

Acute Appendicitis

Mechanisms • Morphology • Clinicopathologic correlation

An integrated pathology lecture

Dr Abu Suraih Sakhri

MBBS, MD (Pathology)

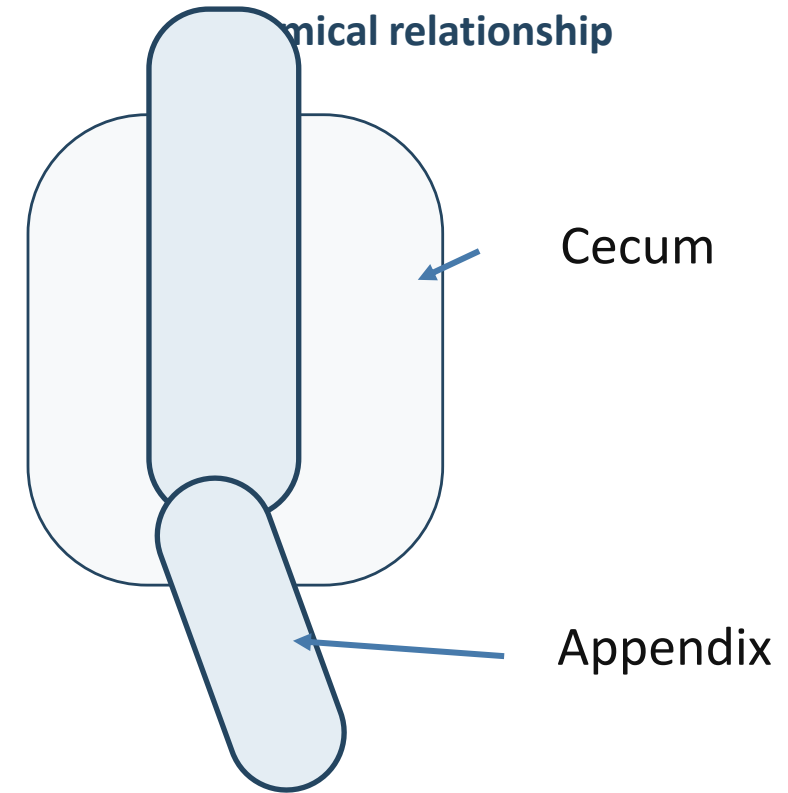
www.abusuraihsakhri.com

Learning outcomes

- Explain why luminal obstruction and compromised venous outflow initiate injury.
- Identify the diagnostic significance of neutrophils in muscularis propria.
- Link morphologic stages to rupture, peritonitis, and clinical signs.
- Distinguish common mimics and atypical appendicitis presentations.

Appendix: A true diverticulum of the cecum

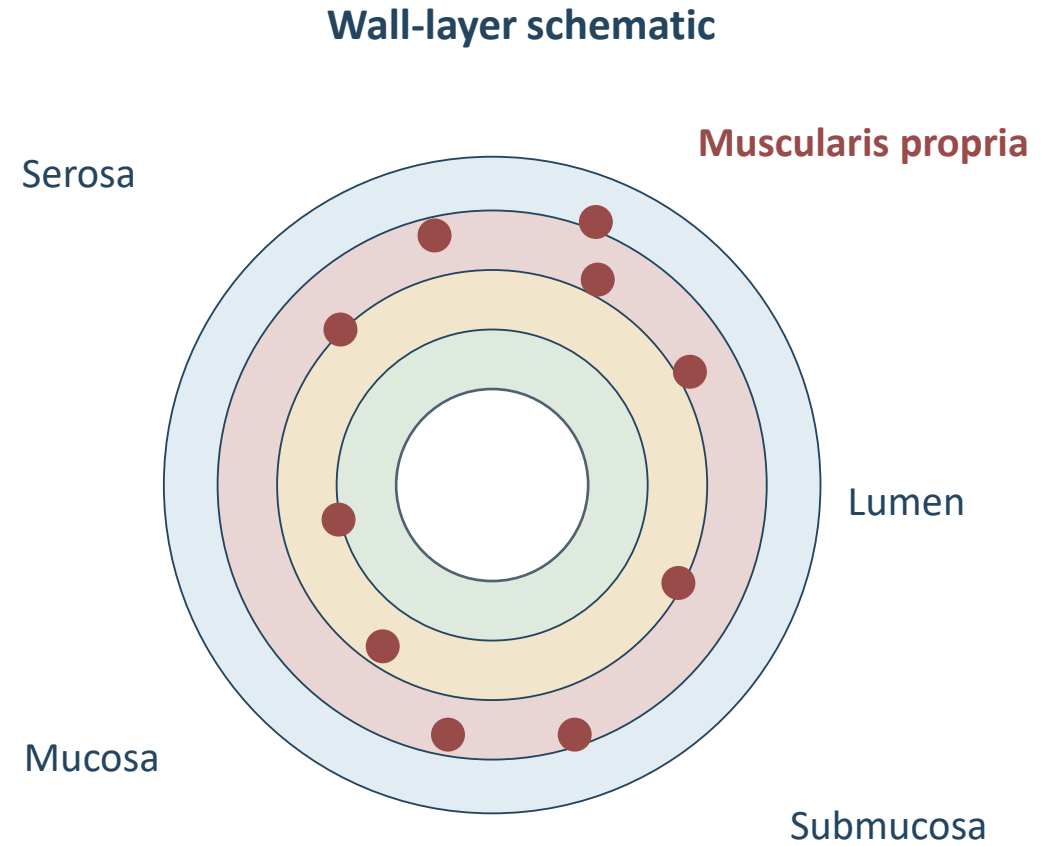
- The appendix is a normal, true diverticulum of the cecum.
- It is susceptible to both acute and chronic inflammatory processes.
- Its luminal configuration provides a setting in which obstruction can precipitate acute injury.



Normal anatomical schematic

What defines acute appendicitis?

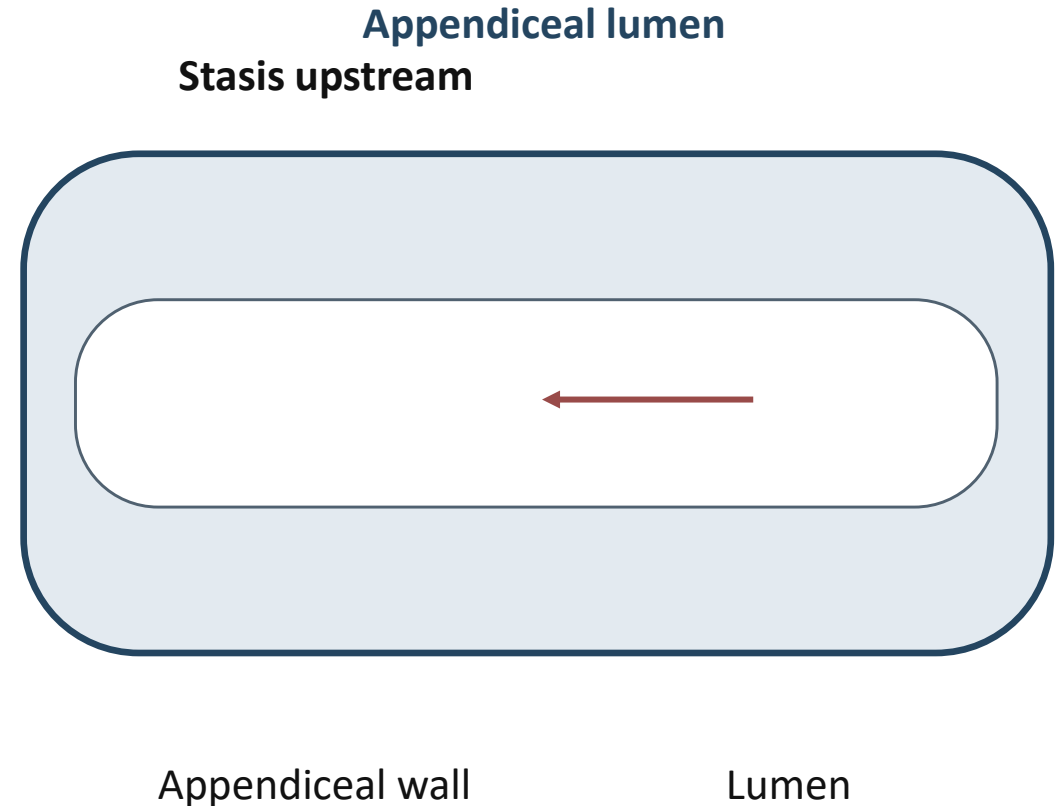
- An acute inflammatory disorder of the appendix.
- The critical histologic requirement is neutrophilic infiltration of the muscularis propria.
- Clinical suspicion and the diagnostic histologic threshold are separate questions.



Conceptual wall cross-section — not histology

Why the appendix can become inflamed

- Elevated intraluminal pressure compromises venous drainage.
- Retained contents permit bacterial proliferation.
- Ischemia and tissue inflammation amplify the local injury.



Age distribution

- Acute appendicitis is most common in adolescents and young adults.
- The Robbins summary also emphasizes children and adolescents as major affected groups.
- Age influences the breadth and reliability of the clinical differential.

Population risk and sex distribution

Population perspective

- A lifetime risk of approximately 7%.
- Males are affected slightly more often than females.
- These population observations do not confirm or exclude an individual acute-abdomen diagnosis.

