

Spermatic Cord and Paratesticular Tumors

Anatomic localization • morphologic diagnosis • clinical significance

Pathology lecture

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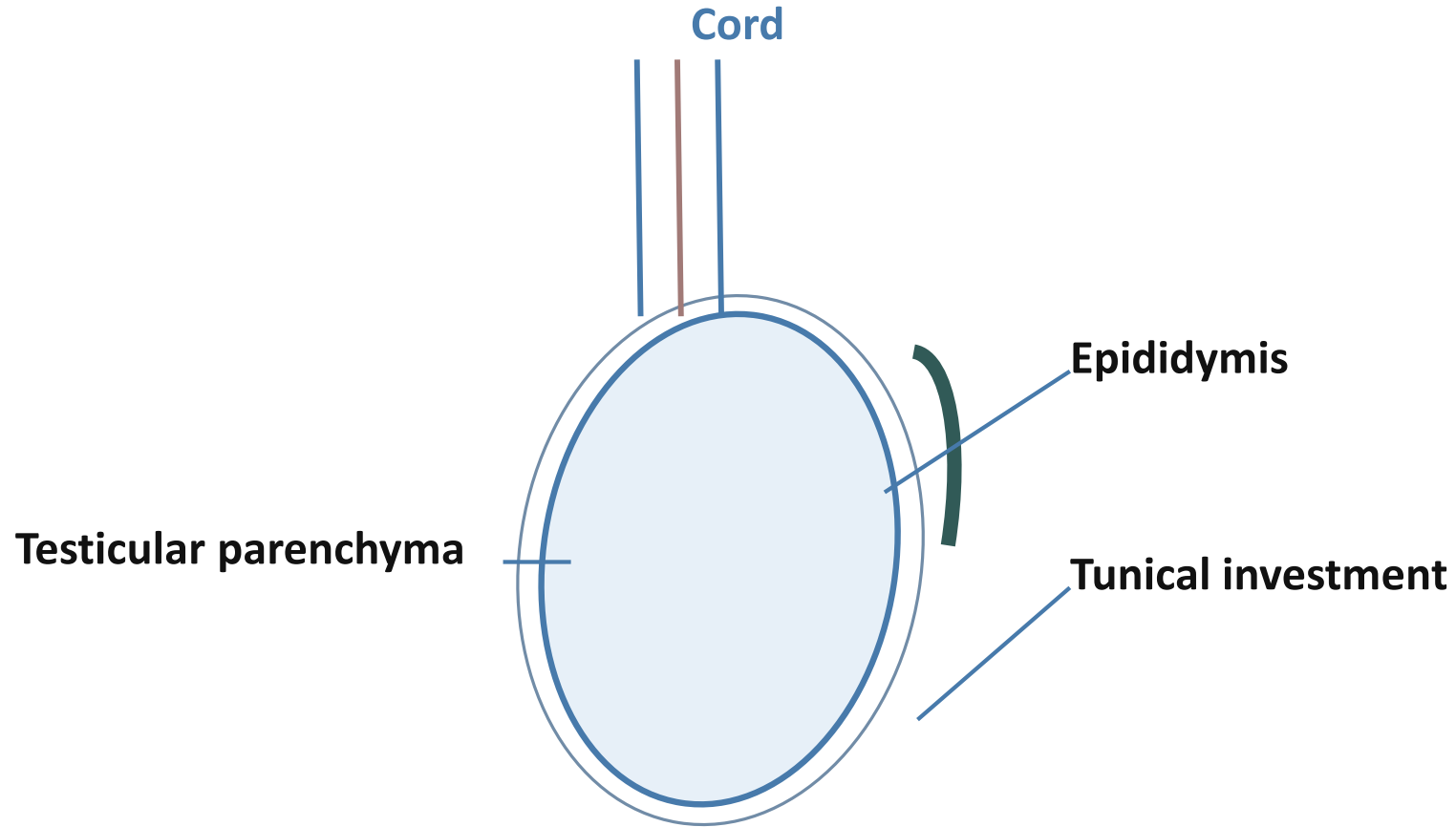
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Learning outcomes

- Localize a scrotal lesion to testis, epididymis, tunics, or spermatic cord.
- Recognize spermatic-cord adipose pseudolesions and adenomatoid tumor.
- Differentiate the principal malignant tumors by age and lineage.
- Choose pathology investigations that preserve diagnostic confidence and avoid overtreatment.

