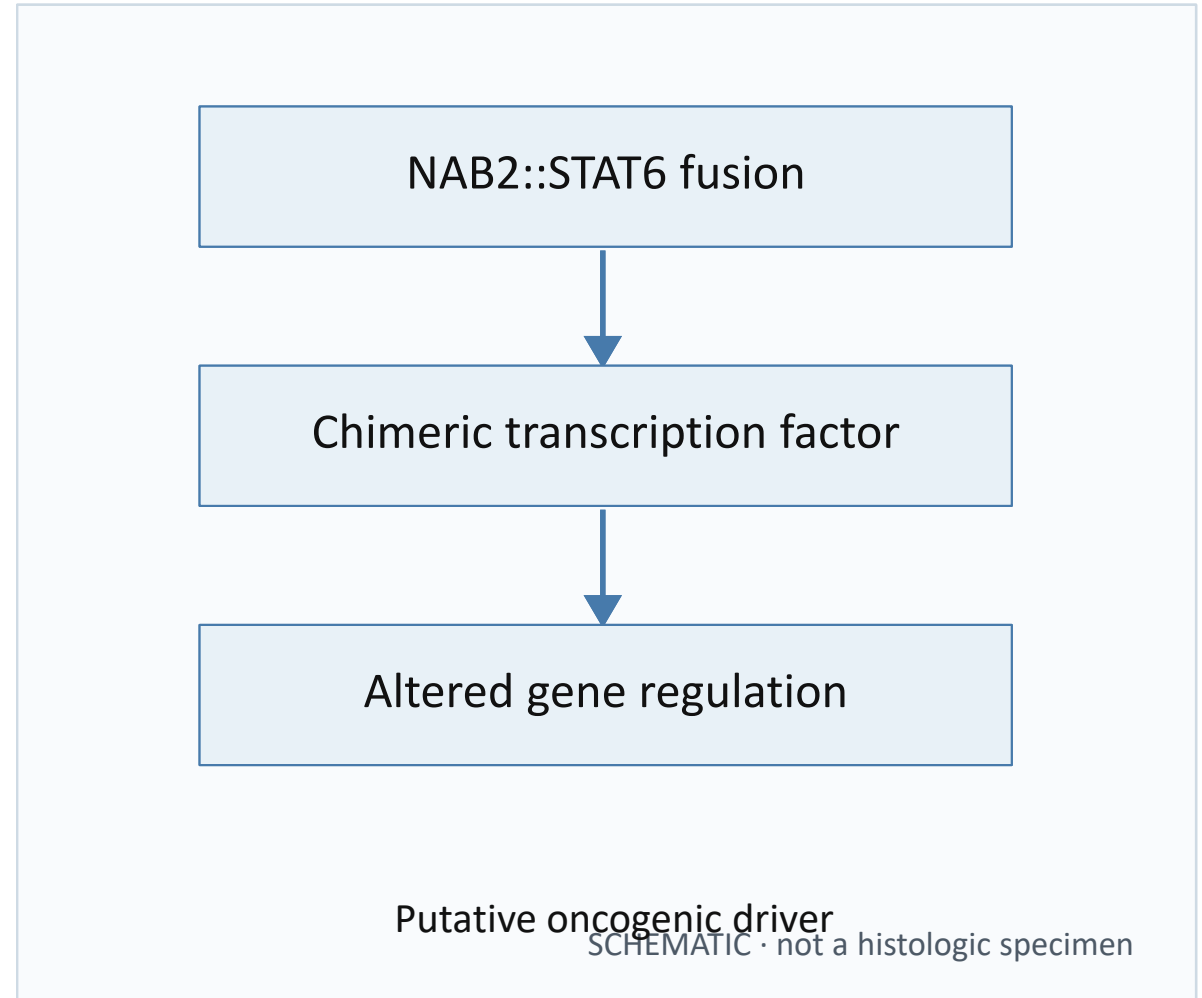


Intrachromosomal rearrangement · chromosome 12

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NAB2::STAT6 is hypothesized to drive tumorigenesis

- The fusion brings functional regions of NAB2 and STAT6 together.
- The chimeric product affects transcriptional regulation.
- Its driver role as a hypothesis, not an experimentally complete mechanism.
- Nuclear STAT6 immunoreactivity serves as a practical surrogate signal.

