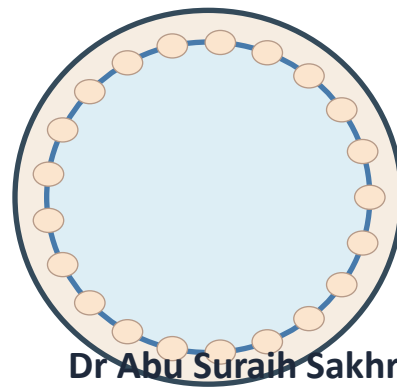


Congenital cysts of the pancreas

Developmental cysts, morphologic recognition, hereditary associations, and major diagnostic mimics



Dr Abu Suraih Sakhri

MBBS, MD (Pathology)

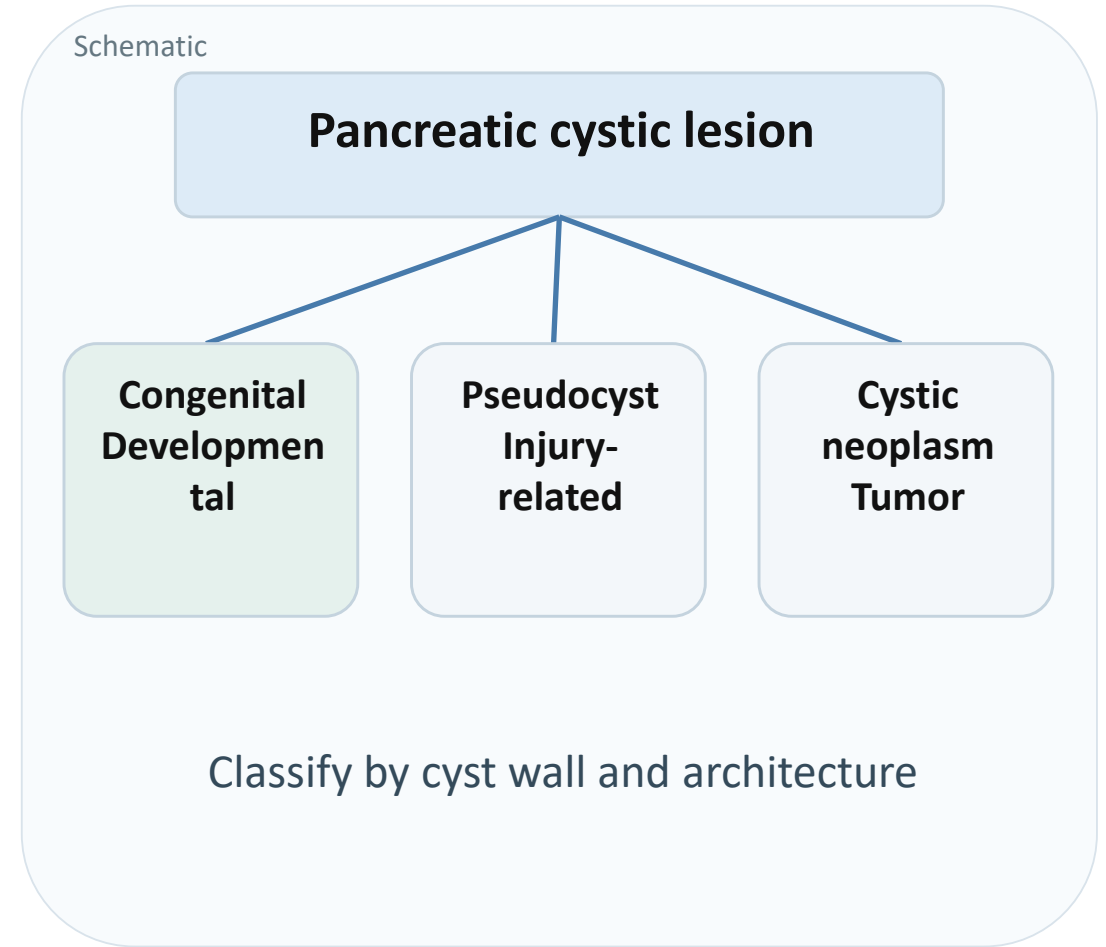
www.abusuraisakhri.com

Learning objectives

- Identify the core gross and microscopic appearance of congenital pancreatic cysts.
- Explain the proposed ductal developmental origin and its uncertainty.
- Recognize associations with ADPKD and von Hippel–Lindau disease.
- Distinguish true congenital cysts from pseudocysts and cystic neoplasms.

Pancreatic cysts belong to different biologic classes

- Congenital cysts: Developmental, epithelial-lined lesions.
- Pseudocysts: Acquired injury-related cavities without epithelial lining.
- Cystic neoplasms: Epithelial tumors with different malignant potentials.



Developmental origin: The precise claim

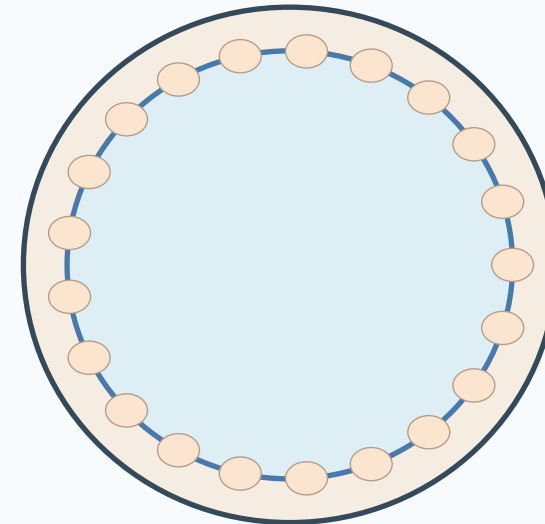
- Congenital pancreatic cysts likely arise from anomalous pancreatic duct development.
- “Likely” signals a proposed rather than directly demonstrated mechanism.
- Their epithelial lining is consistent with a true cyst, unlike a pseudocyst.

Schematic

**Developing
Pancreatic duct**



**Possible ductal
Anomaly**



Proposed mechanism, not directly proven

Developmental abnormality is not pancreatitis

Characteristic evidence

- Congenital cysts are classified by a putative ductal developmental disturbance.
- Pseudocysts instead follow tissue injury, hemorrhage, and fat necrosis.

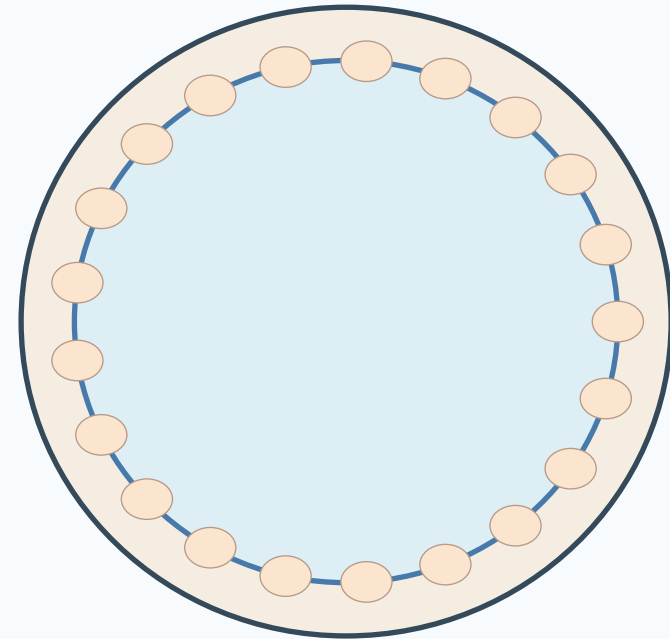
Diagnostic implication

- These represent fundamentally different processes despite both appearing cystic.

Unilocular architecture

- The typical congenital pancreatic cyst is a single cavity.
- Unilocular means one locule rather than a honeycomb of small spaces.
- Locule number is informative, but cannot independently classify every lesion.

Schematic



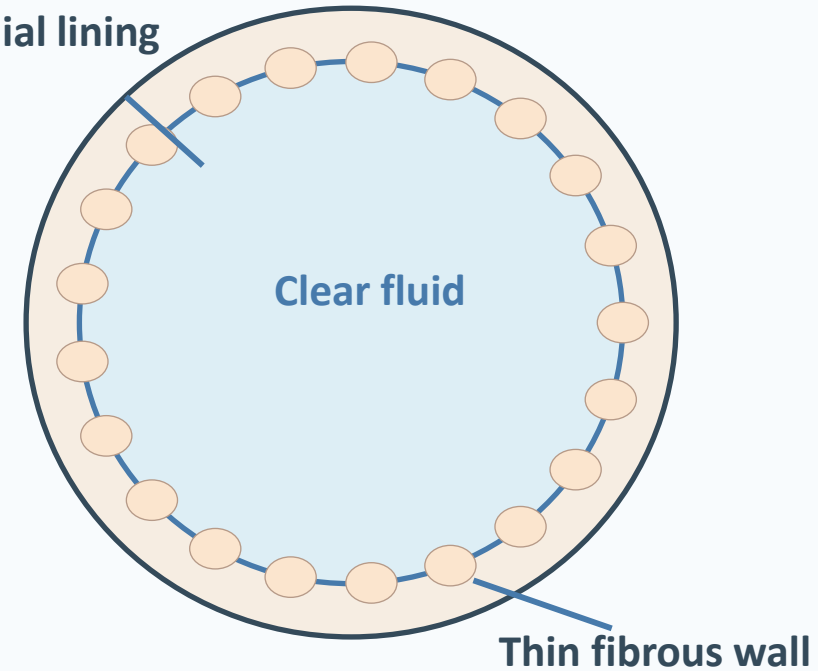
One continuous lumen

Thin-walled configuration

- A thin cyst wall is characteristic in the Robbins description.
- The wall contains a thin fibrous capsule and a continuous epithelial lining.
- A conspicuously thick inflammatory wall suggests an alternative process.

Schematic

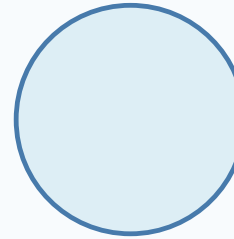
Epithelial lining



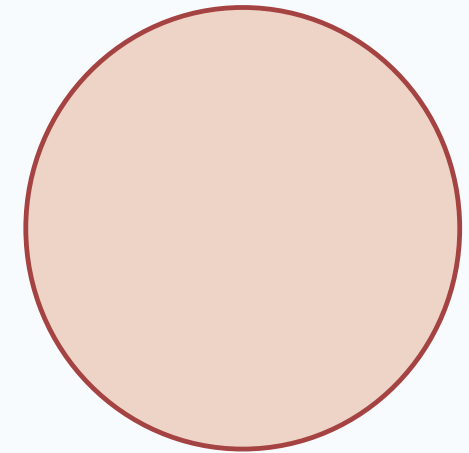
Lesion size: Microscopic to 5 cm

- Congenital cysts range from microscopically identifiable spaces to approximately 5 cm.
- Size describes the reported morphologic spectrum, not a stand-alone diagnostic threshold.
- Comparison: The cited pseudocyst size range is substantially broader.

Schematic



**Congenital
Microscopic–5 cm**



**Pseudocyst
2–30 cm**

Ranges are descriptions, not decision cutoffs

Clear serous contents

Characteristic evidence

- A typical congenital cyst contains clear serous fluid.
- Serous means watery rather than tenacious mucin or hemorrhagic debris.