The paratesticular compartment



Why the anatomic site changes interpretation

Intratesticular mass

Solid intratesticular lesions prompt high suspicion for malignancy and a germ-cell–focused evaluation.

Extratesticular mass

Many lesions are benign, but site alone cannot exclude sarcoma or mesothelioma.

Four questions for every scrotal mass

Where?

Intra- vs extratesticular; Epididymal, tunical, or funicular origin.

What tissue?

Fat, cystic fluid, fibrous stroma, mesothelial, or solid soft tissue.

How does it behave?

Discrete vs infiltrative; Small stable vs enlarging / heterogeneous.

What can pathology establish?

Morphology, lineage markers, molecular features and margin status.

The basic diagnostic map

Benign / tumor-like

Spermatic-cord fat; Adenomatoid tumor; Fibrous pseudotumor; Leiomyoma.

Malignant

Rhabdomyosarcoma in children; Liposarcoma in adults; Rarer sarcomas and tunical mesothelioma.

Age is a useful clue—not a diagnosis

- Children and adolescents: Consider paratesticular rhabdomyosarcoma in a suspicious solid mass.
- Adults: Consider liposarcoma and other soft-tissue sarcomas when the cord mass is large or enlarging.
- Adenomatoid tumor and tumor-like lesions can occur across adult age groups.
- Age informs the differential; Imaging and tissue findings establish the final diagnosis.

Presentation can be deceptively indolent

- Painless scrotal or inguinoscrotal swelling is a frequent presentation.
- An incidental small epididymal nodule may be discovered during examination or ultrasound.
- Cord adipose masses may simulate an inguinal hernia.
- A painless course or slow growth does not reliably establish benignity.

First-line localization: Ultrasound

Define site

Determine whether the mass originates inside or outside the testicular parenchyma.



Characterize

Document size, solidity/cystic nature, vascularity and relation to adjacent structures.



Escalate judiciously

Use MRI when lesion characterization or local extent remains indeterminate.

What imaging cannot do alone

- An extratesticular site raises the prior probability of benign disease but does not prove it.
- Ultrasound appearances of several benign and malignant solid masses overlap.
- Imaging can map fat and anatomic extent; Morphology and molecular tests can still be decisive.
- When malignancy is plausible, planning should involve an appropriate surgical / sarcoma team.

Cord “lipoma”: Terminology may mislead

- Adipose masses of the proximal cord found at inguinal hernia operations.
- Many are displaced or protruding retroperitoneal adipose tissue—not clonal adipocytic neoplasms.
- A true localized lipoma is a separate possibility.
- Always reconcile the macroscopic fatty lesion with the operative anatomy.

How a cord fat pseudolesion arises

Retroperitoneal fat

Adipose tissue is continuous with proximal inguinal anatomy.



Protrusion into canal

Fat extends alongside the hernia sac or spermatic cord.



Apparent “lipoma”

Fatty tissue appears as a discrete lesion during hernia repair.

Native schematic: Anatomical continuity, not a histologic specimen.

Why the distinction is not semantic

- Non-neoplastic cord fat may not require a tumor-specific biological diagnosis.
- Confusing fat protrusion with a distinct soft-tissue tumor can distort documentation.
- Conversely, calling an enlarging atypical fatty mass a “lipoma” can miss liposarcoma.
- Assess operative findings, gross features, histology and imaging together.

The proximal inguinal mass differential

Fat continuity

Protruding retroperitoneal adipose tissue / hernia-associated fat.

Benign tumor

Conventional lipoma or another benign adipocytic neoplasm.

Malignant tumor

Atypical lipomatous tumor / well-differentiated liposarcoma, sometimes with dedifferentiation.

When “fatty” should trigger further work-up

- Large, deep, recurrent or progressively enlarging adipocytic mass.
- Thickened fibrous septa or nonfatty nodular components on imaging / gross inspection.
- Hyperchromatic atypical stromal cells or atypical septa histologically.
- Concerning features favor deliberate sampling and, where indicated, MDM2 testing.

Do not equate lipoblasts with liposarcoma

- Lipoblast-like cells alone are not sufficient to assign a malignant adipocytic diagnosis.
- Overall architecture and atypical stromal-cell population are important.
- Benign mimics may include reactive atypia and vacuolated cells.
- Molecular analysis helps selected equivocal deep-site tumors, but must be interpreted with morphology.