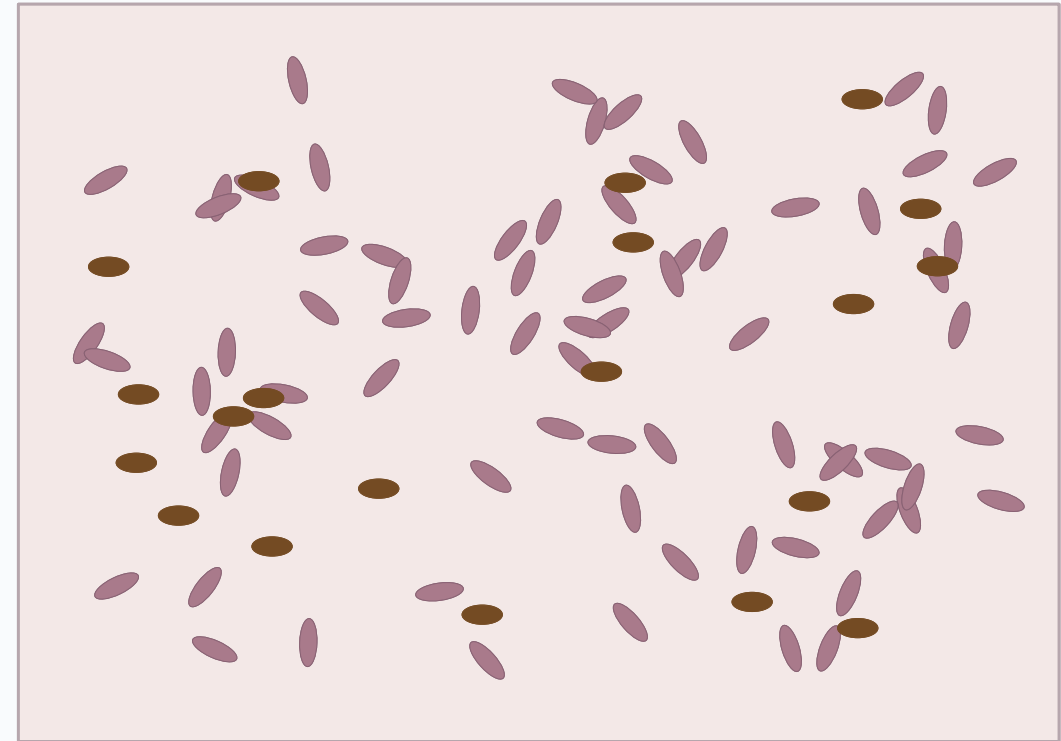


Diagnostic specificity comes from fusion context

- An individual immunostain is not equivalent to direct sequencing.
- A characteristic morphologic phenotype increases the weight of STAT6 positivity.
- Some non-SFT tumors may show nuclear STAT6 staining.
- Fusion testing is useful when morphology and immunophenotype conflict.

Nuclear STAT6: The most informative routine stain

- Strong, diffuse nuclear staining is characteristic of conventional SFT.
- The localization matters: Evaluate tumor nuclei, not merely background cells.
- STAT6 is a surrogate for NAB2::STAT6, not direct proof of the gene fusion.
- Rare mimics and high-grade marker loss require interpretation.



Dark nuclei represent IHC nuclear signal

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CD34: Common but insufficient by itself

- Conventional SFTs are commonly CD34 positive.
- CD34 is not specific: Multiple other spindle-cell lesions also stain.
- Loss of CD34 may occur in malignant or dedifferentiated components.
- Use CD34 in concert with nuclear STAT6 and tumor morphology.

CD99 and BCL2 are supporting, nonspecific stains

- CD99 and BCL2 are often positive in SFT.
- Both are expressed in other spindle-cell neoplasms.
- They may contribute when the differential is wide.
- Neither substitutes for a specific molecular or convincing STAT6 result.