7%

Lifetime risk cited

Not a prediction for an individual patient

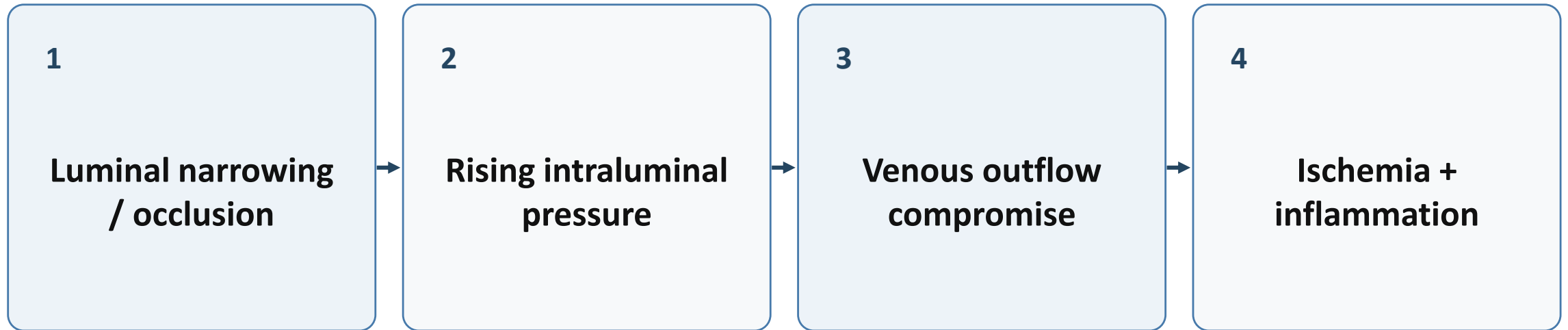
Clinical importance across age groups

- The typical patient is young, but appendicitis also occurs at age extremes.
- Young children and older adults more often have atypical presentations.
- Competing causes of abdominal emergencies complicate evaluation in these groups.

Adult appendicitis: Think beyond inflammation

- In an adult with suspected appendicitis, an appendiceal neoplasm must also be considered.
- A tumor can obstruct the appendiceal lumen or cause swelling that resembles appendicitis.
- This caution is etiologic; The excerpt does not provide a tumor-screening algorithm.

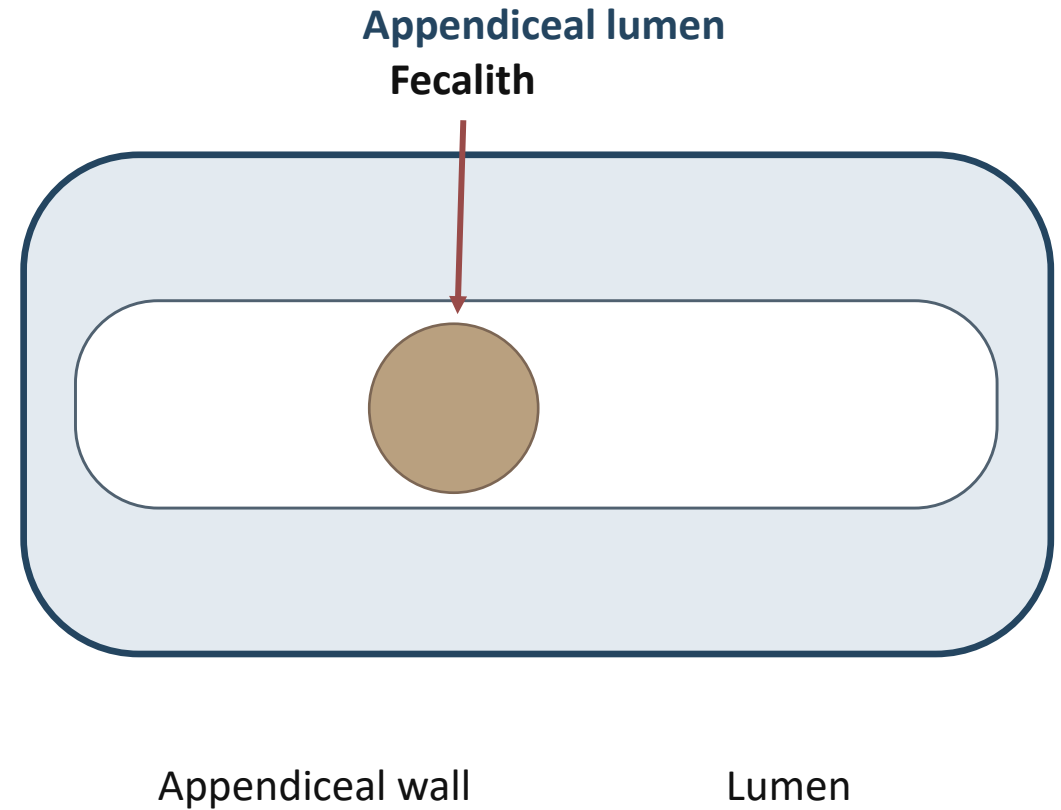
Etiologic framework: Obstruction or compression



- The model is a proposed dominant pathway, not an obligatory sequence in every case.

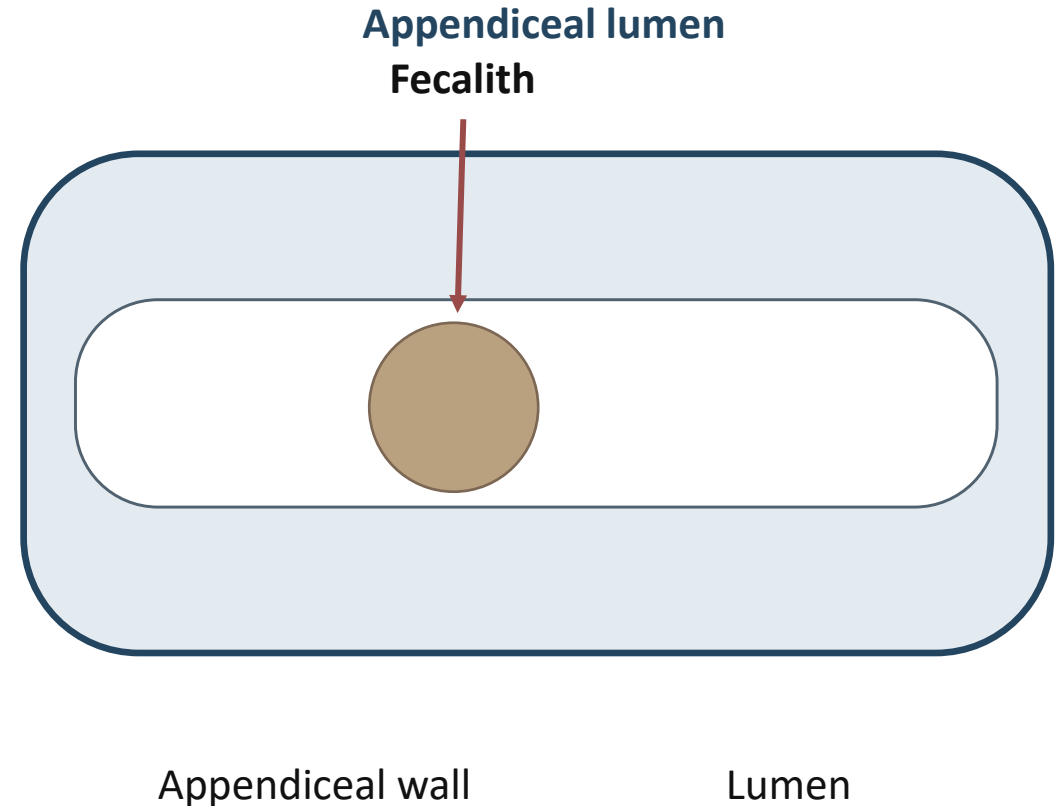
Overt obstruction: Important but not universal

- Overt luminal obstruction in 50%–80% of cases.
- An obvious obstructing object is therefore absent in a meaningful proportion of cases.
- Avoid equating the disease exclusively with a visible fecalith.



Fecalith: The usual obstructing material

- A fecalith is a small, stone-like mass of stool.
- It is the most common named cause of overt appendiceal luminal obstruction in the excerpt.
- Occlusion promotes rising pressure and retention of luminal contents.