Diagnostic implication

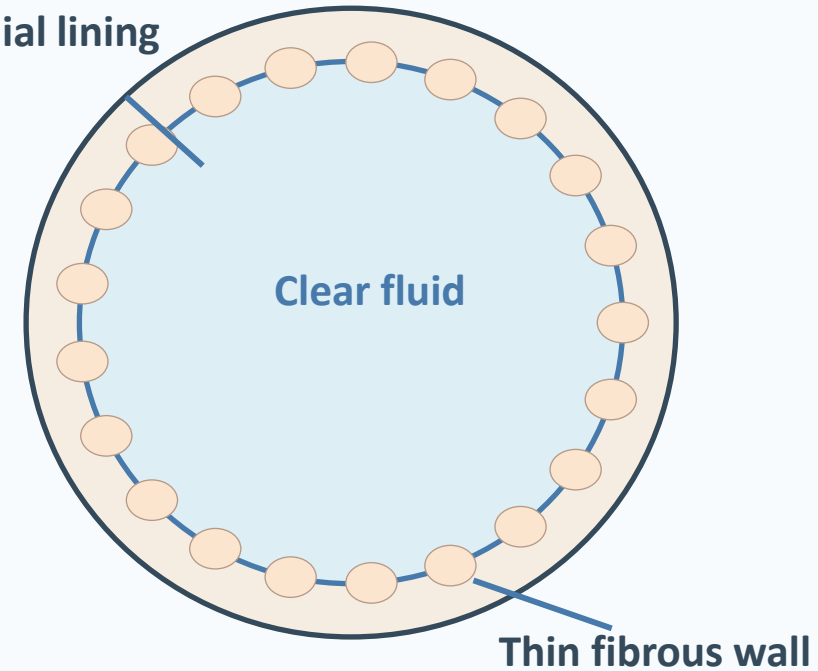
- Clear fluid is not specific: Serous cystic neoplasms also contain clear fluid.

Thin fibrous capsule

- The fibrous capsule provides the stromal wall of the cyst.
- The lining epithelium is a separate histologic component.
- Recognizing both layers prevents confusing an epithelial cyst with a fibrotic pseudocyst.

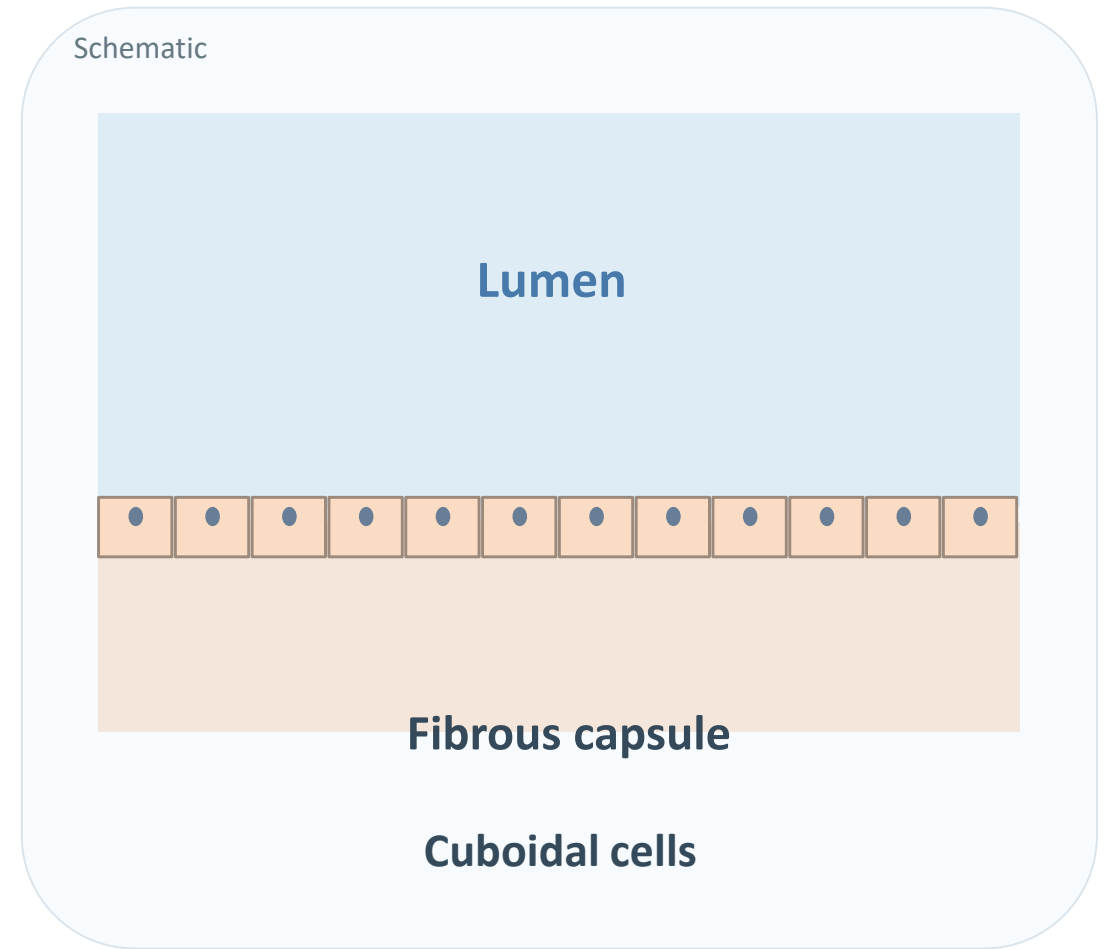
Schematic

Epithelial lining



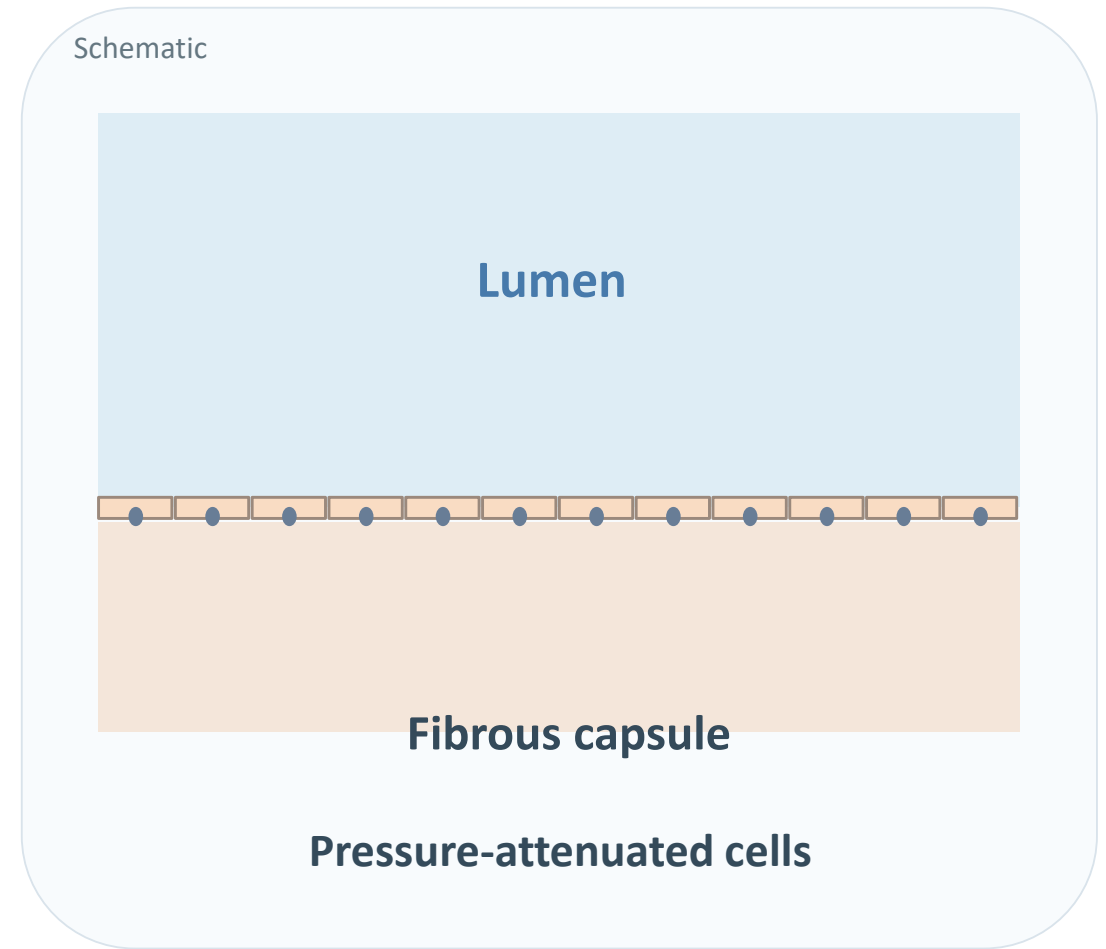
Cuboidal epithelial lining

- At ordinary intracystic pressure, a uniform cuboidal epithelium lines the cavity.
- Look for a single orderly layer separating the lumen from the fibrous wall.
- This is the key positive histologic feature of a true congenital cyst.



Flattening at higher intracystic pressure

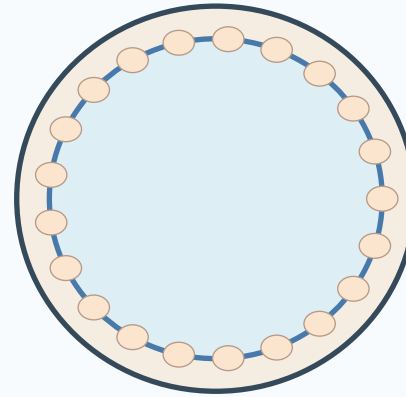
- The lining may become flattened and attenuated when intracystic pressure is high.
- A low cuboidal profile does not exclude a congenital cyst.
- Evaluate the continuity of epithelium rather than cell height alone.



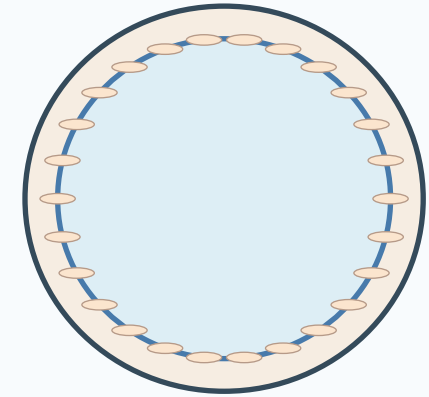
Pressure alters appearance, not cyst category

- Low-pressure morphology: Recognizable cuboidal lining.
- Higher-pressure morphology: Flattened attenuated epithelial cells.
- Both patterns remain epithelial-lined congenital cysts.

Schematic



Cuboidal lining



Flattened lining

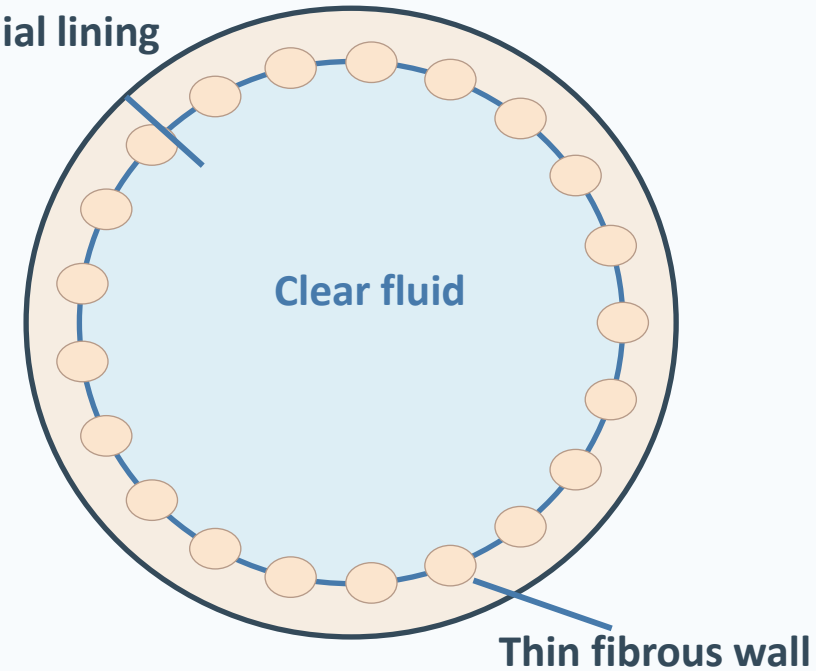
Increased intracystic pressure → cell attenuation

Integrating the cyst wall compartments

- Lumen: Usually clear serous fluid.
- Inner boundary: Cuboidal or flattened epithelial cells.
- Outer support: Thin fibrous capsule embedded in pancreatic tissue.