Adenomatoid tumor: The key benign neoplasm

- Mesothelial-derived benign tumor, emphasized by Robbins as the commonest benign paratesticular neoplasm.
- Typically a small, well-demarcated lesion near the epididymis; Tunical and other locations occur.
- Clinically important because accurate recognition permits local excision in suitable cases.
- Do not label the lesion “mesothelioma” merely because it expresses mesothelial markers.

Where an adenomatoid tumor may arise

Epididymis

Often near its head/upper testicular pole; Other locations including tail are reported.

Tunica albuginea / vaginalis

May abut or indent testis and mimic an intratesticular neoplasm.

Spermatic cord

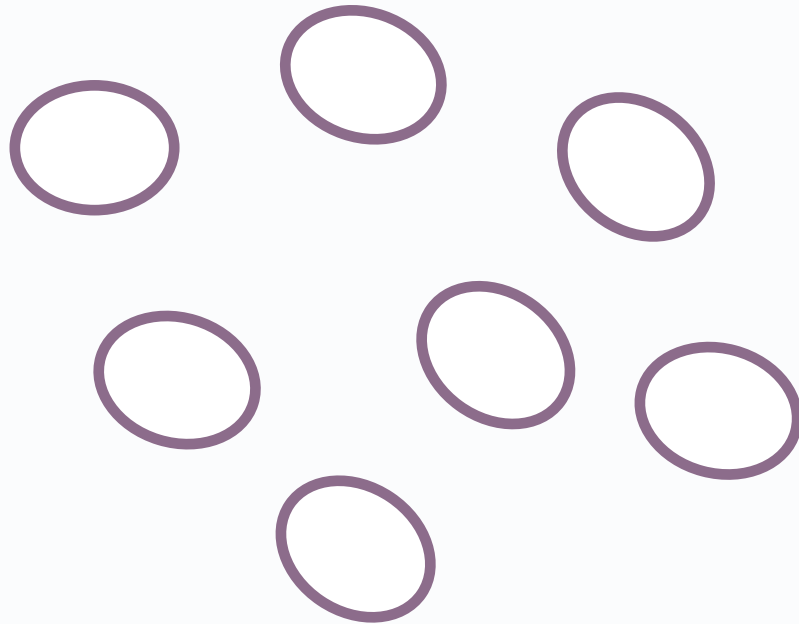
Less common paratesticular location; Requires attention to the anatomical origin.

Adenomatoid tumor: Gross recognition

- Usually a small, solid, white-to-tan, firm, relatively well-circumscribed nodule.
- The main diagnostic task is establishing its relation to epididymis and testicular parenchyma.
- Gross appearance is not by itself specific for mesothelial differentiation.
- Submit the interface with adjacent structures when the lesion is close to the testis.

Adenomatoid tumor: The classic pattern

Conceptual microscopic pattern



Tubules / microcysts

Interconnected bland spaces lined by mesothelial cells

Vacuolated cytoplasm

May resemble endothelial or gland-like spaces

Schematic illustration — not a histologic specimen.

Why the vacuoles matter

- Intracytoplasmic vacuoles and attenuated cell borders can create pseudovascular or signet-ring-like appearances.
- Look for bridging cytoplasmic strands and mesothelial-lined clefts in appropriate examples.
- Bland chromatin and absent destructive malignant cytology favor a benign lesion.
- Correlate the morphology with a lineage panel rather than interpreting a vacuole alone.

Adenomatoid: Useful stromal clues

- Dense fibrous or smooth-muscle-containing stroma may dominate some sections.
- Lymphoid aggregates and focal inflammation may occur around tumor structures.
- Other cases are more cellular, with relatively inconspicuous microcysts.
- Overly restricted sampling can create a misleading spindle-cell or gland-forming differential.

Mesothelial differentiation: A panel, not one stain

Frequently positive

Calretinin, WT1, pancytokeratin, D2-40/podoplanin; Expression varies by sample.

Interpretation

Combined cytomorphology, mesothelial immunophenotype and low-grade architecture support adenomatoid tumor.

Exclusion markers are context-specific

- SALL4 and other germ-cell markers help when a germ-cell tumor is morphologically plausible.
- Inhibin may help distinguish selected sex cord–stromal tumors.
- CD31 / CD34 support a vascular differential when pseudovascular spaces dominate.
- Epithelial carcinoma panels and clinical context help evaluate possible metastasis.

Adenomatoid vs sex cord–stromal mimic

Adenomatoid tumor

Mesothelial tubules, vacuoles; Keratin and WT1 usually positive; Inhibin often negative.