Other obstructing materials

Gallstone

Uncommon intraluminal cause

Tumor

Can obstruct the lumen; Especially important in adults

Worm mass

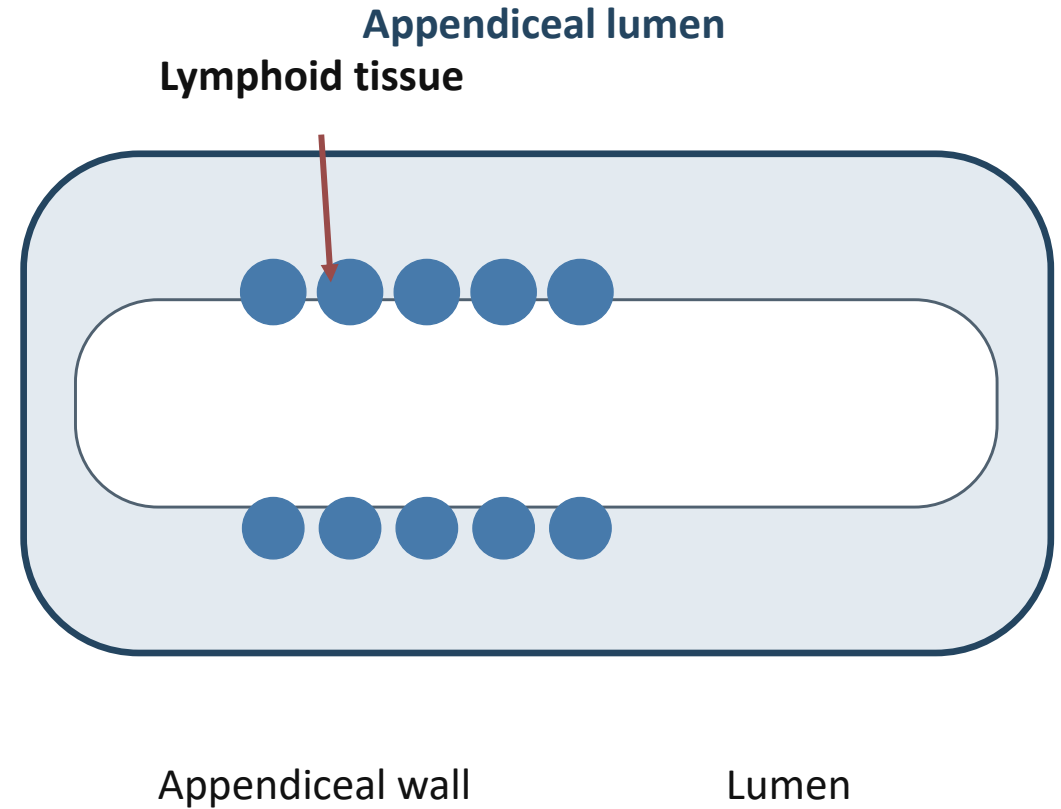
Less common obstructing material named

Fecalith

Most commonly implicated obstructing mass

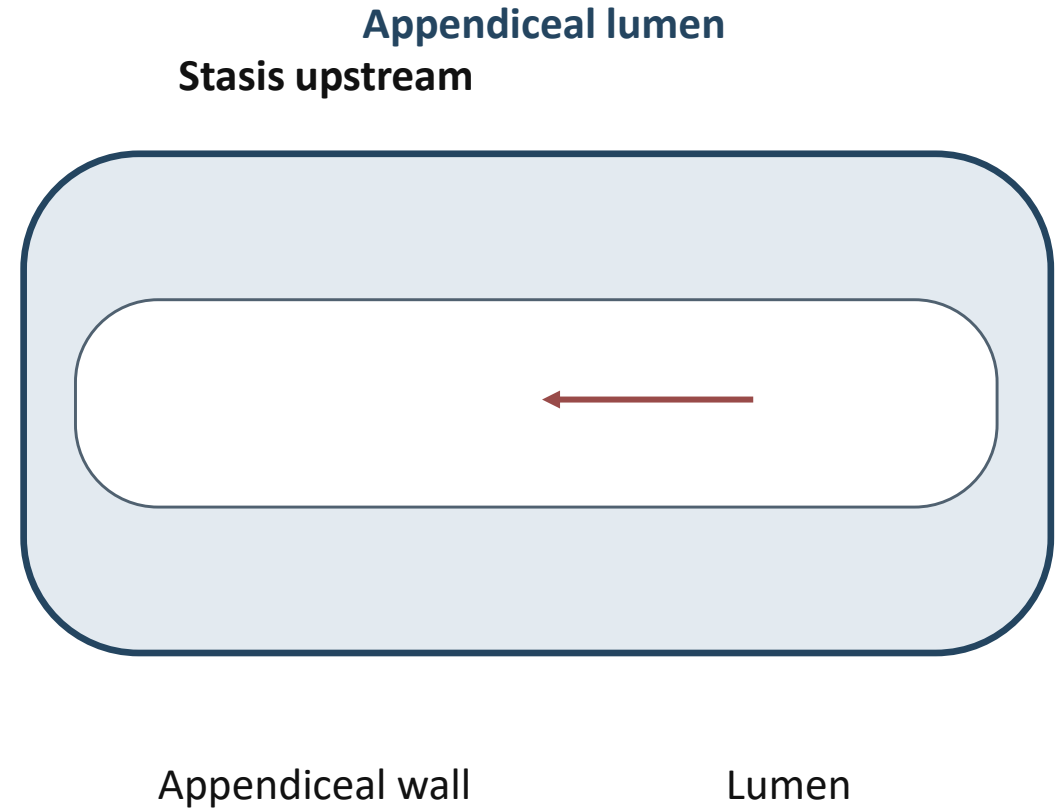
Postinfectious lymphoid hyperplasia

- Periappendiceal lymphoid hyperplasia may follow a viral infection.
- Expansion of local lymphoid tissue has been proposed to compress the appendix.
- This provides an alternative route to venous and luminal obstruction.



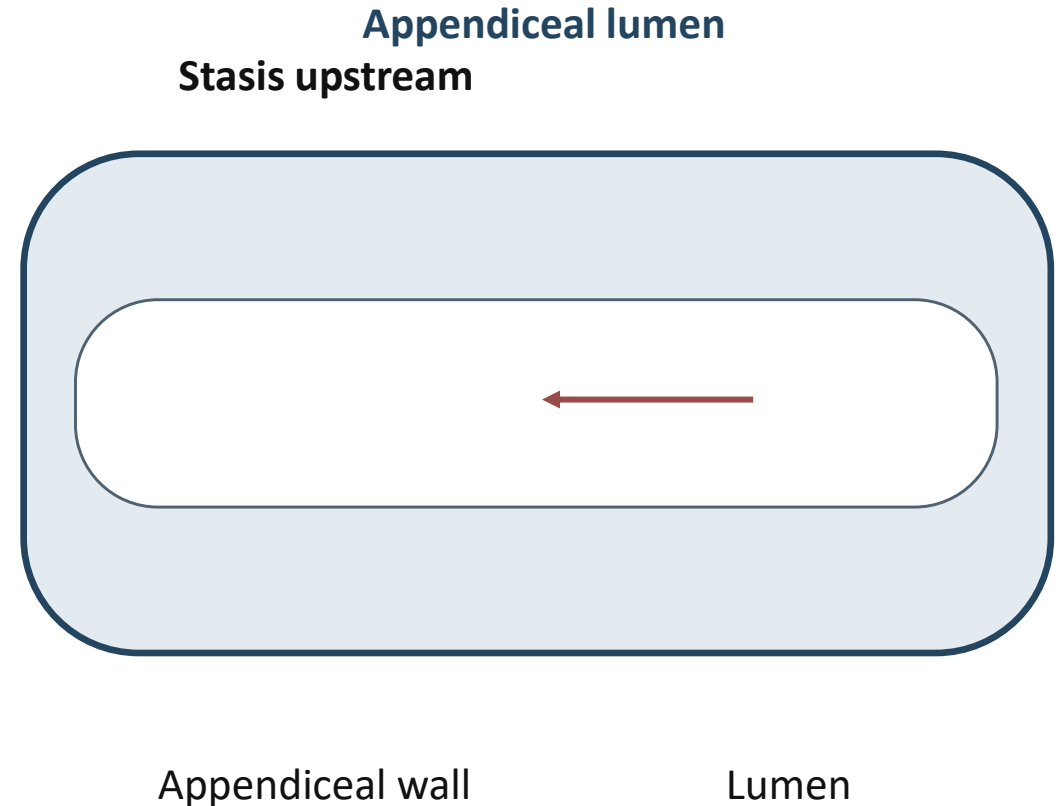
Rising pressure compromises venous outflow

- As intraluminal pressure increases, venous drainage is impaired.
- Congestion develops before more severe ischemic injury.
- Early morphology includes congested subserosal vessels.



Luminal stasis favors bacterial proliferation

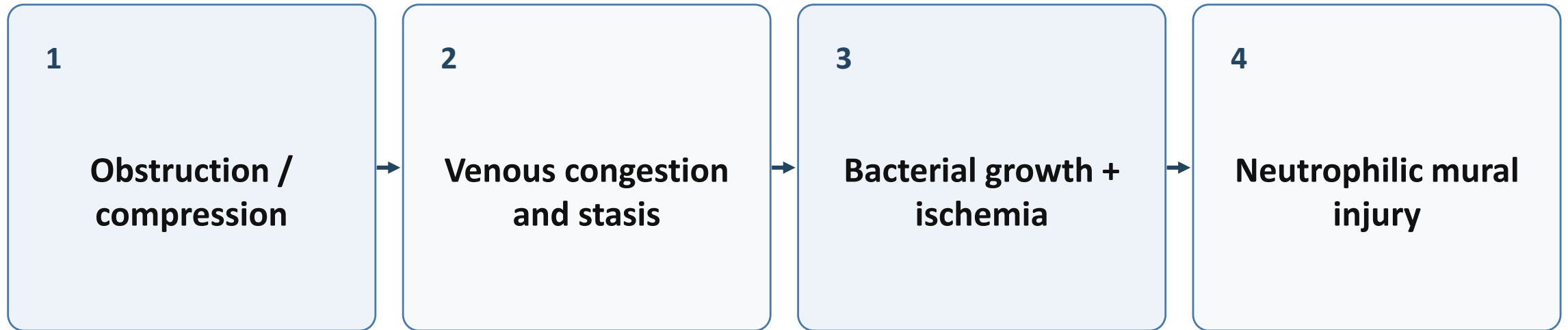
- Obstruction limits clearance of luminal contents.
- Stasis permits proliferation of bacteria already present in the appendiceal environment.
- The resulting inflammatory response contributes to structural tissue injury.



Ischemia connects pressure to tissue injury

- Venous compromise diminishes effective tissue perfusion.
- Progressive ischemia can coexist with bacterial proliferation and neutrophilic inflammation.
- Severe vascular compromise is associated with hemorrhagic ulceration and gangrenous necrosis.

Pathogenesis is a reinforcing cascade



- Increasing tissue damage can culminate in necrosis, perforation, or peritonitis.

Trigger and tissue response are distinct

- Potential triggers include fecalith, tumor, gallstone, worm mass, and lymphoid hyperplasia.
- Immediate physiologic consequences include increased pressure and venous impairment.
- The tissue response is acute neutrophilic inflammation with variable ischemic damage.

Do not require a fecalith for diagnosis

- Fecaliths are a common mechanism, not a diagnostic criterion.
- Overt luminal obstruction is reported in 50%–80%, not all, cases.
- Histologic evidence of acute mural inflammation remains central in a resected specimen.

Obstruction is not universal

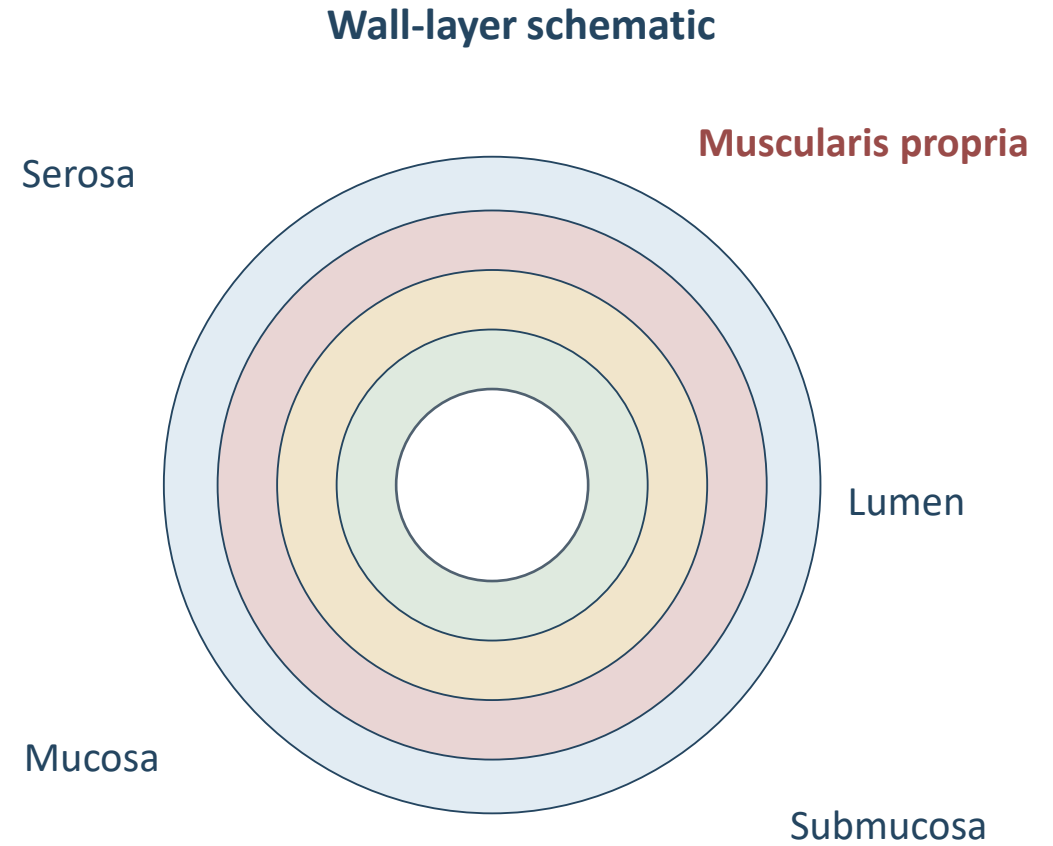
50–80%

Cases with overt luminal obstruction

An obstructing object is not a prerequisite for the histologic diagnosis.