Keratin negativity supports separation from mesothelioma

- Keratin negativity in usual SFT.
- Mesothelioma generally expresses epithelial keratins.
- A broad-spectrum cytokeratin stain is part of a pleural spindle-tumor panel.
- Rare focal keratin expression in SFT means interpretation needs context.

Pleural SFT versus malignant mesothelioma

SFT is generally localized; Mesothelioma often diffusely invests pleura.

Feature	Solitary fibrous tumor	Mesothelioma
Architecture	Localized mass ± pedicle	Often diffuse pleural rind
STAT6 nuclei	Usually positive	Usually negative
CD34 tumor cells	Commonly positive	Usually negative
Cytokeratin	Usually negative	Usually positive

Sarcomatoid carcinoma is another pleural mimic

- Spindle-cell epithelial malignancy can simulate sarcoma morphology.
- Broad keratin expression favors an epithelial process.
- SFT morphology plus nuclear STAT6 supports the alternative lineage.
- Interpret staining within the clinical and imaging context.

Soft-tissue spindle-cell differential is broad

Schwannoma or MPNST: Neural-lineage morphology and marker context.

Mimic	Overlapping feature	Useful discriminator
Schwannoma	Spindle-cell architecture	Neural marker pattern
GIST	CD34-positive spindle cells	KIT / DOG1 context
Desmoid fibromatosis	Collagen-rich spindle cells	β-catenin / clinical pattern
Synovial sarcoma	Monomorphic spindle cells	Keratin / SS18 fusion

STAT6 positivity is not absolutely specific

- Dedifferentiated liposarcoma can exhibit nuclear STAT6 positivity.
- Other mesenchymal tumors may rarely show nuclear immunoreactivity.
- MDM2 amplification testing may be needed in a liposarcoma differential.
- Fusion detection offers added confidence in an equivocal case.

Diagnostic pitfalls intensify after dedifferentiation

- A high-grade focus may lose CD34, STAT6 or both.
- Sampling only this area may conceal the conventional SFT component.
- Search for a lower-grade area and compare different tumor blocks.
- Confirm the diagnosis molecularly when necessary.

When to request molecular confirmation

- Consider fusion-directed testing if immunophenotype is discordant.
- Consider it in unusual site, high-grade morphology or competing STAT6-positive mimic.
- A positive NAB2::STAT6 fusion supports SFT identity.
- Assay sensitivity depends on method, fusion partners and specimen quality.