Schematic

Epithelial lining



Why an epithelial lining is decisive

Characteristic evidence

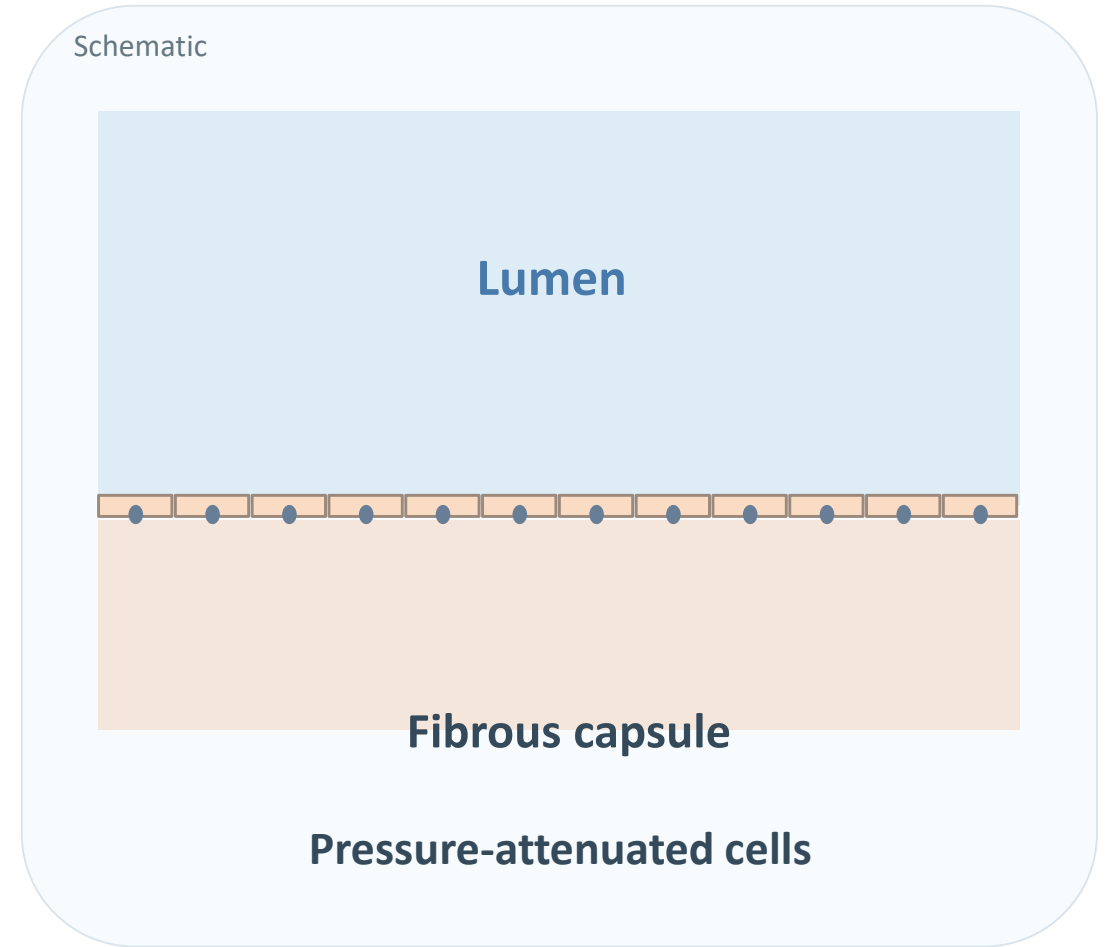
- A true cyst has cells lining its luminal surface.
- A pseudocyst lacks a true epithelial lining and is bounded by repair tissue.

Diagnostic implication

- This distinction directly encodes the developmental versus injury-related history.

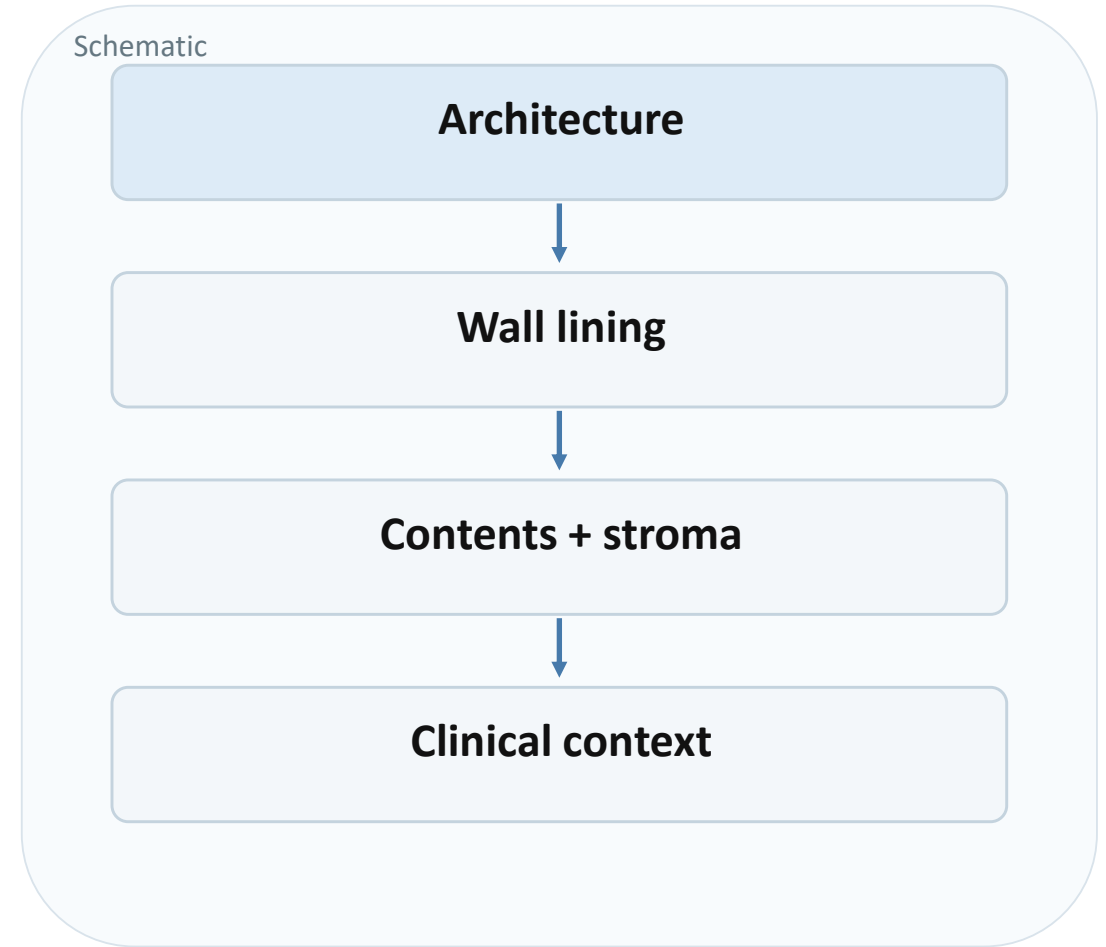
Do not confuse attenuated epithelium with absence

- Flat cells can be easy to overlook in a highly distended congenital cyst.
- Absence of epithelium is a defining description of pseudocysts.
- The comparison requires careful inspection of the luminal wall.



What gross inspection can establish

- Unilocular architecture, thin wall, size, and clear fluid may support congenital cyst.
- Gross morphology alone does not demonstrate a true epithelial lining.
- Histology and clinical context are needed for a defensible interpretation.



Features that cannot classify a cyst alone

Characteristic evidence

- Clear contents occur in congenital cysts and serous cystic neoplasms.
- Cuboidal epithelium appears in both entities, with different overall architectures.

Diagnostic implication

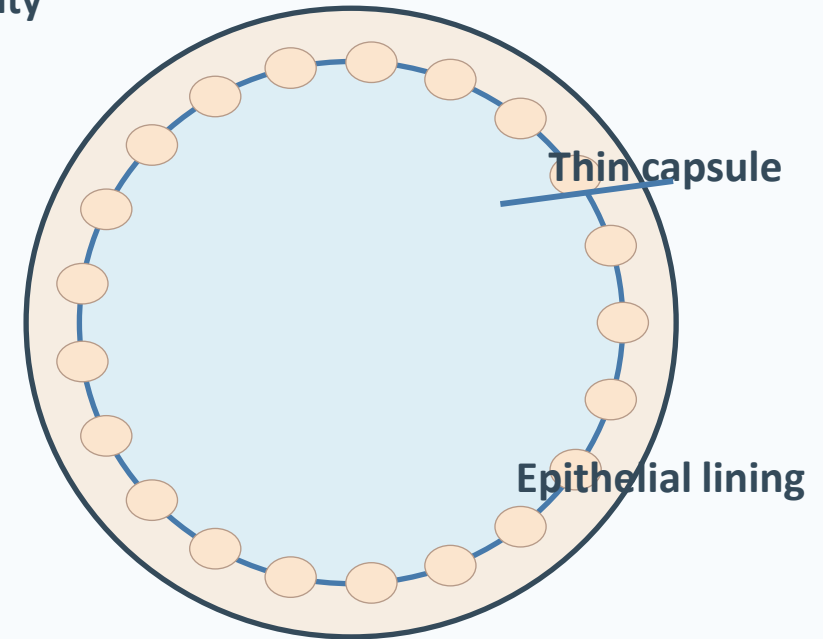
- Single features should be interpreted in their full morphologic context.

The congenital cyst phenotype: Integrated

- One locule, thin wall, and clear serous contents.
- Uniform cuboidal epithelial lining, sometimes pressure-flattened.
- Thin fibrous capsule; Lesion may be sporadic or syndromic.