The appendiceal wall: Anatomical orientation

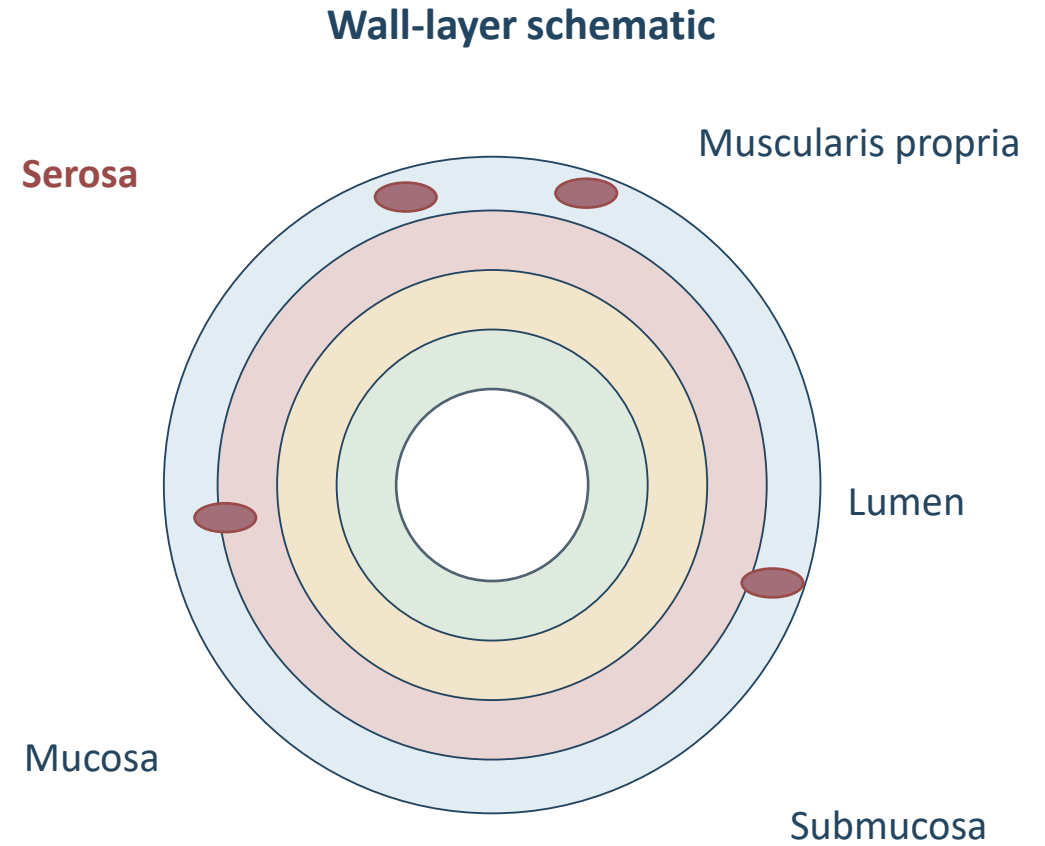
- Mucosa borders the lumen; Submucosa lies beneath it.
- Muscularis propria forms the principal smooth-muscle layer.
- Subserosal vessels and the serosal surface participate in inflammatory progression.



Conceptual wall cross-section — not histology

Early microscopic change: Vascular congestion

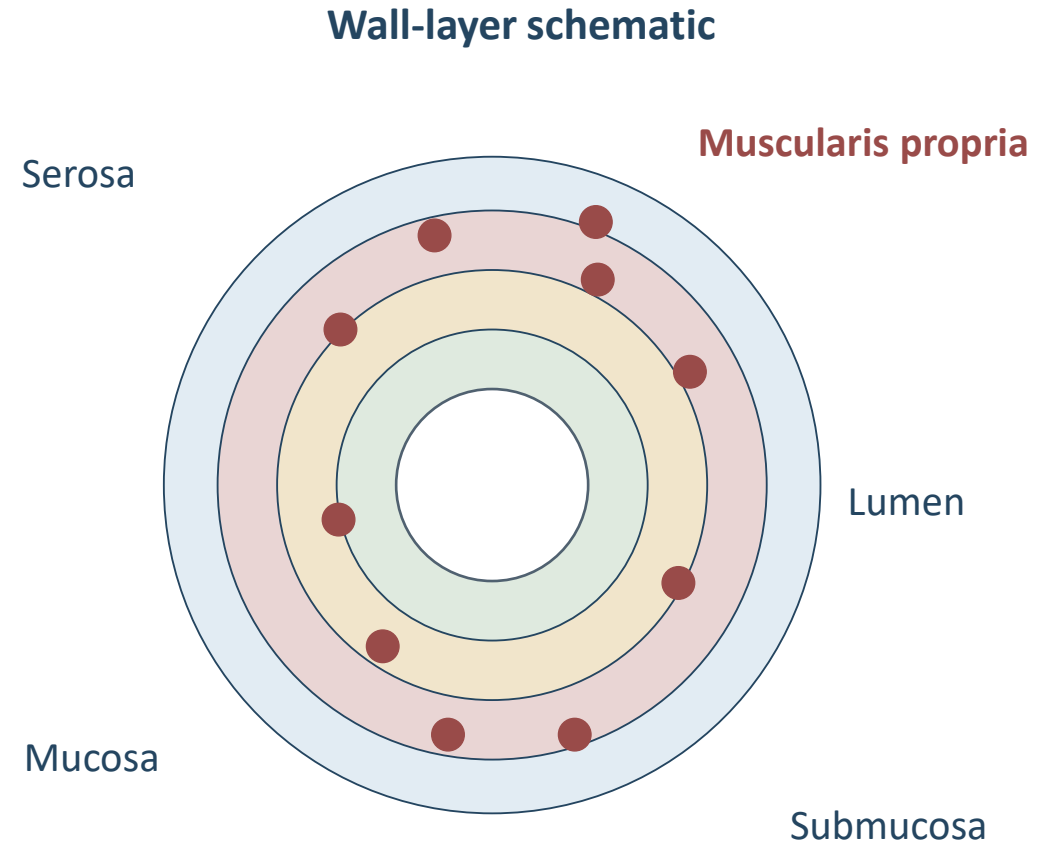
- Early acute appendicitis can show congestion in subserosal vessels.
- A modest perivascular neutrophilic infiltrate may be present.
- These changes precede the more conspicuous suppurative and gangrenous patterns.



Conceptual wall cross-section — not histology

Early neutrophils can span wall layers

- Modest perivascular neutrophilic infiltration within all wall layers.
- Distribution and depth are more informative than simple presence in the mucosa.
- Interpret inflammation in relation to the muscularis propria.



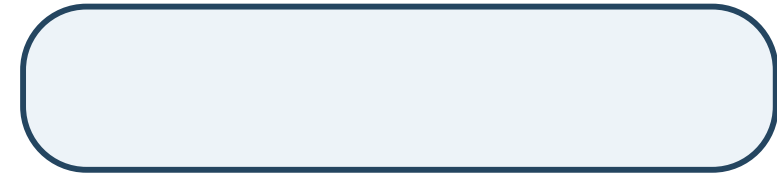
Conceptual wall cross-section — not histology

Serosal response: From glistening to dull

- Normal serosa is smooth and glistening.
- Acute inflammation produces a dull, granular, erythematous external surface.
- The visible surface response correlates with underlying mural inflammation.