Small biopsy: Identity is easier than risk prediction

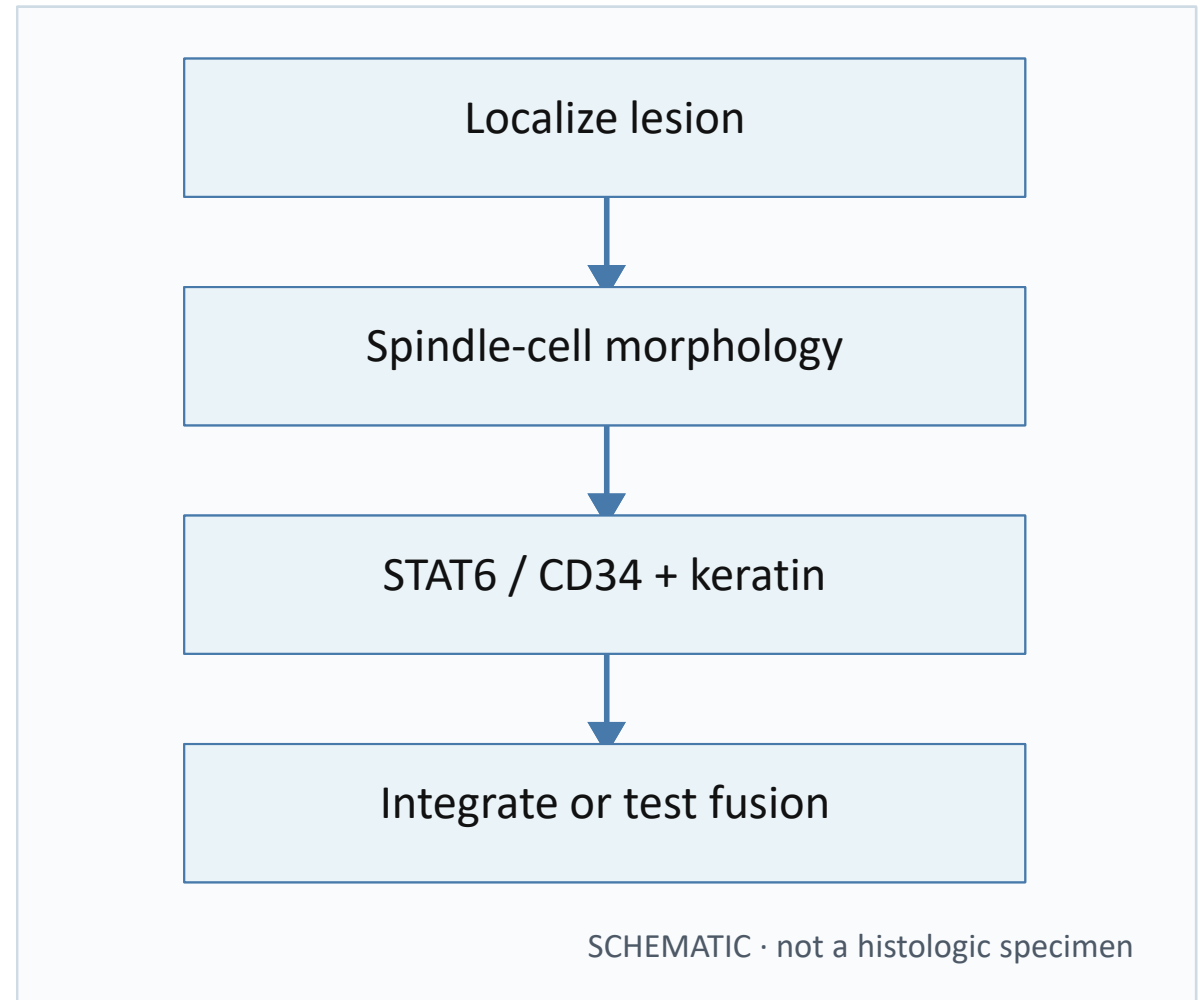
- A core biopsy can show the characteristic cell/vessel/stroma triad.
- A limited fragment may miss necrosis, focal hypercellularity or dedifferentiation.
- Immunostains can narrow the lineage diagnosis on small material.
- Complete risk stratification is most reliable with the resection specimen.

Report the features that affect clinical interpretation

- Specify site, tumor size and margins when assessable.
- Describe mitotic activity using a defined counting area.
- Record necrosis, pleomorphism and dedifferentiation if present.
- Include relevant STAT6/CD34/keratin results and molecular results when performed.

A practical workflow for a pleural spindle-cell lesion

- Step 1: Locate the mass and evaluate its architecture.
- Step 2: Assess spindle cytology, collagen and vascular pattern.
- Step 3: Perform STAT6, CD34 and exclusionary epithelial-lineage stains.
- Step 4: Resolve discordance through additional markers or fusion testing.