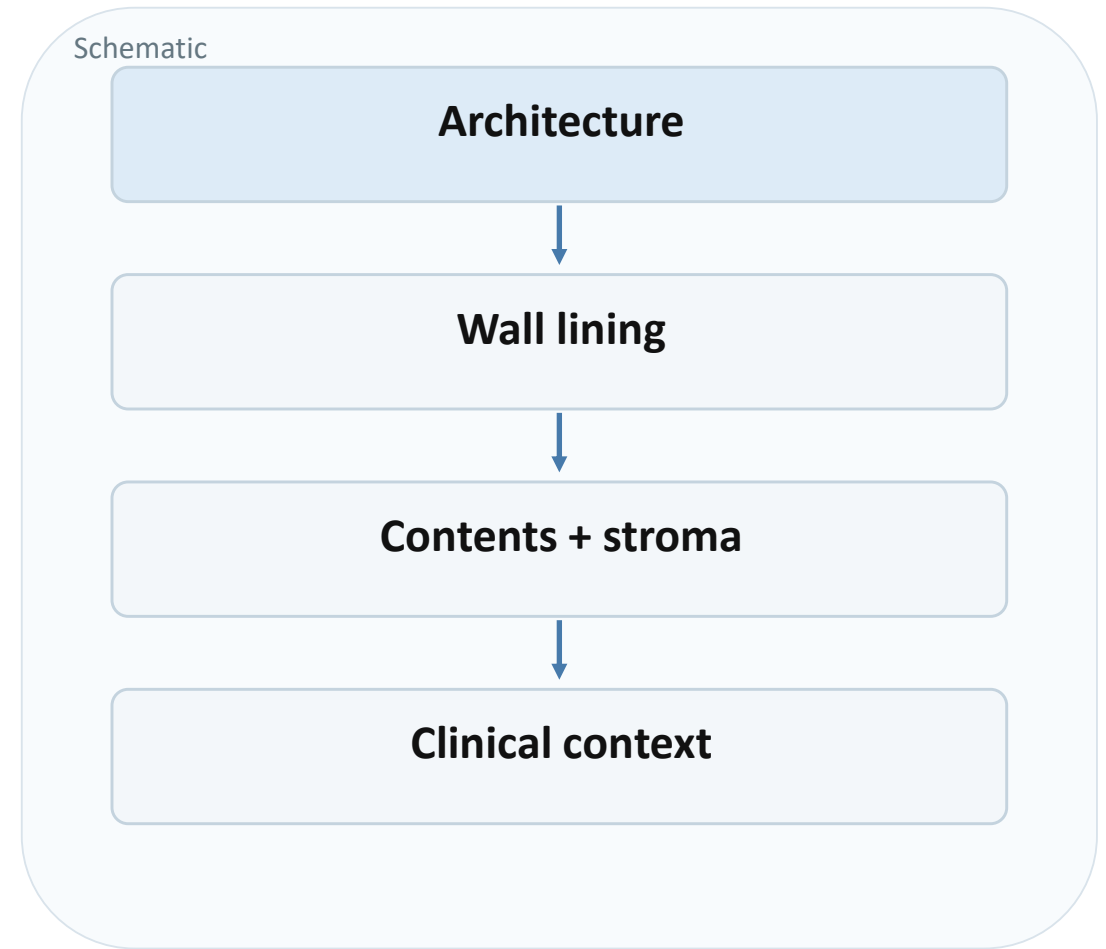
Schematic

One cavity



A practical morphology-first reading sequence

- First inspect the entire cavity pattern:
Unilocular or complex.
- Then examine the luminal boundary:
Epithelium or repair tissue.
- Finally evaluate contents, stroma, and
syndromic context.

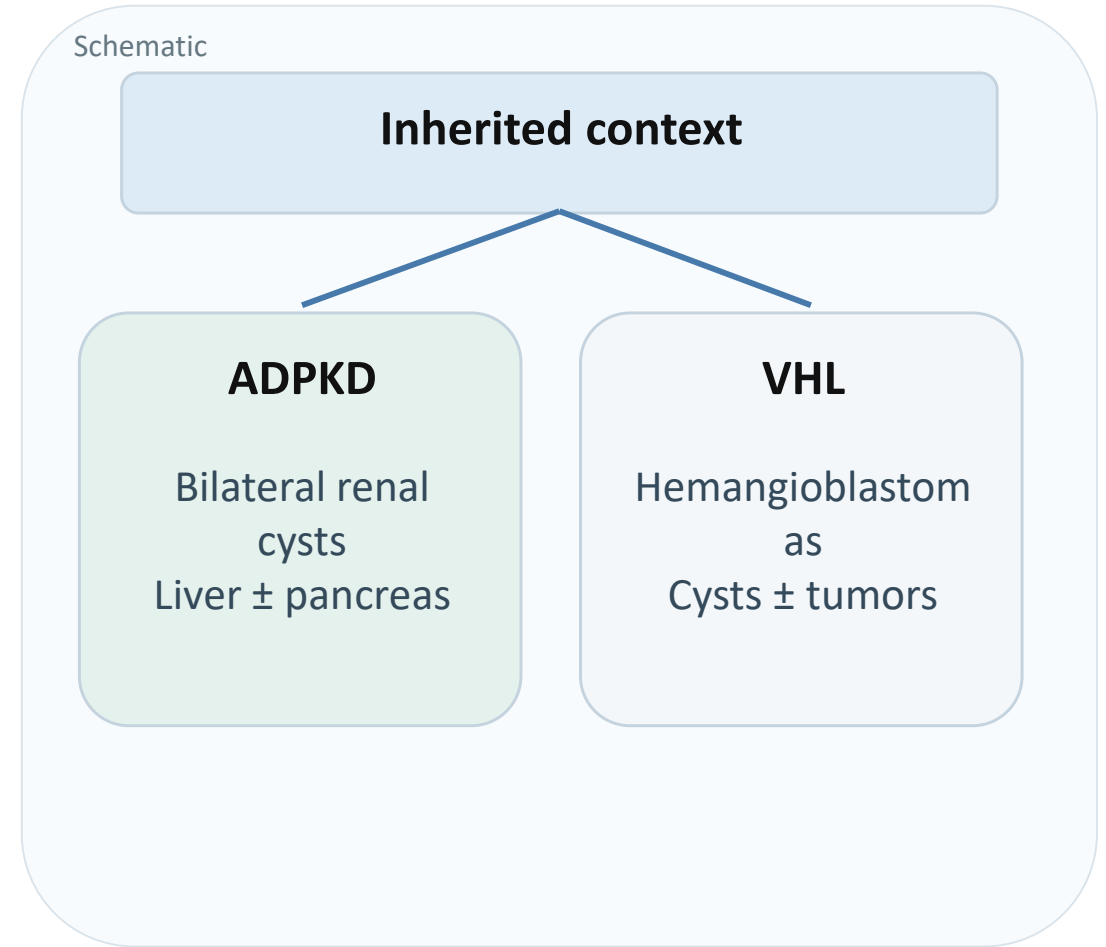


Sporadic presentation is possible

- Congenital pancreatic cysts need not occur within a hereditary syndrome.
- A solitary cyst can occur without documented multisystem cystic disease.
- Nevertheless, important inherited associations.

Two hereditary associations to recognize

- Autosomal dominant polycystic kidney disease (ADPKD).
- Von Hippel–Lindau (VHL) disease.
- The associated extra-pancreatic findings differ and help organize the differential.



ADPKD: Pancreatic cyst as one organ manifestation

- ADPKD chiefly produces bilateral, expanding renal cysts.
- Cysts may also affect the liver and pancreas.
- A pancreatic cyst must be interpreted within the pattern of organ involvement.

Schematic

Kidney

Cysts

Liver

Cysts

Pancreas

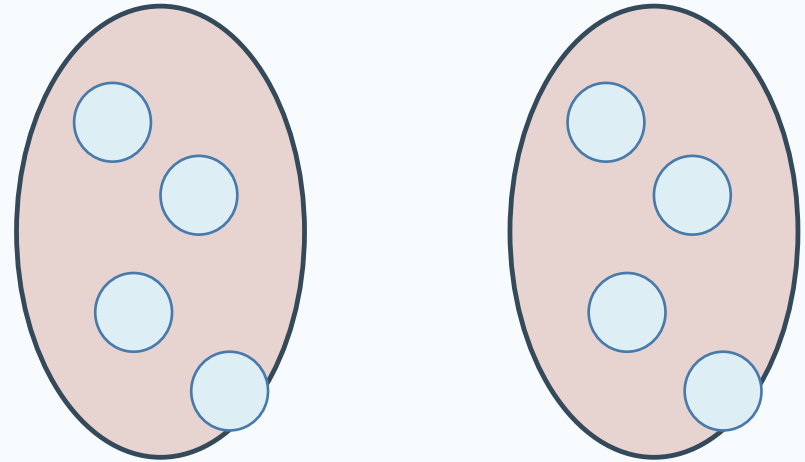
Cysts

ADPKD: Kidney-centered syndrome

ADPKD: The defining renal phenotype

- Multiple expanding cysts develop in both kidneys.
- Progressive cyst expansion displaces and destroys renal parenchyma.
- Kidney involvement is central; A pancreatic cyst alone does not establish ADPKD.

Schematic



Bilateral expanding renal cysts

ADPKD: Extrarenal cyst distribution

- Hepatic cysts are a well-recognized extrarenal feature.
- Pancreatic cysts can occur, although the renal chapter describes them as less frequent.
- Cyst distribution is more informative than a cyst in isolation.

Schematic

Kidney

Cysts

Liver

Cysts

Pancreas

Cysts

ADPKD: Kidney-centered syndrome

ADPKD: PKD1 and PKD2 are the main genes

- PKD1 encodes polycystin-1; PKD2 encodes polycystin-2.
- They explain nearly all ADPKD.
- These are ADPKD genetics—not specific tests established for isolated congenital pancreatic cysts.

Schematic

PKD1

Polycystin-1

PKD2

Polycystin-2

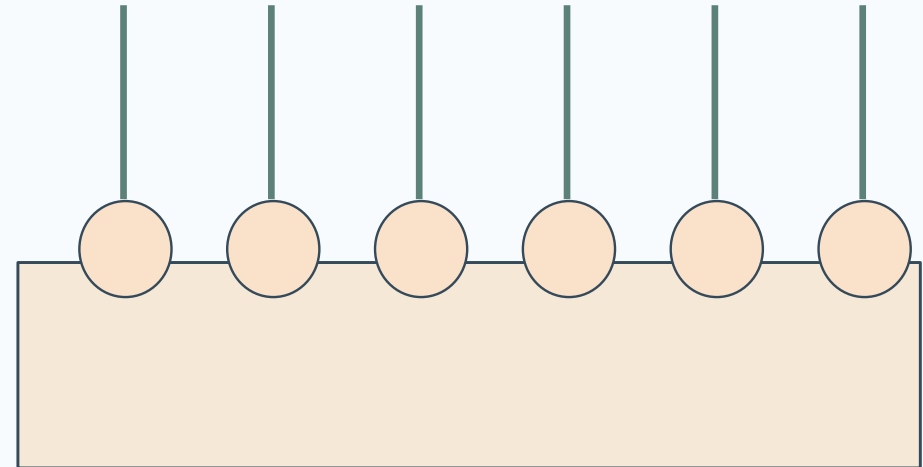
Genes implicated in renal ADPKD

Renal ciliary dysfunction: Proper interpretation

- A cilia–centrosome hypothesis for renal cyst formation in ADPKD.
- Defects in mechanosensation and calcium signaling are implicated.
- Do not present this renal hypothesis as proven pathogenesis of every pancreatic congenital cyst.

Schematic

Primary cilia of renal tubular epithelium



Renal mechanism; Not shown as pancreatic proof

ADPKD: Interpretation of a pancreatic cyst

- A pancreatic cyst may be part of a multisystem ADPKD phenotype.
- The underlying renal disease supplies the main diagnostic context.
- Association does not imply that every pancreatic cyst in ADPKD is congenital.

VHL disease: Multisystem cystic and neoplastic changes

- Cysts involving pancreas, liver, and kidneys.
- The syndrome additionally predisposes to several neoplasms.
- A pancreatic lesion in VHL should not automatically be assumed to be a harmless simple cyst.

Schematic

Kidney

Cysts

Liver

Cysts

Pancreas

Cysts

VHL: Add retinal/CNS vascular tumors

VHL: Retinal and CNS hemangioblastomas

- Hemangioblastomas are characteristic VHL-associated neoplasms.
- The retina and cerebellum are especially important sites.
- Brain-stem and other CNS sites can also be involved.