Macroscopic serosal change

Normal glistening serosa



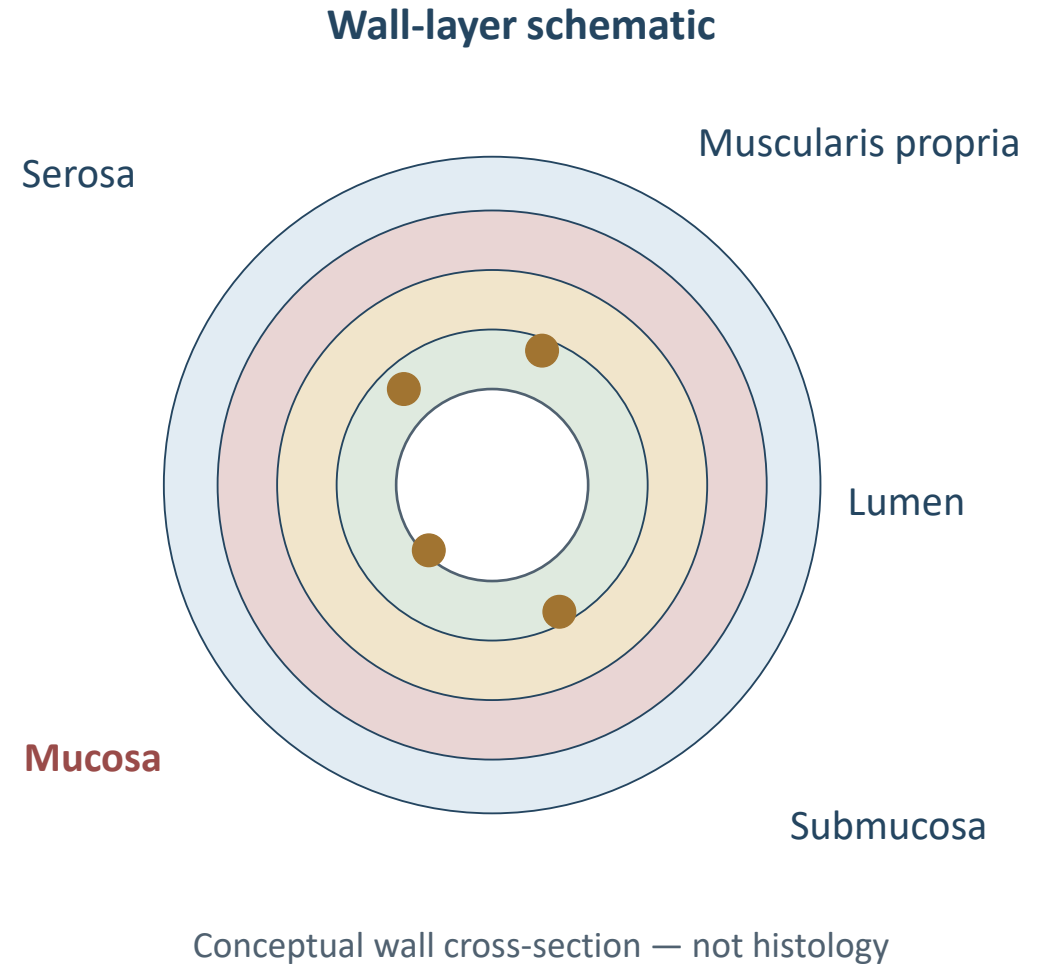
Inflamed, granular serosa



Schematic surface comparison — not a gross specimen

Mucosal injury is not specific

- Mucosal neutrophils may appear in acute appendicitis.
- Focal superficial ulceration is also commonly encountered.
- Neither finding alone is specific enough for the diagnosis.



The muscularis propria is decisive

- Neutrophilic infiltration of muscularis propria is the key histologic criterion.
- A finding restricted to the mucosal surface is insufficient by itself.
- The diagnostic decision depends on anatomic localization of the infiltrate.

Specificity of findings

Mucosal neutrophils alone

Insufficiently specific

Neutrophils in muscularis propria

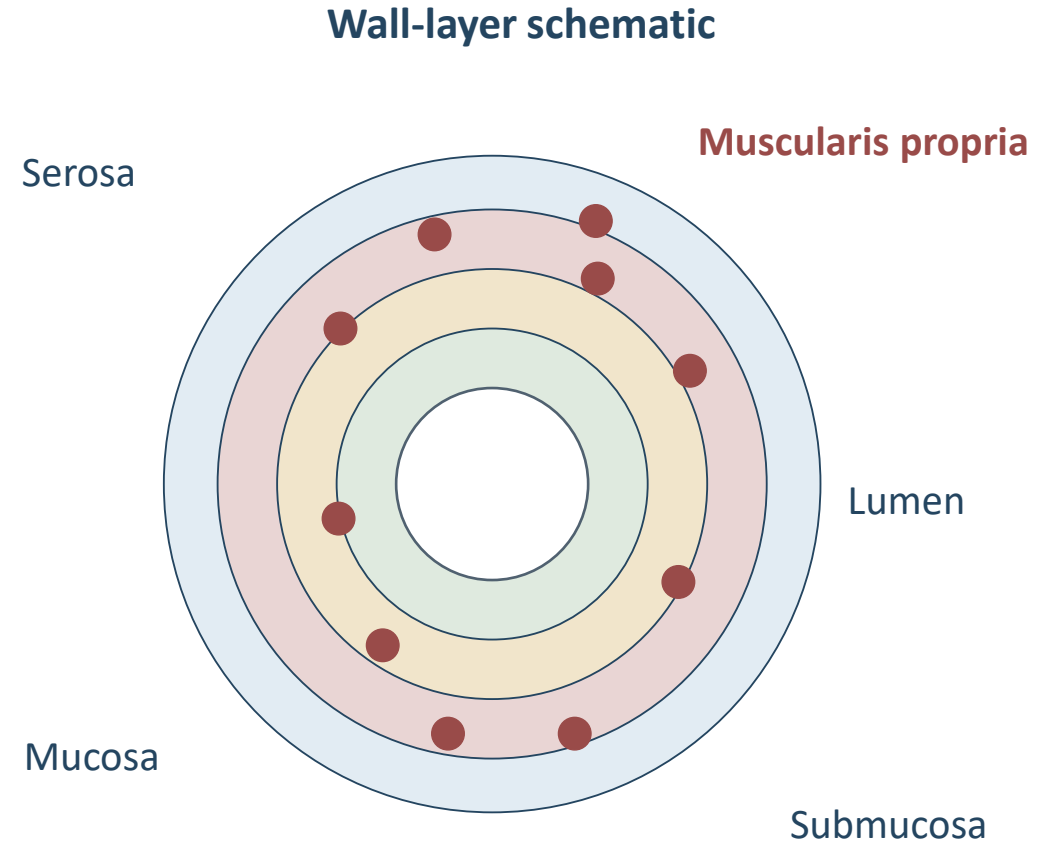
Key histologic diagnostic threshold

Why tissue-layer identification matters

Observation	Diagnostic implication
Neutrophils in mucosa only	Not a specific marker of acute appendicitis
Superficial mucosal ulceration	May coexist, but does not establish the diagnosis
Neutrophils within muscularis propria	Required criterion in Robbins
Serosal fibrinopurulent reaction	Suggests more severe established inflammation

Inflammation progresses beyond the mucosa

- Neutrophils appear around vessels and throughout the wall.
- As injury intensifies, serosal inflammation becomes conspicuous.
- Advanced forms may produce mural abscesses and necrosis.



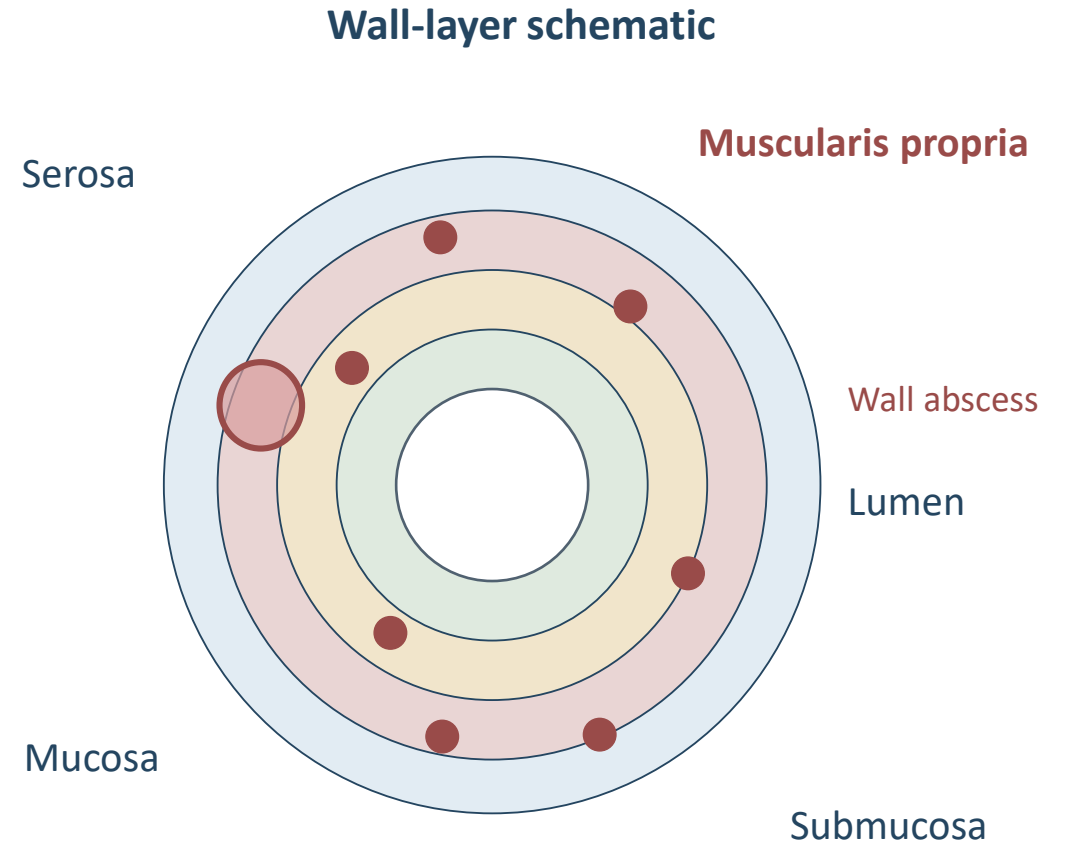
Conceptual wall cross-section — not histology

Serosal fibrinopurulent reaction

- Severe inflammation can create a prominent neutrophil-rich exudate.
- Fibrin and purulent material involve the serosal surface.
- This is a more advanced manifestation than isolated superficial mucosal change.