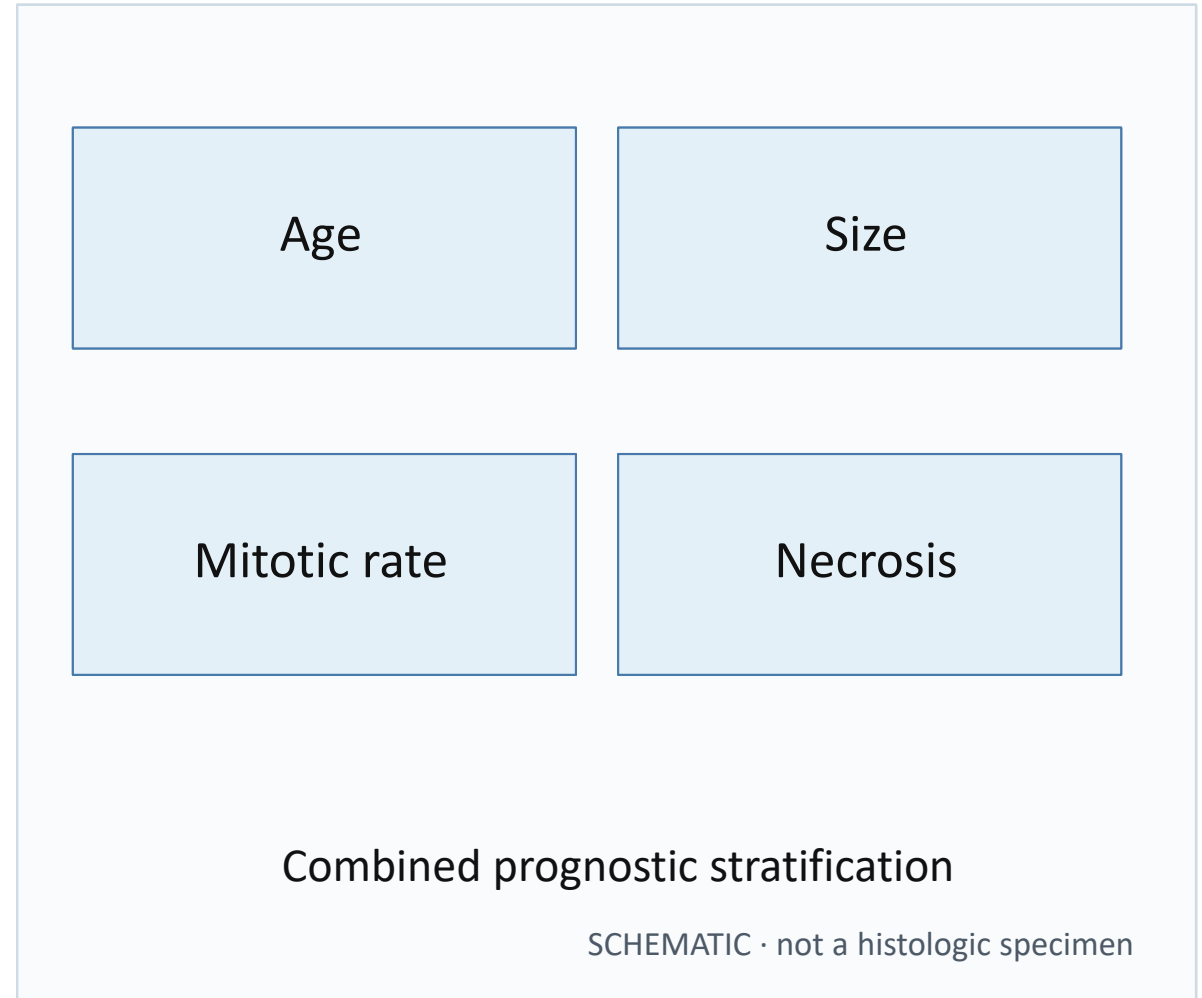


“Malignant” morphology and metastasis risk are distinct

- Histologic atypia is evidence, not certainty, of future progression.
- Metastasis can occur in a minority without striking early atypia.
- Risk assessment incorporates clinical and morphologic predictors.
- Communicate a risk category rather than promising a deterministic outcome.

The Demicco model uses four variables

- Patient age provides a clinical dimension.
- Tumor size quantifies growth burden.
- Mitotic rate reflects proliferative activity.
- Tumor necrosis supplies another adverse morphologic variable.



Risk categories must be applied to the right setting

- The revised Demicco model stratifies non-meningeal SFT by metastatic risk.
- Its categories are low, intermediate and high risk.
- It complements—but does not replace—histologic interpretation.
- A model is calibrated to studied populations, not every site or scenario.

Do not use a single adverse feature as a binary verdict

- A large tumor may still follow a relatively indolent course.
- A mitotically active, necrotic tumor deserves greater concern.
- Risk estimates depend on combined factors and appropriate sampling.
- Avoid presenting an isolated measurement as a categorical diagnosis.

Metastasis remains possible after apparently complete excision

- A minority of SFTs metastasize, sometimes after a prolonged interval.
- Distant spread indicates clinically malignant behavior.
- Long-term surveillance is justified even for seemingly bland primary tumors.
- Follow-up should reflect location, resection status and validated risk.