Sex cord–stromal tumor

Morphology and hormonal lineage markers differ; Calretinin may be shared and is NOT a discriminator alone.

Adenomatoid vs metastatic carcinoma

Favor adenomatoid

Localized paratesticular mass, bland tubules/vacuoles, mesothelial markers and compatible architecture.

Favor carcinoma

Destructive atypical epithelium, relevant primary tumor history and an epithelial-marker profile supporting a site of origin.

Adenomatoid vs malignant mesothelioma

- A shared calretinin/WT1/D2-40 phenotype establishes lineage—not benign behavior.
- Complex atypical growth, significant invasive malignant cytology, and clinical/radiologic extent warrant concern.
- Interpret BAP1 or MTAP loss only as supplementary evidence in the correct context.
- Malignant mesothelioma of tunica vaginalis is uncommon but clinically consequential.

Frozen section: A management-changing step

Intraoperative question

Does a clearly localized mass show benign adenomatoid morphology?



If confidently benign

Local excision may preserve the testis rather than prompting orchiectomy.



If uncertain

Defer definitive classification;
Avoid false reassurance on limited frozen material.

Limits of frozen section

- Crush, freezing artefact and limited sampling may obscure vacuoles and stromal relationships.
- A rare malignant or mixed tumor can be underrepresented in a small sample.
- Permanent sections allow fuller architectural assessment and immunohistochemistry.
- The frozen-section report should explicitly communicate diagnostic confidence.

Adenomatoid tumor: Clinical consequence

- After confident histopathological confirmation, local excision is generally adequate.
- Diagnosis may avoid removal of otherwise uninvolved testicular parenchyma.
- The lesion is benign; Atypical morphology should prompt reassessment rather than automatic malignant labeling.
- Careful localization and consultation matter most before irreversible surgery.

Checkpoint: A classic epididymal nodule

- An adult has a small, circumscribed, solid nodule adjacent to the epididymis.
- H&E: Bland cords and pseudoglands in fibrous stroma, with conspicuous vacuoles.
- IHC: Calretinin+, WT1+, keratin+; No compelling atypical malignant features.
- Interpretation: Adenomatoid tumor; Preservation of testis can be considered when anatomically feasible.

Fibrous pseudotumor: A neoplastic mimic

- Benign fibrosing mass or multinodular process, often related to the testicular tunics.
- H&E may show dense hyalinized collagen with scattered fibroblasts and inflammation.
- Prior inflammation, trauma or hydrocele may be part of the clinical history.
- Its firmness and irregular surface can imitate malignancy despite benign biology.

Fibrous pseudotumor and IgG4

- Some lesions show lymphoplasmacytic inflammation and increased IgG4-positive plasma cells.
- An IgG4-rich infiltrate alone does not establish systemic IgG4-related disease.
- Evaluate morphology and systemic context; Do not force all fibrous pseudotumors into one etiology.
- Tissue preservation may be possible after an accurate diagnosis.

Leiomyoma: A smooth-muscle benign lesion

- An uncommon epididymal or cord neoplasm may form interlacing bland smooth-muscle bundles.
- Elongated nuclei, eosinophilic cytoplasm and low proliferative activity support benignity.
- SMA, desmin and h-caldesmon may support smooth-muscle lineage.
- Exclude atypia, necrosis, mitotic activity and infiltration suggestive of leiomyosarcoma.

Papillary cystadenoma: A separate epididymal pattern

- Usually a cystic/papillary epithelial neoplasm rather than a solid mesothelial tumor.
- Papillary clear-cell morphology should not be mistaken for adenomatoid vacuoles.
- Consider von Hippel–Lindau context, especially with bilateral epididymal lesions.
- Pathologic lineage and clinical context distinguish it from metastatic clear-cell renal carcinoma.

Benign lesions: Decisive differentiators

Adipose pseudolesion

Mature fat anatomically continuous with retroperitoneal tissue.

Adenomatoid tumor

Bland mesothelial tubules/cords and cytoplasmic vacuoles.

Fibrous pseudotumor

Hypocellular hyalinized collagen with inflammatory features.

Leiomyoma

Bland intersecting smooth-muscle fascicles.

Malignant lesions: Organize by lineage

Skeletal-muscle lineage

Rhabdomyosarcoma; Particularly relevant in childhood.

Adipocytic lineage

Well-differentiated / dedifferentiated liposarcoma; Adult cord tumors.

Smooth-muscle lineage

Leiomyosarcoma; Less common adult paratesticular sarcoma.