Schematic

Retina

Hemangioblastoma

Cerebellum

Hemangioblastoma

Characteristic VHL-associated tumors

VHL: Other characteristic tumors

- VHL also predisposes to renal cell carcinoma.
- Pheochromocytomas are included in the syndrome.
- Therefore, “cysts plus neoplasms” is a more accurate summary than “cysts only.”

Schematic

Kidney

Cysts

Liver

Cysts

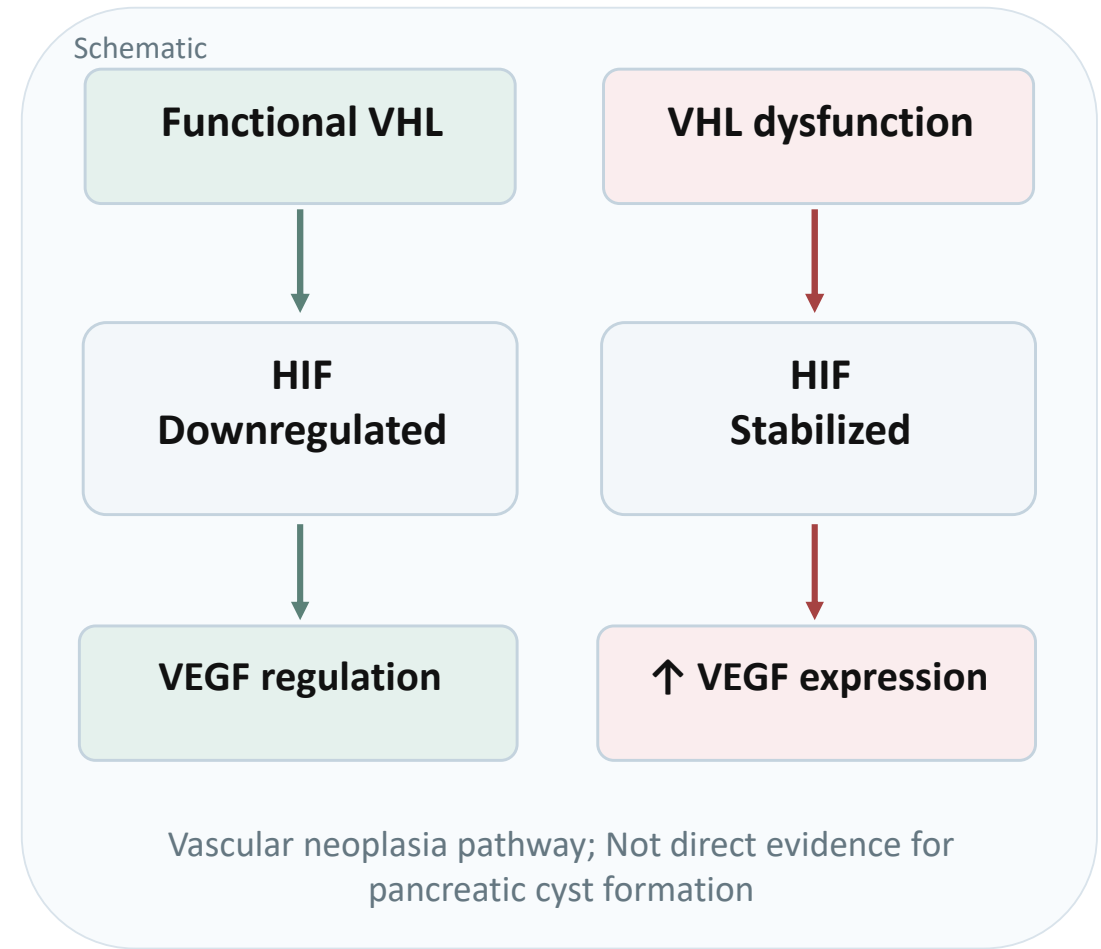
Pancreas

Cysts

VHL: Add retinal/CNS vascular tumors

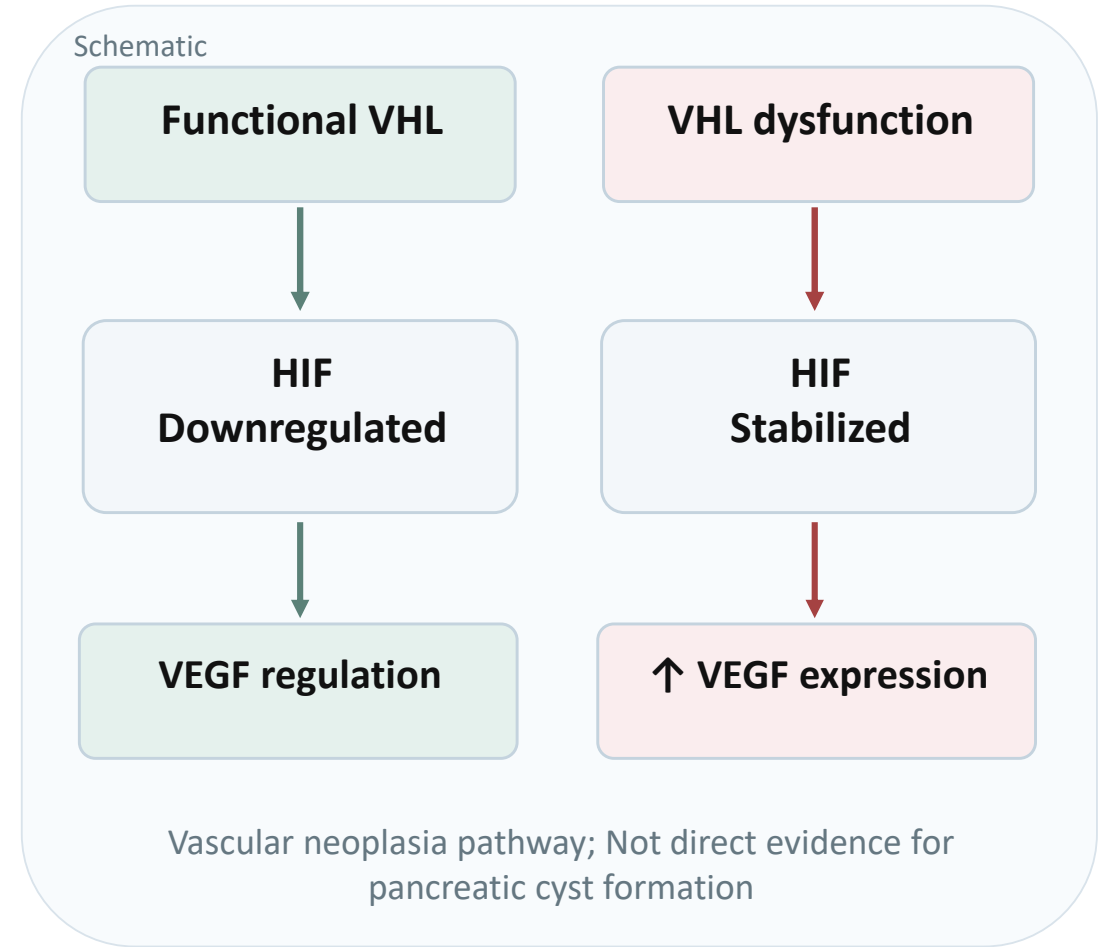
VHL: The tumor suppressor locus

- VHL is a tumor-suppressor gene on chromosome 3p25.3.
- Its protein participates in a ubiquitin ligase complex.
- One major physiologic role is downregulating HIF transcription factors.



VHL–HIF signaling: Why vascular tumors develop

- Impaired VHL pathway function permits increased HIF signaling.
- HIF-regulated VEGF expression drives excessive vessel growth.
- This explains the vascular character of hemangioblastomas—not the histology of a simple pancreatic cyst.



VHL-associated pancreas: Cysts and neoplasms coexist

Characteristic evidence

- Congenital cysts and pancreatic neoplasms in VHL.
- Separately, serous cystic neoplasms commonly show VHL gene inactivation.

Diagnostic implication

- A syndromic association must not substitute for lesion-specific morphologic classification.

ADPKD versus VHL: What changes the suspicion?

Characteristic evidence

- ADPKD: Bilateral multicystic kidneys dominate the phenotype.
- VHL: Hemangioblastomas and associated tumors are salient clues.

Diagnostic implication

- Both can include pancreatic and hepatic cysts.

Multiple-organ cysts: An interpretation matrix

- Kidney + liver + pancreas cysts: Consider ADPKD or VHL context.
- Retinal or CNS hemangioblastoma: Strongly shifts attention toward VHL.
- Pattern recognition helps, but no isolated cyst is a syndrome diagnosis.