Local recurrence has several possible drivers

- Incomplete excision can leave microscopic residual disease.
- High-risk morphology can indicate greater propensity to recur.
- Anatomic constraints may complicate obtaining negative margins.
- A recurrence should be resampled for evolution or dedifferentiation.

Surgery is the principal treatment for localized disease

- Complete excision with negative margins is the usual primary objective.
- Resection strategy depends on pleural attachment and involved structures.
- The pathology report guides multidisciplinary risk discussion.
- There is no universal fixed follow-up schedule in the Robbins excerpt.

Long-term follow-up is a biological, not decorative, add-on

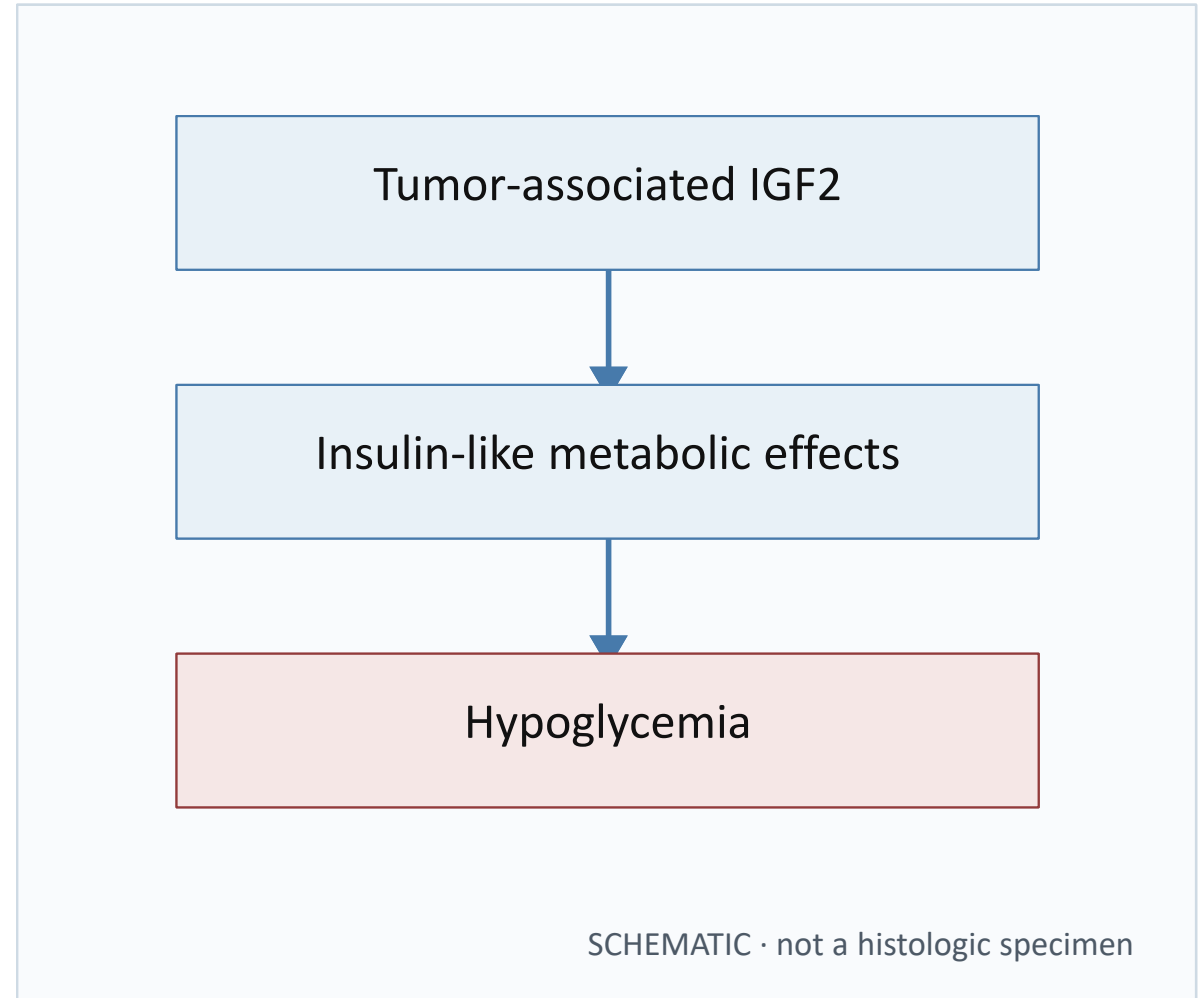
- SFT outcome can be delayed and is not fully predicted by bland histology.
- Clinical surveillance should be individualized by risk and site.
- Review new masses for local recurrence versus metastasis.
- Avoid declaring cure solely because the initial lesion was circumscribed.