Acute suppurative appendicitis

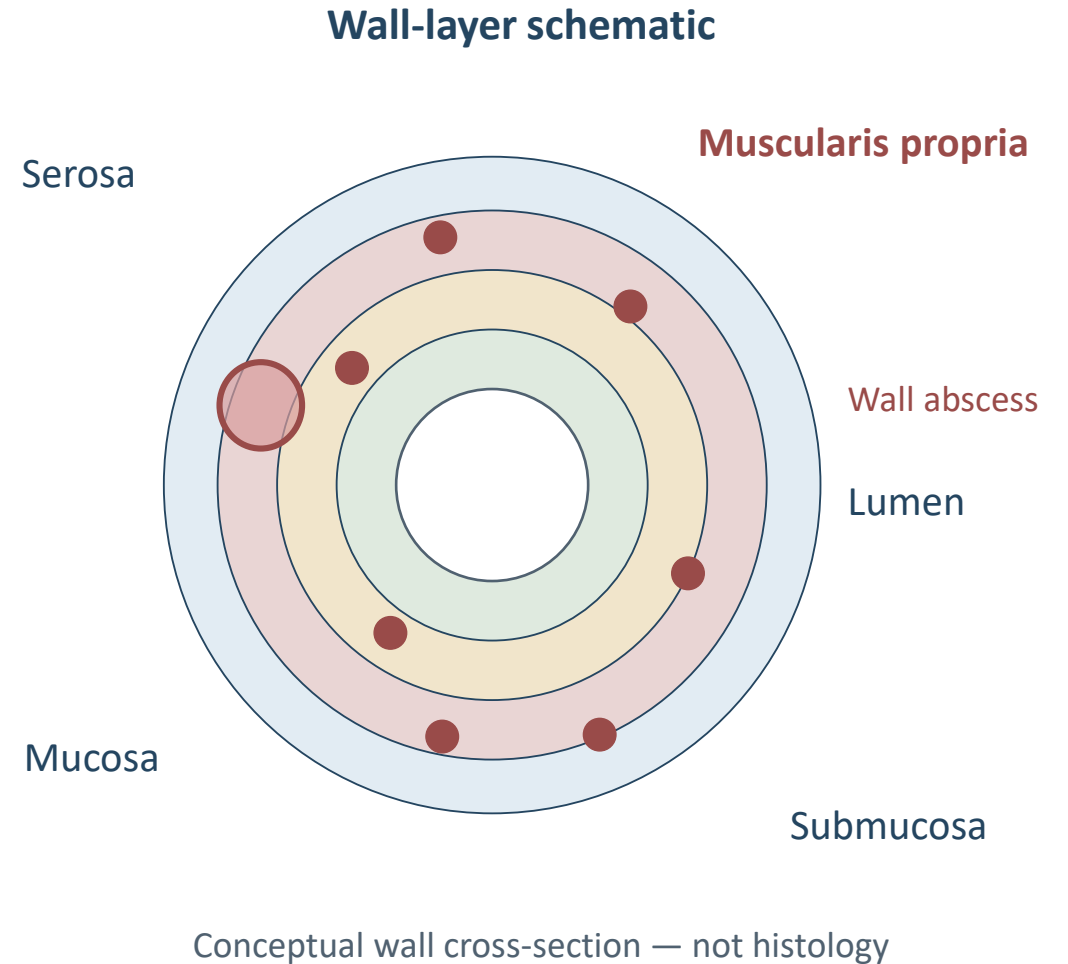
- Focal abscesses can form within the appendiceal wall.
- The term “suppurative” emphasizes pus-forming neutrophilic inflammation.
- Progression increases the possibility of wall destruction and perforation.



Conceptual wall cross-section — not histology

Mural abscesses signal destructive inflammation

- An intramural abscess represents a localized neutrophil-rich collection in the wall.
- The finding indicates deeper suppurative injury.
- It is not synonymous with a simple luminal collection of inflammatory cells.

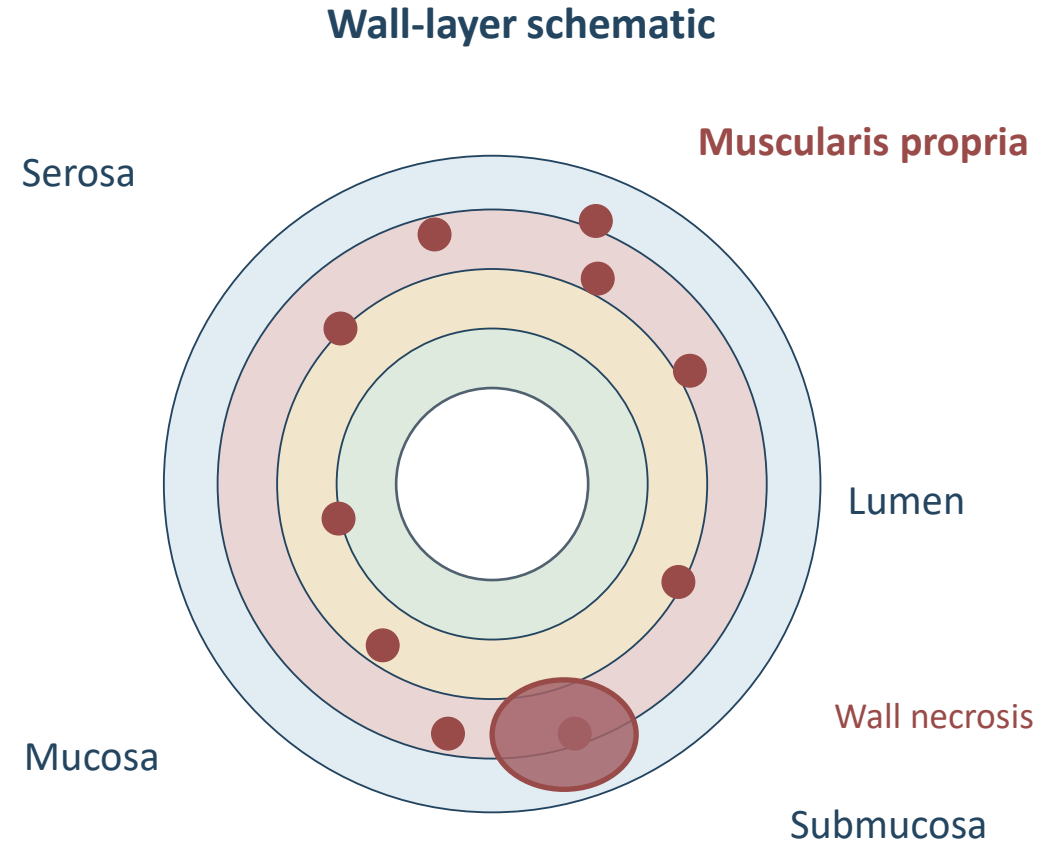


Continued vascular compromise

- More severe vessel compromise aggravates tissue ischemia.
- The mucosa may develop hemorrhagic ulceration.
- Gangrenous necrosis can extend outward as far as the serosa.

Acute gangrenous appendicitis

- Defined in the excerpt by gangrenous necrosis related to ischemic injury.
- Necrosis may extend through the wall to the serosal surface.
- Rupture and suppurative peritonitis are major potential sequelae.



Conceptual wall cross-section — not histology

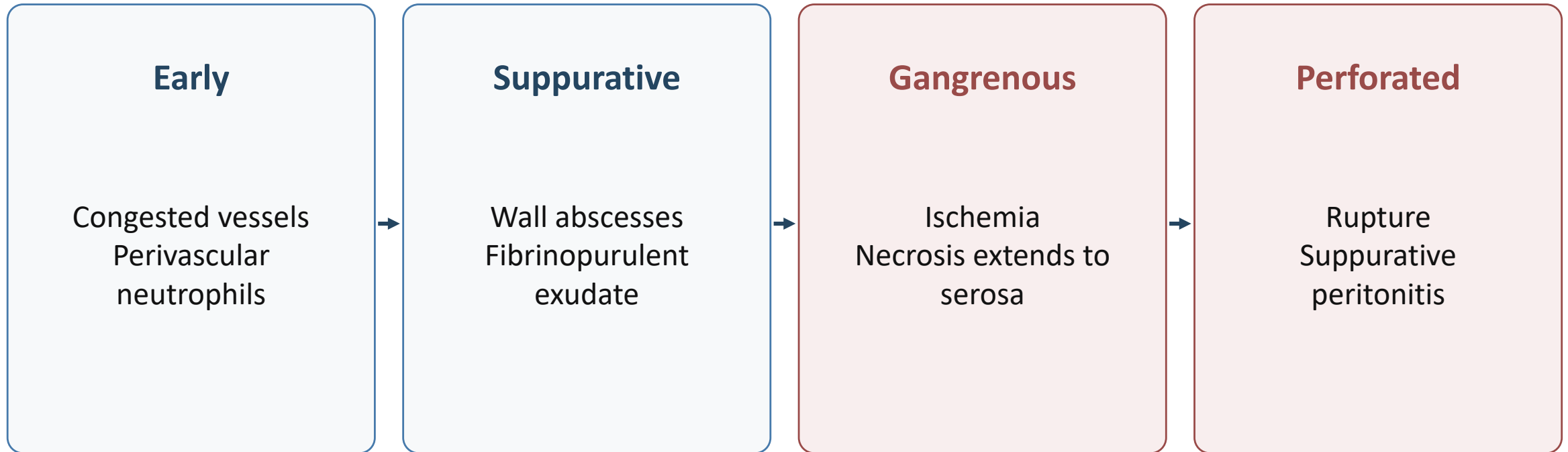
Perforation: Loss of wall integrity

- Suppurative injury and gangrene may progress to appendiceal rupture.
- Perforation permits inflammatory and infected material to reach the peritoneal cavity.
- The excerpt highlights the morbidity and mortality associated with delayed treatment after perforation.

Peritonitis follows a ruptured appendix

- Rupture can cause suppurative peritonitis.
- The local appendiceal process becomes a peritoneal inflammatory emergency.
- This transition is central to the clinical consequences of diagnostic delay.

Morphologic stages as a continuum



Compare early, suppurative, and gangrenous lesions

Form	Principal morphology	Potential consequence
Early	Vascular congestion, perivascular neutrophils	Progressive mural inflammation
Suppurative	Wall abscesses, fibrinopurulent serositis	Perforation may occur
Gangrenous	Ischemia, hemorrhage, necrosis	Rupture and peritonitis

One microscopic finding anchors the diagnosis

- The required feature is neutrophils in muscularis propria.
- Mucosal neutrophils and superficial ulceration can be misleading when isolated.
- Suppuration and necrosis indicate severity; They are not required for every acute case.