Schematic

Kidney

Cysts

Liver

Cysts

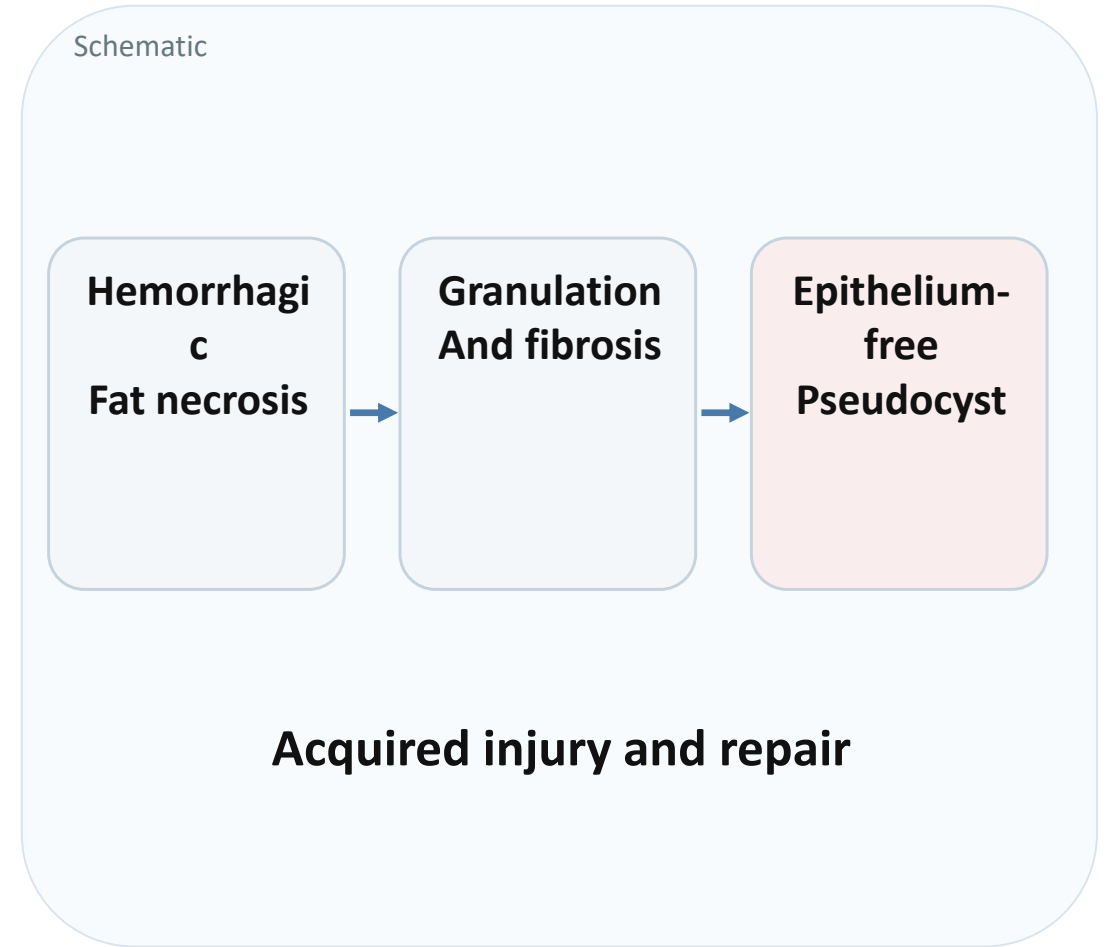
Pancreas

Cysts

VHL: Add retinal/CNS vascular tumors

Pseudocyst pathogenesis begins with tissue injury

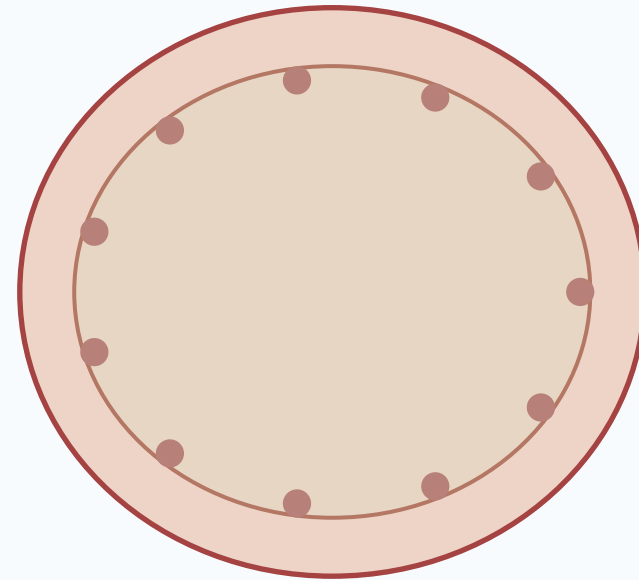
- Intrapancreatic or peripancreatic hemorrhagic fat necrosis can form a cavity.
- Fibrosis and granulation tissue subsequently wall off the injury.
- The resulting cavity is a pseudocyst, not a developmental epithelial cyst.



Pseudocyst-associated clinical settings

- Pseudocysts often follow an attack of acute pancreatitis.
- Chronic alcohol-associated pancreatitis may provide the background.
- Pancreatic trauma is another possible antecedent.

Schematic

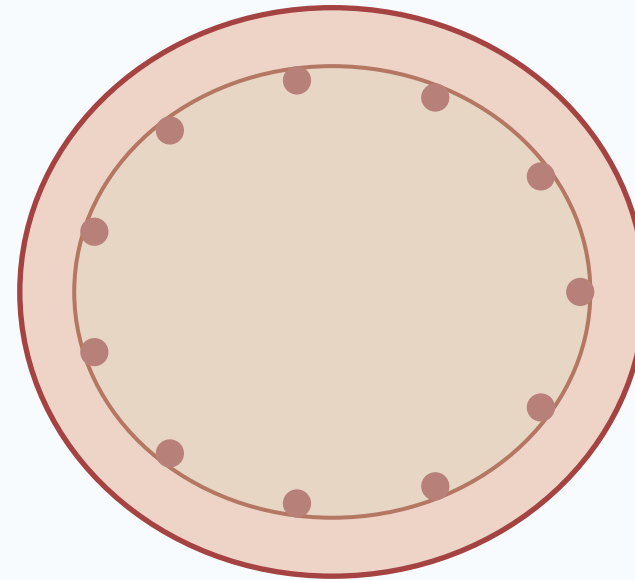


Often follows pancreatitis or trauma

Pseudocyst: The defining wall composition

- Fibrous tissue and granulation tissue line the cavity.
- A true epithelial lining is absent.
- The term “pseudo” reflects this architectural distinction.

Schematic



No true epithelial lining

Granulation tissue is not an epithelium

Characteristic evidence

- Granulation tissue represents a vascular reparative response.
- It lacks the organized continuous cellular surface of a true epithelial-lined cyst.

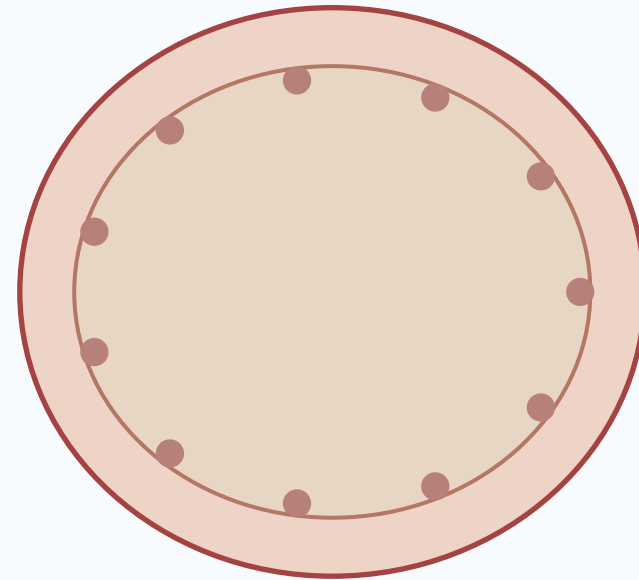
Diagnostic implication

- The comparison is more useful than fluid color alone.

Pseudocysts can extend beyond the pancreas

- They may lie inside the pancreas or in adjacent abdominal spaces.
- The lesser omental sac and retroperitoneal locations.
- A congenital pancreatic cyst is described as a pancreatic developmental cyst.

Schematic



Pancreatic or peripancreatic spaces

Pseudocyst size and wall differ

Characteristic evidence

- Robbins gives pseudocysts a range of approximately 2–30 cm.
- The wall may be fibrous and granulation-tissue-rich.

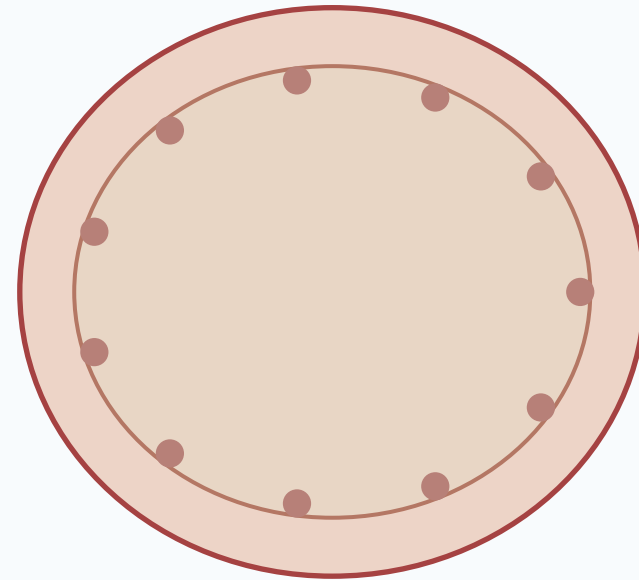
Diagnostic implication

- Congenital cysts are described as thin-walled lesions up to approximately 5 cm.

Pseudocyst complications

- Some pseudocysts resolve spontaneously.
- Secondary infection may occur.
- Larger lesions can compress or erode neighboring structures.

Schematic



Infection · compression · erosion

True congenital cyst versus pseudocyst

Characteristic evidence

- Congenital: Proposed duct developmental origin; Epithelial lining present.
- Pseudocyst: Tissue injury and repair; Epithelial lining absent.

Diagnostic implication

- Background pancreatic inflammation and lesion position may add context.

Cystic tumors form a separate category

- Cystic pancreatic neoplasms can be benign or precancerous.
- Robbins differentiates serous, mucinous, intraductal papillary mucinous, and solid-pseudopapillary neoplasms.
- A cystic structure is not sufficient evidence for a congenital lesion.

Schematic

Serous

Mucinous

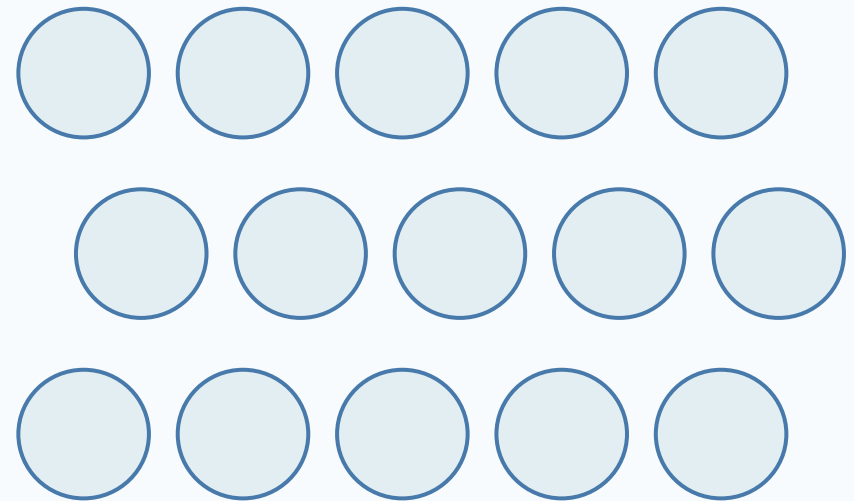
IPMN

Solid-pseudo-Papillary

Serous cystic neoplasm: Architecture

- Often contains many tiny cysts forming a honeycomb architecture.
- The described microcysts measure about 1–3 mm.
- This pattern contrasts with the typical single congenital cyst cavity.

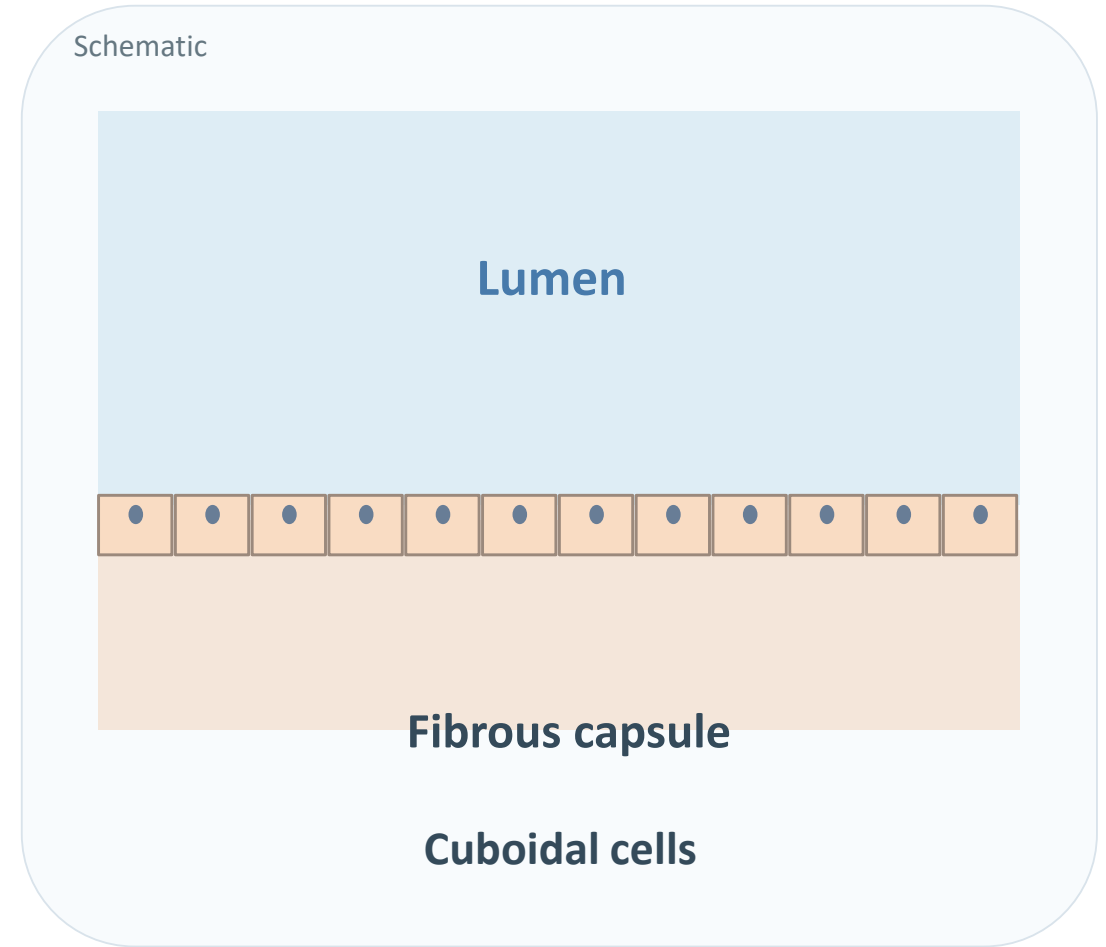
Schematic



Microcystic / honeycomb architecture

Serous cystic neoplasm: Epithelial phenotype

- Serous cystic neoplasms have glycogen-rich cuboidal epithelial cells.
- Contents are clear, thin, and straw colored.
- Neither cuboidal cells nor clear fluid uniquely identifies a congenital cyst.