Mesothelial lineage

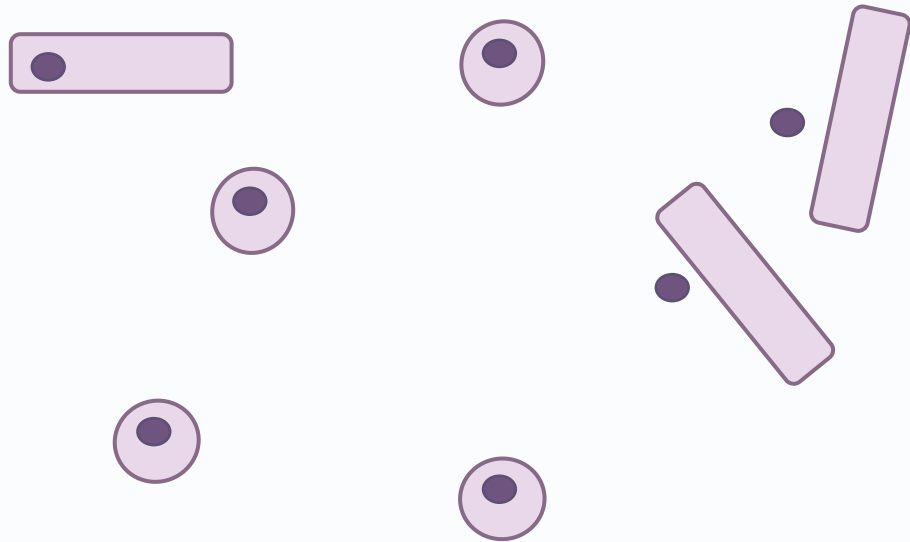
Malignant mesothelioma of tunica vaginalis.

Paratesticular rhabdomyosarcoma

- The childhood counterpart emphasized among malignant paratesticular neoplasms.
- Usually presents as a suspicious paratesticular or spermatic-cord solid mass.
- Morphology and skeletal-muscle lineage markers establish diagnosis.
- Final risk assessment incorporates anatomical extent and molecular subgroup—not histology alone.

Rhabdomyosarcoma: Microscopic clues

Conceptual microscopic pattern



Schematic illustration — not a histologic specimen.

Primitive mesenchymal cells

Round-to-spindle cells with variable atypia

Myogenic differentiation

Strap-shaped rhabdomyoblasts may be present; Confirm with nuclear myogenin / MYOD1

Myogenic differentiation on immunohistochemistry

- Desmin supports muscular lineage but is not specific for rhabdomyosarcoma.
- Nuclear myogenin and/or MYOD1 support skeletal-muscle differentiation.
- Staining pattern must be interpreted with age, site, morphology and controls.
- Exclude non-rhabdomyoblastic spindle/round-cell lesions with a differential-driven panel.

Molecular subtype changes interpretation

Fusion-negative RMS

Includes most embryonal rhabdomyosarcomas;
Heterogeneous alterations.

FOXO1 fusion–positive RMS

Usually PAX3::FOXO1 or PAX7::FOXO1; Key prognostic/risk variable.

Spindle/sclerosing spectrum

MYOD1 variants or VGLL2/NCOA2 rearrangements in relevant subgroups.

Why “alveolar” histology is not enough

- FOXO1 rearrangement refines classification and risk stratification.
- Fusion-negative alveolar-appearing tumors may biologically resemble embryonal disease.
- Use validated molecular testing when subtype is clinically relevant.
- Avoid assigning prognosis from a pattern on one tissue section.

Rhabdomyosarcoma: Pathology and staging interface

- Identify precise origin and extent along cord/epididymis and proximity to inguinal canal.
- Document involvement of adjacent testis, tunics, scrotal soft tissue and margins.
- Communicate regional node concerns to the treating multidisciplinary team.
- Age, site, size, nodal status and FOXO1 status contribute to overall risk assessment.

Pediatric operative principles are specialist-led

- When a paratesticular sarcoma is strongly suspected, operative approach is part of staging and local control.
- NCI describes inguinal orchiectomy with spermatic cord resection for appropriate paratesticular primaries.
- The need for regional nodal assessment depends on risk features and treatment protocol.
- Pathology should not imply a single universal intervention for every patient.

Treatment details here are supplementary NCI guidance, not from the Robbins paratesticular excerpt.