Specificity of findings

Mucosal neutrophils alone

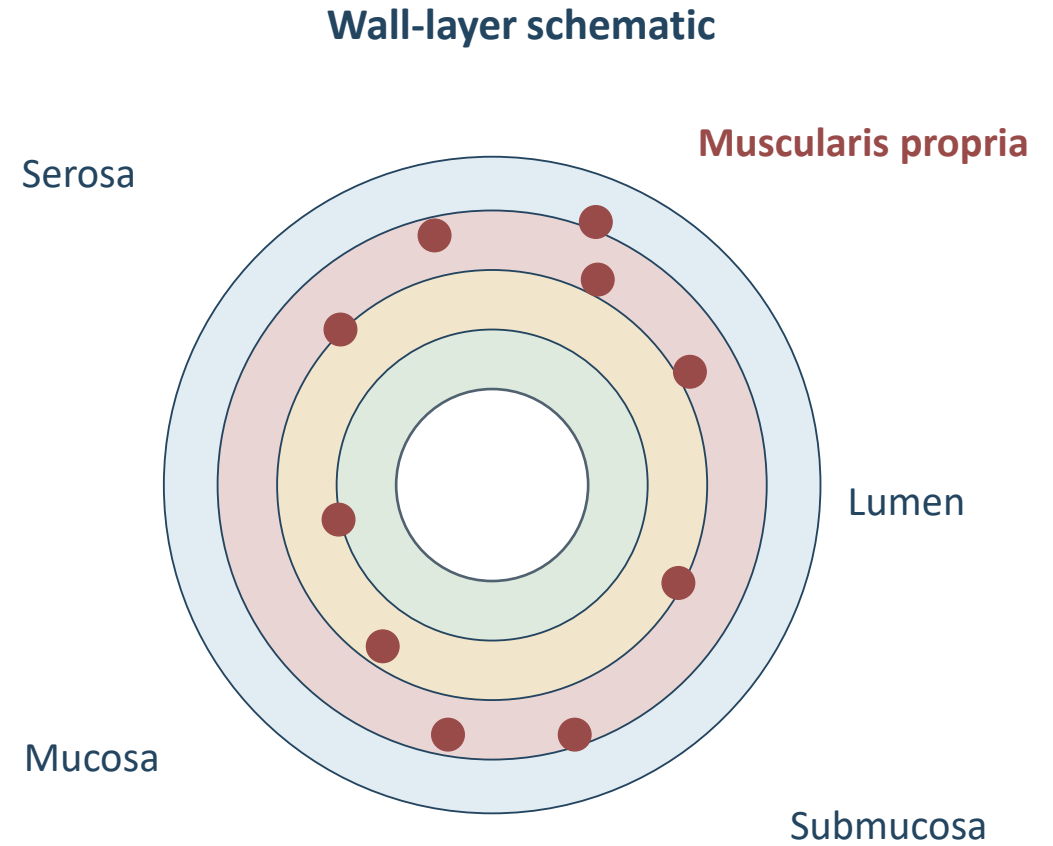
Insufficiently specific

Neutrophils in muscularis propria

Key histologic diagnostic threshold

Structured review of an appendectomy specimen

- Examine serosal appearance for congestion or fibrinopurulent exudate.
- Assess the full thickness of the wall, particularly muscularis propria.
- Document abscesses, ischemic necrosis, and evidence of rupture when present.

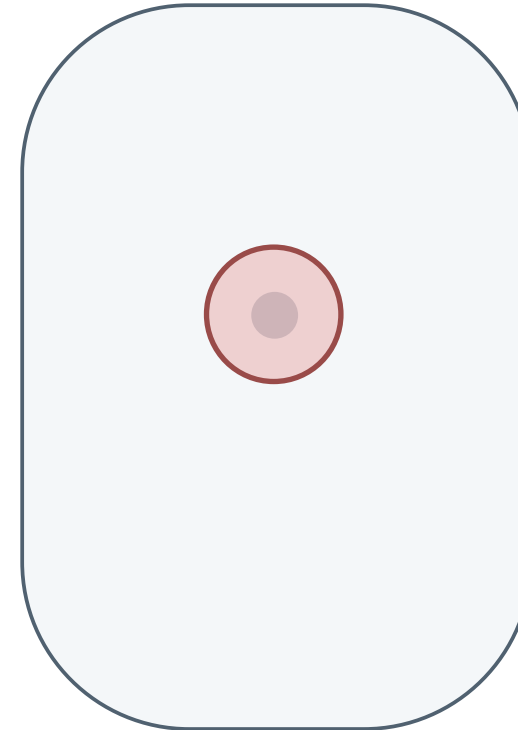


Conceptual wall cross-section — not histology

Clinical onset: Periumbilical pain

- The typical early symptom is poorly localized periumbilical pain.
- Pain can later shift to a more localized right lower quadrant distribution.
- The transition is clinically characteristic but not invariant.

Pain distribution



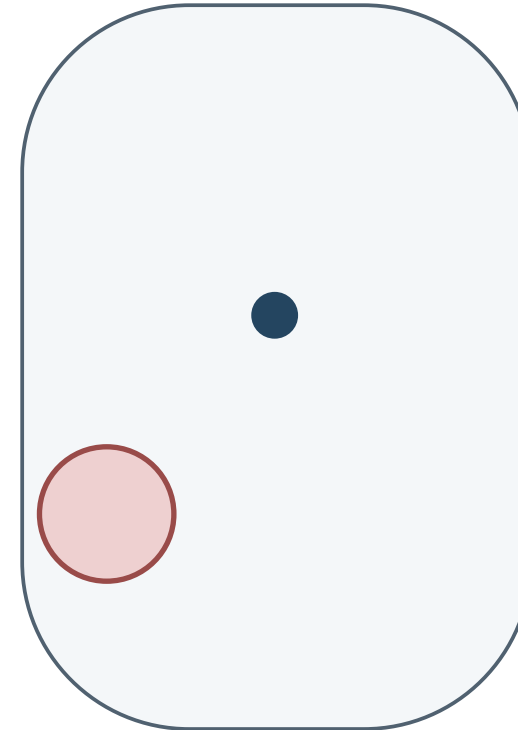
Periumbilical region

Frontal schematic: Patient's right at viewer's left

Pain migration to the right lower quadrant

- A sequence of early periumbilical discomfort followed by right lower quadrant pain is classic.
- The final location is associated with local inflammatory involvement.
- Absence of textbook migration does not rule out appendicitis.

Pain distribution



Patient's right lower quadrant

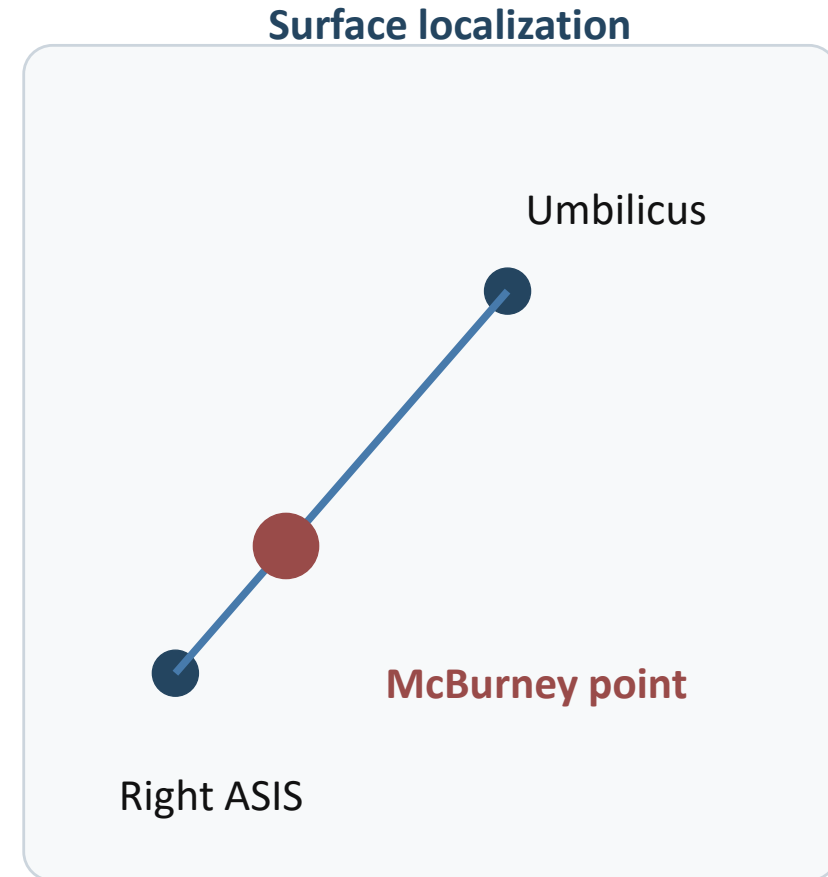
Frontal schematic: Patient's right at viewer's left

Associated symptoms and signs

- Nausea and vomiting may follow the initial pain.
- Low-grade fever is typical in a classic presentation.
- A mildly elevated peripheral white-cell count is common.

McBurney point: Examination landmark

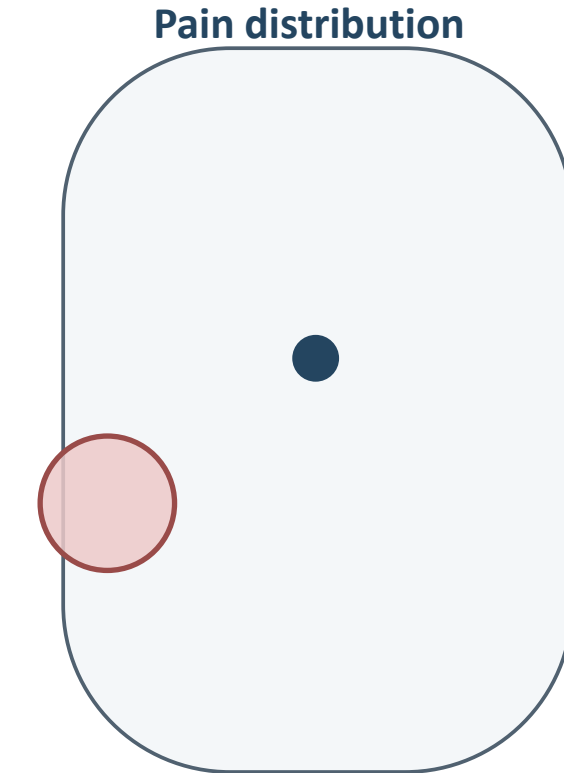
- Deep tenderness at McBurney point is a classic physical finding.
- The supplied Robbins text locates it two-thirds of the distance from umbilicus to right ASIS.
- The sign supports, but does not independently prove, appendicitis.



2/3 of line measured from umbilicus

Localization reflects appendix position

- An inflamed appendix does not always generate standard right lower quadrant pain.
- Retrocecal position may produce right flank or pelvic pain.
- Anatomic variation must be considered alongside clinical findings.