VHL signaling and serous neoplasia are not identical to congenital cysts

Characteristic evidence

- Inactivation of VHL is common in serous cystic neoplasms.
- VHL syndrome can also include pancreatic congenital cysts.

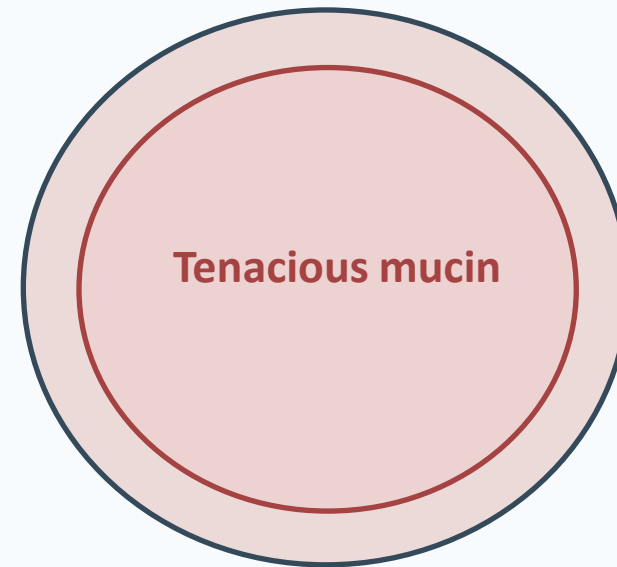
Diagnostic implication

- Shared syndrome or gene context does not erase the distinction between neoplastic and developmental lesions.

Mucinous cystic neoplasm: Essential contrast

- Larger cyst cavities contain thick tenacious mucin.
- Columnar mucin-producing epithelium lines the cysts.
- A dense ovarian-type stroma is a major defining feature.

Schematic

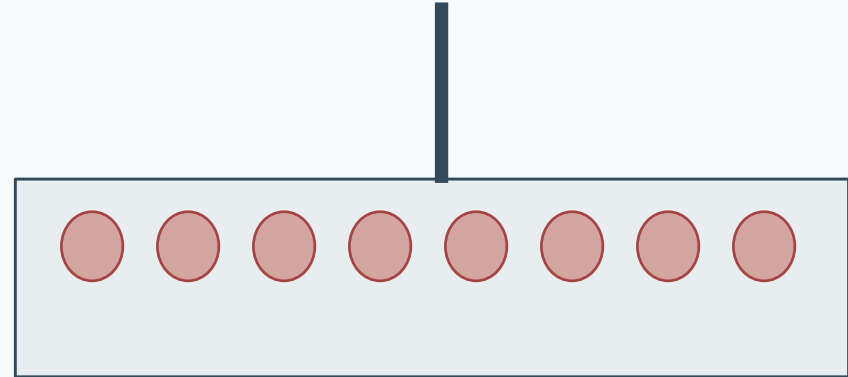


Columnar mucinous lining + ovarian-type stroma

IPMN: Duct-centered lesion

- Intraductal papillary mucinous neoplasms involve major or branch pancreatic ducts.
- Neoplastic papillary epithelium produces mucin.
- Duct involvement is a discriminator from a simple congenital cyst.

Schematic

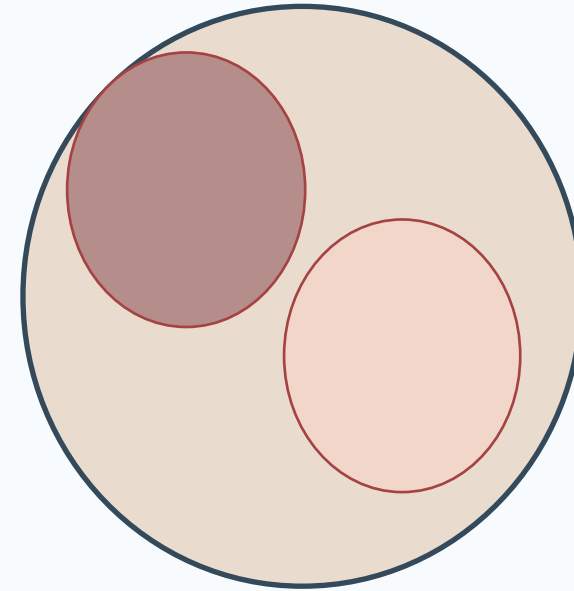


Papillary mucinous growth within a duct

Solid-pseudopapillary neoplasm: Another mimic

- A well-circumscribed mass can combine solid and cystic components.
- The cystic areas contain hemorrhagic debris.
- This is not the uniform clear-fluid, single-cavity congenital phenotype.

Schematic



Solid + cystic areas / hemorrhagic debris

Compare cystic lesions by their defining tissue

Characteristic evidence

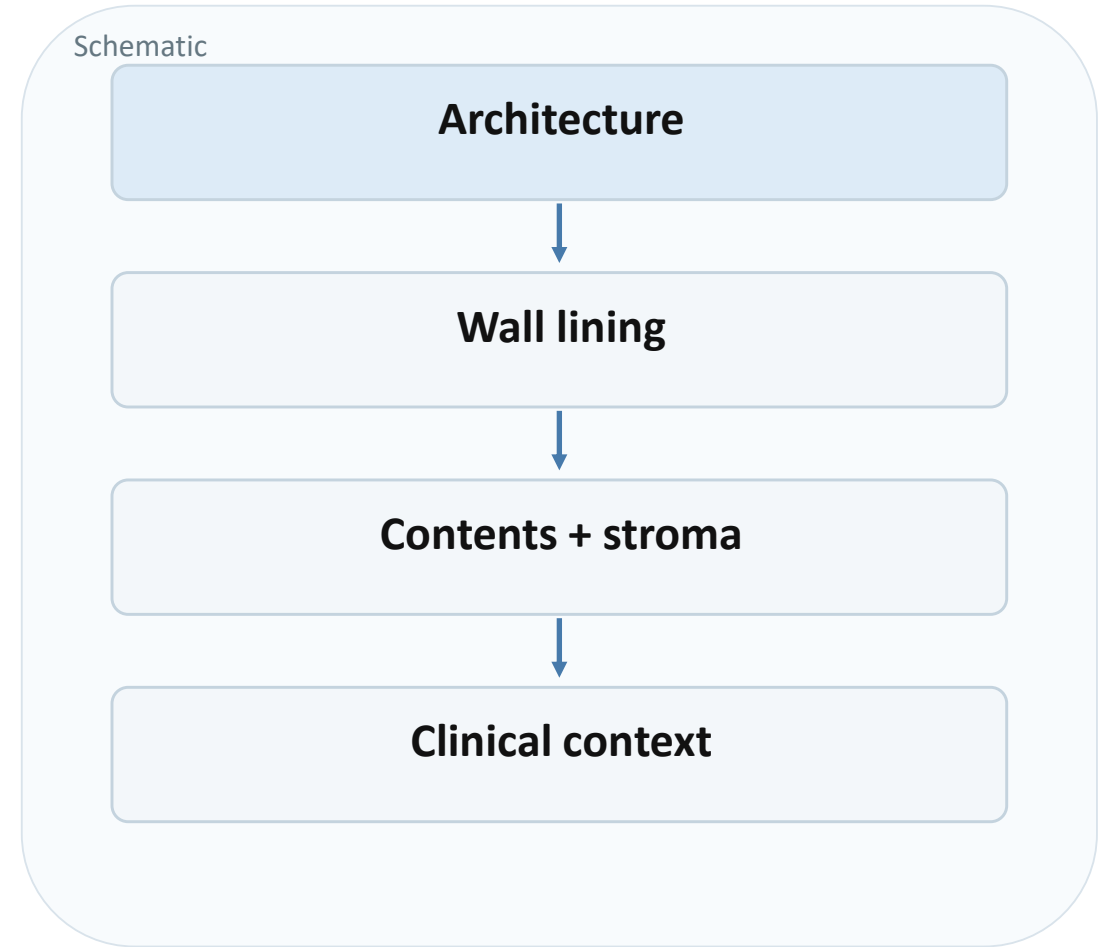
- Congenital cyst: Uniform cuboidal or flattened lining, thin capsule.
- Pseudocyst: Fibrous and granulation tissue; No epithelium.

Diagnostic implication

- Mucinous cystic neoplasm: Mucinous cells with ovarian-type stroma.
- IPMN: Duct-centered papillary mucinous neoplasm.

Pattern-based differential: Four focal questions

- Does the cavity possess a true epithelial lining?
- Is the architecture single-chambered or microcystic?
- Does mucin, ovarian-type stroma, or papillary duct growth appear?
- Are there clinical features of pancreatitis, ADPKD, or VHL?

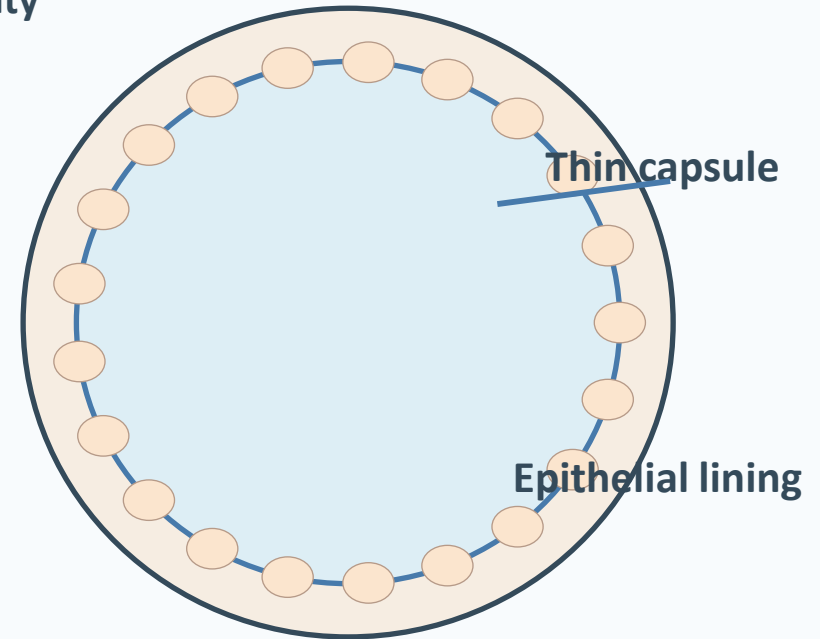


Worked case: A solitary thin-walled lesion

- A resected pancreatic lesion is unilocular and contains clear fluid.
- A continuous cuboidal lining rests on a thin fibrous capsule.
- Most supported classification: Congenital cyst; Ask about associated syndromes.