Doege–Potter syndrome: Uncommon paraneoplastic hypoglycemia

- A subset of SFTs produces insulin-like growth factor 2 (IGF2).
- The resulting non-islet-cell tumor hypoglycemia may be clinically significant.
- Recurrent unexplained hypoglycemia can provide a clue to an occult SFT.
- This syndrome is supplementary to, not described in, the supplied Robbins excerpt.

Why excess IGF2 can cause hypoglycemia

- Tumor-related IGF2 exerts insulin-like metabolic effects.
- Glucose consumption and reduced hepatic glucose output contribute to low glucose.
- Definitive management focuses on the underlying tumor when feasible.
- The clinical phenotype does not independently grade the lesion.



Case 1: Circumscribed pleural mass

- An adult has a large, localized pleural-based mass on imaging.
- The resection is firm and attached by a narrow pedicle.
- Histology shows bland spindle cells, dense collagen and branching vessels.
- Question: What marker pair most strongly supports SFT?

Case 1: Morphology plus markers resolves the lesion

- Diffuse nuclear STAT6 and tumor-cell CD34 support SFT.
- Keratin negativity makes an epithelial pleural tumor less likely.
- Pedunculated growth supports localization but does not establish lineage.
- Final interpretation integrates site, morphology and staining.

Case 2: A pleural spindle-cell lesion stains for keratin

- The lesion extensively coats the pleural surface rather than forming a solitary mass.
- Spindle cells show keratin reactivity without convincing nuclear STAT6.
- Question: Which competing diagnosis is prioritized?
- What additional mesothelial markers or molecular work-up would be appropriate?

Case 2: Avoid mistaking a pleural malignancy for SFT

- Sarcomatoid mesothelioma is an important diagnostic consideration.
- A cytokeratin-positive, STAT6-negative profile argues against typical SFT.
- Extend the mesothelial versus carcinoma differential according to findings.
- Clinical asbestos exposure is contextual, never a substitute for pathology.

Case 3: Atypia, necrosis and brisk mitoses

- A resected SFT contains a region of marked atypia with tumor necrosis.
- Several blocks show higher mitotic activity than the bland component.
- Question: Is “large” alone an adequate final risk assessment?
- What additional parameters belong in the report?

Case 3: Combine variables and document heterogeneity

- No: Size alone does not classify metastatic risk.
- Document age, size, mitoses and tumor necrosis for the Demicco model.
- Report dedifferentiation, margins and other relevant pathology findings.
- Discuss high-risk features without claiming inevitable metastasis.

Five diagnostic and prognostic principles

- Think SFT for a localized collagen-rich, vascular spindle-cell mass.
- Recognize the defining NAB2::STAT6 molecular association.
- Use nuclear STAT6 with CD34 and an appropriate exclusionary panel.
- Separate SFT from asbestos-associated mesothelioma.
- Combine clinical and pathologic variables when assessing risk.

References and scope of evidence

- Robbins, Cotran & Kumar. Pathologic Basis of Disease. 11th ed. (2026). Chapter 15, pp. 661–662.
- Tariq MU, et al. Diagnostic Pathology. 2021;16:32. doi:10.1186/s13000-021-01095-2.
- Demicco EG, et al. Modern Pathology. 2017;30:1433–1442. doi:10.1038/modpathol.2017.54.
- Supplementary reviews address variants, molecular differential diagnoses and clinical management; Robbins remains the primary teaching source.