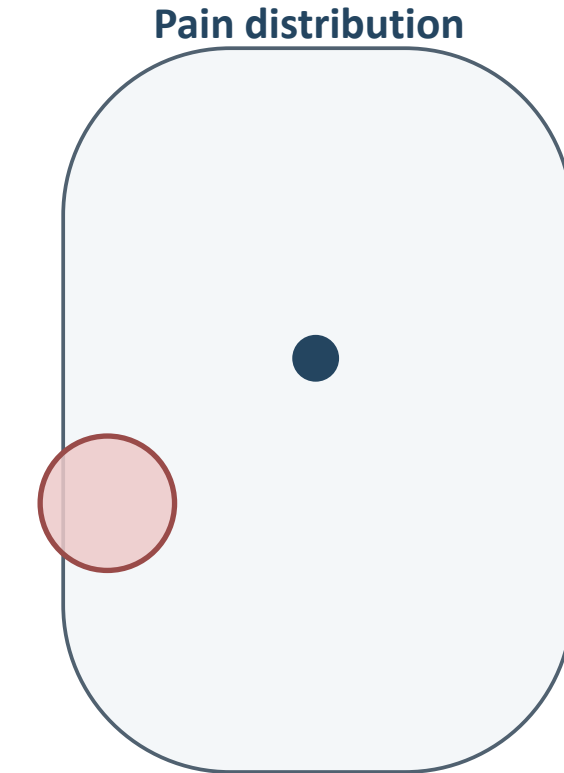


Right flank / pelvic region

Frontal schematic: Patient's right at viewer's left

Retrocecal appendicitis: Atypical pain

- Right flank pain can dominate when the appendix lies retrocecaly.
- Pelvic pain is another presentation mentioned.
- An atypical pain location should broaden, not prematurely close, the differential.



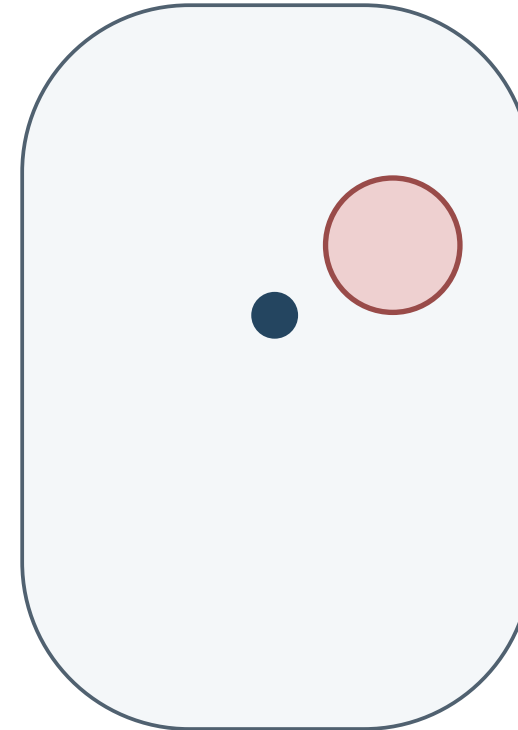
Right flank / pelvic region

Frontal schematic: Patient's right at viewer's left

Malrotation may shift the pain location

- A malrotated colon can lead to appendiceal pain in the left upper quadrant.
- Right lower quadrant localization is therefore not anatomically obligatory.
- Clinical reasoning should account for unexpected intestinal position.

Pain distribution



Atypical left-sided site

Frontal schematic: Patient's right at viewer's left

Classic findings are frequently absent

- Robbins explicitly cautions that classic signs and symptoms are often absent.
- Atypical findings may reflect anatomy, age, or clinical variability.
- Relying on one characteristic symptom risks diagnostic delay.

Leukocytosis: Supportive, not absolute

- Acute appendicitis often causes neutrophilic leukocytosis.
- Some patients have only minimal leukocytosis.
- In others, the white-cell elevation is marked enough to suggest other possibilities.

White-cell responses form a spectrum

Minimal response

A near-normal peripheral white count does not eliminate suspicion

Common pattern

Mild elevation accompanies many classic cases

Marked response

A striking leukocytosis can widen the differential

Young children: Diagnostic difficulty

- Appendicitis may be clinically atypical in very young children.
- Other abdominal emergencies can resemble it.
- The classic symptom sequence is a less reliable gatekeeper in this age group.

Older adults: Diagnostic difficulty

- Very old patients more often present atypically.
- Alternative causes of acute abdominal symptoms are more prevalent.
- Failure to recognize appendicitis early carries the risk of perforation.

Mesenteric lymphadenitis: A major mimic

- Mesenteric lymphadenitis can cause an acute abdominal presentation resembling appendicitis.
- Unrecognized Yersinia infection and viral enterocolitis as possible associations.
- The competing diagnosis is especially important when the symptom pattern is not distinctive.

Gynecologic causes in the differential

Mimic	Clue in Robbins description
Acute salpingitis	Pelvic inflammatory process can resemble appendiceal pain
Ectopic pregnancy	A competing gynecologic emergency in the acute abdomen
Mittelschmerz	Ovulation-related pain due to minor pelvic bleeding

Meckel diverticulitis can mimic appendicitis

- An inflamed Meckel diverticulum can cause an appendicitis-like syndrome.
- Right-sided abdominal symptoms alone may not identify the affected structure.
- Meckel diverticulitis among preoperative differential diagnoses.

Differential diagnosis as competing processes

Intestinal / lymphatic

Mesenteric lymphadenitis; Meckel diverticulitis

Gynecologic

Salpingitis; Ectopic pregnancy; Ovulation-related pain

Appendiceal

Acute appendicitis; Obstruction associated with an appendiceal tumor

Clinical message

No single classic sign reliably settles the differential

Why a normal appendix may be removed

- Preoperative certainty can be difficult, even for experienced surgeons.
- Some surgically removed appendices have no acute appendicitis.
- The excerpt frames that trade-off against the consequences of delayed treatment and perforation.

Perforation changes the risk profile

- Rupture permits spread beyond the appendix.
- Suppurative peritonitis can follow.
- This is the major local complication emphasized when considering diagnostic delay.

Complications beyond the appendix

Local

Rupture and suppurative peritonitis

Portal venous system

Pylephlebitis and portal venous thrombosis

Liver

Liver abscess

Bloodstream

Bacteremia

Portal venous and systemic complications

- Pylephlebitis is listed among appendicitis complications.
- Portal venous thrombosis and liver abscess are additional recognized complications.
- Bacteremia signals that consequences need not remain local to the appendix.

Case 1: Evolving right lower quadrant pain

An adolescent develops periumbilical pain that later localizes to the right lower quadrant, followed by vomiting, low fever, and tenderness.

- Which features reproduce the classic sequence?
- What anatomic diagnosis is suspected, and why is it not certain?

Case 1: Interpretation

- The pain migration, gastrointestinal symptoms, fever, and focal tenderness are typical of appendicitis.
- Diagnosis is not assured solely from this clinical pattern.
- Alternative causes of acute abdominal pain still require consideration.

Case 2: What does the histology establish?

An appendectomy specimen shows mucosal ulceration and scattered mucosal neutrophils. A separate section shows neutrophils infiltrating muscularis propria.

- Which finding supports the diagnostic threshold?
- Why should mucosal ulceration not be used alone?

Case 2: Morphology interpretation

- Neutrophils in muscularis propria fulfill the key Robbins diagnostic criterion.
- Mucosal inflammation and surface ulceration are nonspecific by themselves.
- The diagnosis therefore hinges on the full-thickness localization of neutrophils.

Case 3: Absence of the classic pain site

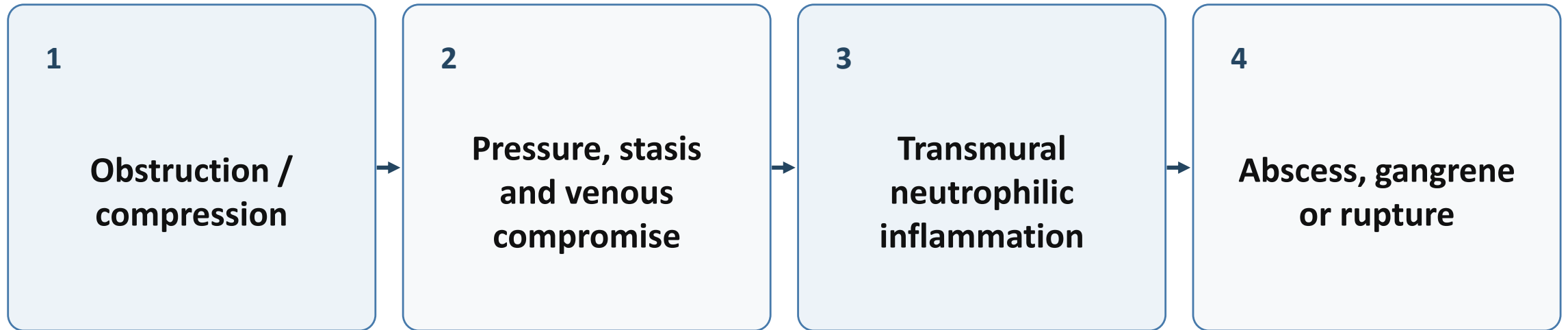
An older patient has right flank discomfort with only modest leukocytosis and no clear history of pain migration.

- Could appendicitis remain in the differential?
- Which described anatomical and age-related factors may explain this?

Case 3: Interpretation

- A retrocecal appendix may produce right flank or pelvic pain.
- Older age is associated with less typical presentations.
- Minimal leukocytosis does not remove appendicitis from consideration.

Integrated mechanism-to-morphology synthesis



- Neutrophils in muscularis propria—not isolated mucosal inflammation—anchor histologic diagnosis.

Diagnostic and clinical synthesis

- Typical clinical pattern: Periumbilical pain, right lower quadrant localization, nausea/vomiting, low fever.
- Histology: Neutrophilic infiltration of muscularis propria.
- Major threats: Gangrenous necrosis, perforation, suppurative peritonitis, and septic complications.

Source and scientific provenance

Core textbook source

Robbins, Cotran & Kumar: Pathologic Basis of Disease.
11th edition (2026).
Section: Acute Appendicitis.

Microscopic diagnostic criteria and complications are discussed in the primary excerpt.
All diagrams in this lecture are original PowerPoint schematics, not photographs.