Schematic

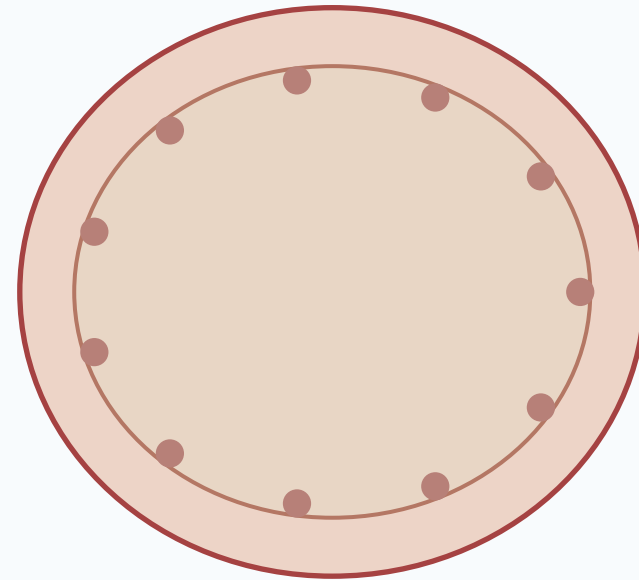
One cavity



Worked case: Cyst after acute pancreatitis

- A cystic mass develops following pancreatitis.
- The wall is granulation tissue and fibrosis without epithelium.
- Most supported classification: Pseudocyst due to prior tissue injury.

Schematic



No true epithelial lining

Worked case: Cyst plus enlarged cystic kidneys

- A pancreatic cyst accompanies bilateral multicystic kidneys.
- Hepatic cysts are also present.
- Prioritize ADPKD as a possible multisystem explanation; Do not infer cyst type solely from the syndrome.

Schematic

Kidney

Cysts

Liver

Cysts

Pancreas

Cysts

ADPKD: Kidney-centered syndrome

Worked case: Pancreatic cyst and hemangioblastoma

- A pancreatic cyst is found in a patient with a retinal hemangioblastoma.
- The pairing should prompt consideration of VHL disease.
- The pancreatic lesion still requires independent assessment for cyst versus neoplasm.

Schematic

Retina

Hemangioblastoma

Cerebellum

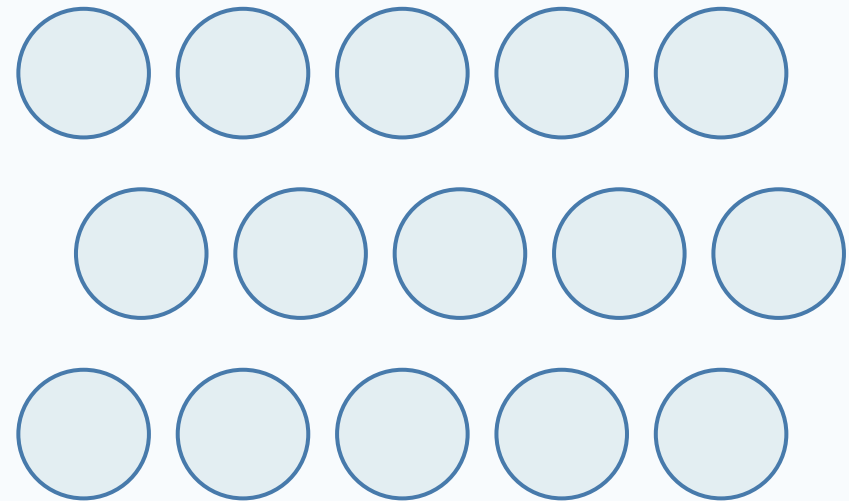
Hemangioblastoma

Characteristic VHL-associated tumors

Worked case: Many small clear-fluid cysts

- A lesion contains numerous 1–3 mm cavities in a honeycomb pattern.
- Cuboidal cells contain glycogen; The cystic fluid is clear.
- Favor serous cystic neoplasm over a typical unilocular congenital cyst.

Schematic

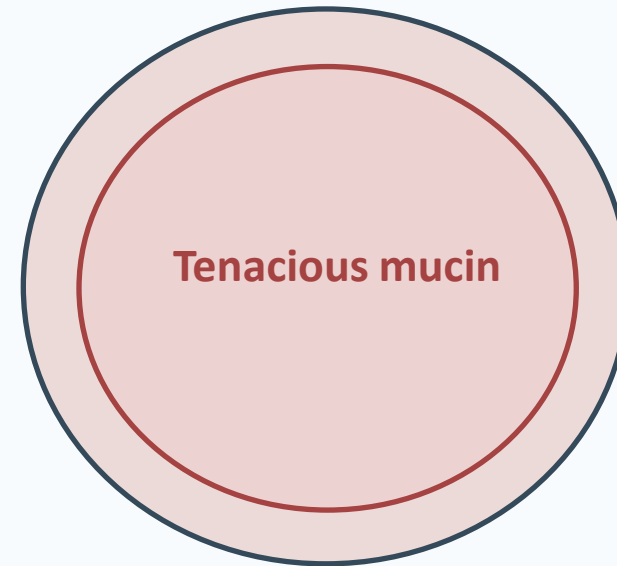


Microcystic / honeycomb architecture

Worked case: Mucin and specialized stroma

- A pancreatic-tail cyst contains tenacious mucin.
- Columnar mucinous epithelium overlies ovarian-type stroma.
- This constellation favors mucinous cystic neoplasm.

Schematic

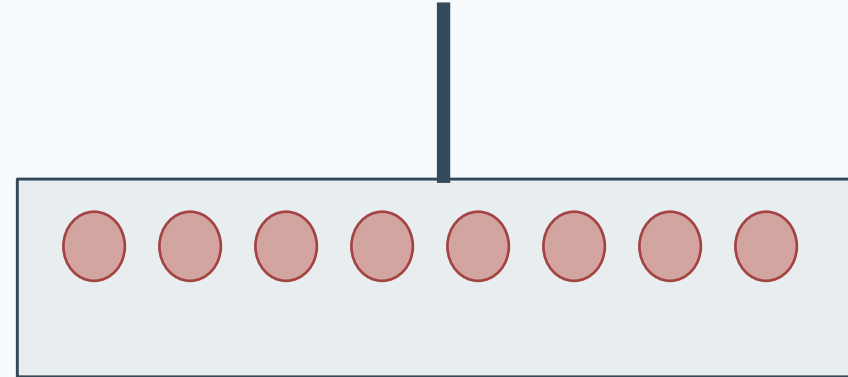


Columnar mucinous lining + ovarian-type stroma

Worked case: Main-duct papillary change

- A cystic lesion communicates with a duct containing papillary mucinous epithelium.
- The pancreatic duct is expanded by the lesion.
- This pattern favors an intraductal papillary mucinous neoplasm.

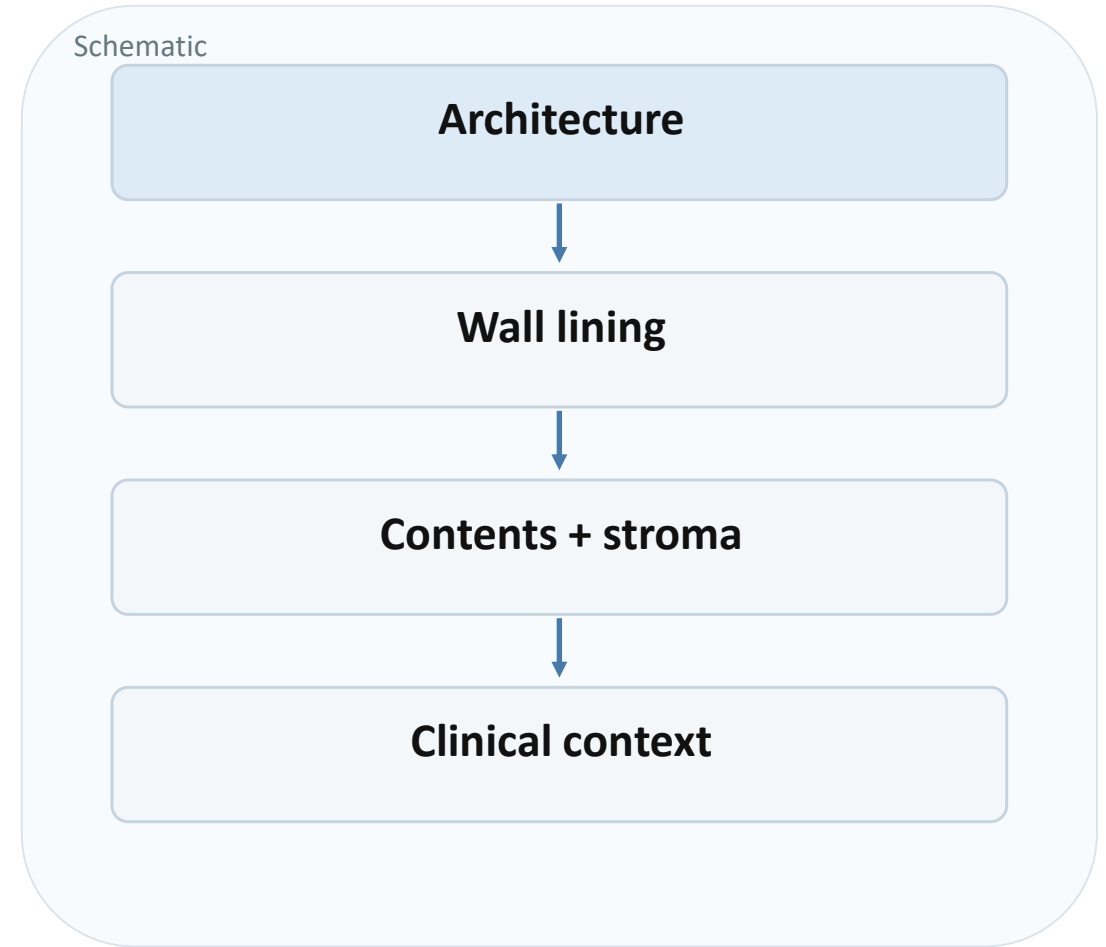
Schematic



Papillary mucinous growth within a duct

A lesion-level interpretation sequence

- Identify cyst category before naming a specific entity.
- Use architecture, wall lining, mucin, and stromal organization.
- Place the microscopic result into relevant inflammatory or inherited context.



Five checks before reporting a “congenital cyst”

- Is the cyst truly epithelial-lined?
- Does it show one lumen and a thin fibrous capsule?
- Are the cells cuboidal or pressure-attenuated?
- Are neoplastic papillae, mucinous epithelium, or ovarian-type stroma absent?
- Is a syndromic context documented or reasonably considered?

Principal distinctions to retain

- Congenital cyst: Developmental interpretation, epithelial lining, thin wall and clear fluid.
- Pseudocyst: Fibrous/granulation-tissue cavity after injury, without epithelial lining.
- Cystic neoplasm: Diagnose by its architecture, epithelial phenotype, and stroma.
- ADPKD and VHL are associations—not substitutes for morphologic diagnosis.

Source and reading context

- Robbins, Cotran & Kumar: Pathologic Basis of Disease, 11th edition (2026).
- Chapter 19: The Pancreas — nonneoplastic cysts and cystic neoplasms, pp. 806–809.
- Chapter 20: The Kidney — autosomal dominant polycystic kidney disease, pp. 856–858.
- Chapter 28: The Central Nervous System — von Hippel–Lindau disease, pp. 1185–1186.