Rhabdomyosarcoma: Applied interpretation

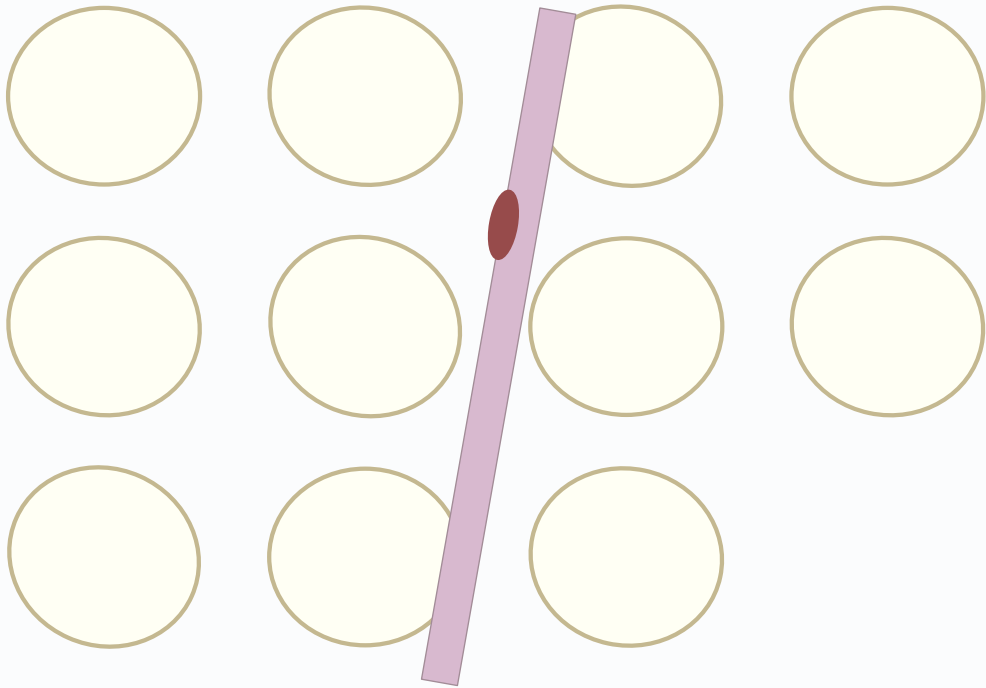
- An adolescent has a rapidly enlarging extratesticular mass extending toward the inguinal canal.
- Primitive spindle/round cells infiltrate soft tissue; Desmin and nuclear myogenin are positive.
- Diagnosis: Rhabdomyosarcoma; Pursue subtype / molecular clarification as indicated.
- Report local extent and margin relationships for specialist risk assessment.

Liposarcoma: The adult cord malignancy

- Liposarcoma as a leading malignant paratesticular tumor in adults.
- Usually an inguinoscrotal soft-tissue/adipocytic mass that may masquerade as a hernia or lipoma.
- Classification requires attention to adipocytic atypia and dedifferentiation.
- Location makes complete excision and local recurrence particularly important.

Well-differentiated liposarcoma: Architecture

Conceptual microscopic pattern



Varying adipocyte size

Mature adipose cells; Enlarged or variable septa

Atypical septal nuclei

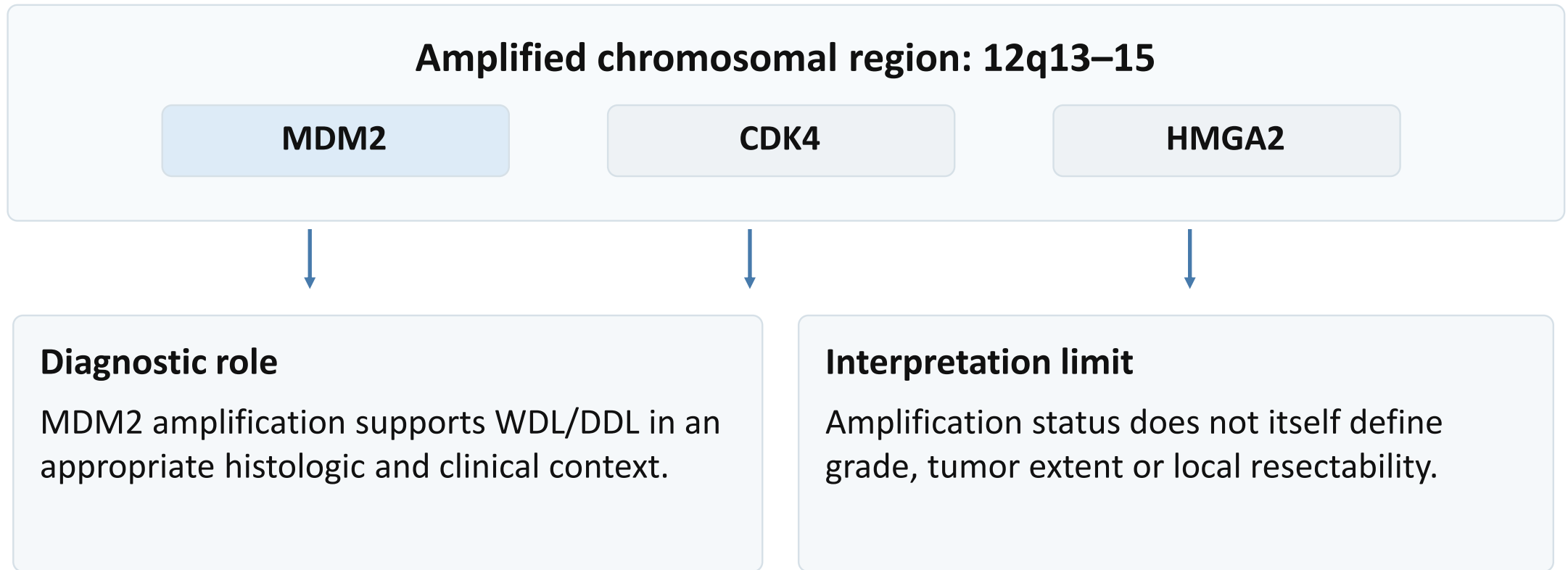
Scattered hyperchromatic stromal cells require deliberate sampling

Schematic illustration — not a histologic specimen.

Dedifferentiated liposarcoma: What changes?

- A nonlipogenic sarcomatous component occurs in association with WDL-like tissue or its molecular background.
- Microscopy may show higher-grade spindle/pleomorphic tumor or a lower-grade-appearing component.
- Dedifferentiation introduces metastatic potential beyond well-differentiated liposarcoma.
- Image-guided and gross sampling should target nonfatty, solid areas.

MDM2 amplification: A biological marker



Schematic: Selected loci, not a scaled chromosome map.

MDM2 IHC is not equivalent to amplification

- Immunostaining may show nuclear MDM2/CDK4 in lesional atypical stromal cells.
- Sensitivity is limited in subtle, sparsely atypical lesions; Occasional false positives occur.
- FISH for amplification may be more reliable than IHC in a challenging benign-vs-WDL differential.
- Use selective testing and verify whether the sample actually contains diagnostic atypical cells.

Lipoma vs well-differentiated liposarcoma

Lipoma / cord fat

Mature adipose tissue; No diagnostic stromal atypia; Hernia-related continuity may be present.

WDL

Atypical hyperchromatic septal stromal cells; Variable thick septa; Often MDM2 amplified.

WDL vs dedifferentiated liposarcoma

Well differentiated

Locally recurrent potential; Does not metastasize without dedifferentiation.

Dedifferentiated

Contains sarcomatous nonlipogenic tissue;
Metastatic risk and local recurrence are greater.

Liposarcoma specimen: What to sample?

- Orient the spermatic-cord / soft-tissue specimen and ink relevant surfaces as appropriate.
- Map adipocytic, fibrous, and any firm nonadipocytic components.
- Sample mass-to-cord, testis and adjacent tissue interfaces; Inspect margin proximity.
- Document any dedifferentiated component, necrosis and lymphovascular invasion if identified.

Leiomyosarcoma: The smooth-muscle malignancy

- Uncommon paratesticular sarcoma, including spermatic-cord and epididymal examples.
- Atypical eosinophilic spindle cells grow in intersecting fascicles.
- Mitotic activity, atypical mitoses, tumor necrosis and infiltrative growth support malignancy.
- SMA, desmin and h-caldesmon help establish lineage; No one stain is absolute.

Mesothelioma of the tunica vaginalis

- Rare malignant tumor arising from mesothelial lining of paratesticular tunics.
- Papillary, tubulopapillary, solid or biphasic morphologies may overlap benign mesothelial lesions.
- WT1, calretinin and cytokeratins support mesothelial lineage but are not markers of malignancy.
- Assess destructive growth, cytologic features and ancillary findings in clinical context.

BAP1 and MTAP: Interpret absences carefully

- Loss of BAP1 or MTAP may support malignant mesothelial proliferation in relevant cases.
- Tunica vaginalis mesotheliomas can retain these markers: Sensitivity is not sufficient to rule out malignancy.
- Retained expression is NOT proof that a lesion is an adenomatoid tumor.
- Integrate histology, morphology, immunophenotype and expert review.

Other malignant considerations

- Additional rare soft-tissue sarcomas arise in the paratesticular region.
- A mass may secondarily extend from testis or represent metastasis from an extratesticular primary.
- Clinical history, imaging and a broad morphologic survey shape the work-up.
- For unusual patterns, expert genitourinary/soft-tissue pathology consultation improves reliability.

The differential in one table

Entity	Dominant pattern	Discriminating adjunct
Adenomatoid	Bland vacuolated mesothelial tubules	Calretinin / WT1; architecture
Rhabdomyosarcoma	Primitive myogenic round/spindle cells	Myogenin / MYOD1; FOXO1 when relevant
WDL/DDL	Adipocytic atypia ± nonlipogenic sarcoma	MDM2 amplification
Leiomyosarcoma	Atypical smooth-muscle fascicles	SMA / desmin / h-caldesmon

Histology must be linked to surgical anatomy

- Confirm extratesticular origin whenever possible; The testis may be compressed or secondarily involved.
- Correlate with imaging and operative description before assigning the organ of origin.
- A “testicular mass” label at accession does not prove intratesticular tumor origin.
- Preserve orientation and document relationship to cord and surgical margins.

A diagnostic decision sequence

Localization

Confirm extra- vs intratesticular origin and identify the involved structure.



Morphologic lineage

Mesothelial, adipocytic, muscular, fibrous or other pattern.



Targeted ancillaries

IHC, amplification/fusion testing or additional sampling when indicated.

Pathology report: Minimum high-value elements

- Anatomic site and histologic entity, with uncertainty transparently stated.
- Tumor size, grade when applicable, and relevant molecular diagnostic findings.
- Extent and involvement of testis, epididymis, tunics, cord and adjacent soft tissue.
- Margin assessment with anatomical orientation and limitations of specimen sampling.

Case exercise: Preserve or remove testis?

- Circumscribed epididymal nodule; Testicular parenchyma separately identifiable.
- Frozen: Bland mesothelial tubes and vacuolated cells; No destructive malignant features.
- Question: What diagnosis can support testis-sparing excision?
- Answer: Confident adenomatoid tumor identification, with permanent-section correlation.

Case exercise: The recurrent “lipoma”

- Older adult with a recurring inguinoscrotal fatty mass after prior surgery.
- Multiple thick fibrous septa and focal atypical hyperchromatic stromal cells are present.
- Question: Which molecular result could support WDL over lipoma?
- Answer: MDM2 gene amplification, interpreted with the histologic findings.

Case exercise: Pediatric spindle-cell mass

- Child with an enlarging extratesticular mass; Small atypical spindle/round cells.
- Tumor shows desmin and nuclear myogenin immunoreactivity.
- Question: What lineage is supported, and what molecular issue may matter?
- Answer: Rhabdomyoblastic differentiation; Assess clinically relevant RMS subgroup / FOXO1 status.

Five avoidable diagnostic errors

- Assuming every paratesticular mass is benign because it is outside the testis.
- Calling retroperitoneal cord fat a neoplastic lipoma without assessing anatomy.
- Using calretinin positivity alone to diagnose a benign adenomatoid tumor.
- Equating MDM2 IHC positivity with proven gene amplification.
- Failing to sample firm, nonfatty areas in a suspicious adipocytic mass.

Integrated clinicopathologic summary

Adult, small epididymal nodule

Think adenomatoid tumor; Histology + mesothelial IHC may enable conservation.

Cord fat during hernia repair

Determine if it represents contiguous retroperitoneal fat rather than neoplasm.

Child with enlarging cord mass

Consider rhabdomyosarcoma; Myogenic pathology and risk stratification.

Adult atypical fatty mass

Consider liposarcoma; Sample heterogeneous areas and assess MDM2 when needed.

What the lecture should change in practice

- Localization is the beginning of diagnosis, not its endpoint.
- Know the three Robbins anchors: Cord fat, adenomatoid tumor and age-linked sarcomas.
- Target ancillary investigations to the relevant histologic differential.
- The correct diagnosis can either preserve a testis or prevent undertreatment of malignancy.

Selected reference sources

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