بسم الله الرحمـٰن الرحيم

{وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ}

GIS PBL Clinical | FINAL 1

Surgery:

Acute Appendicitis

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Acute Appendicitis

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Learning Objectives

- Define acute appendicitis
- Understand anatomy and pathophysiology
- Recognize clinical presentation
- Interpret investigations
- Understand management and complications

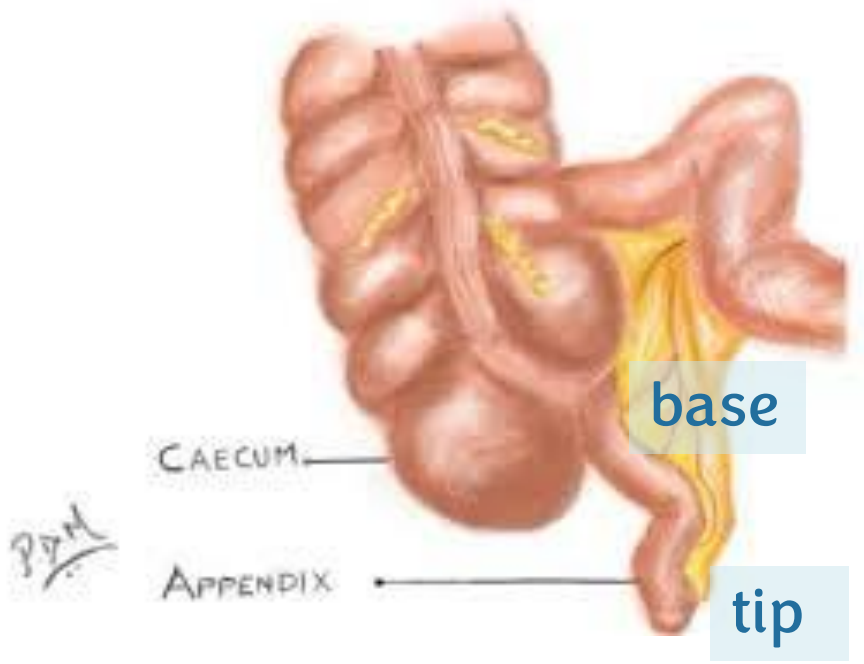
Introduction

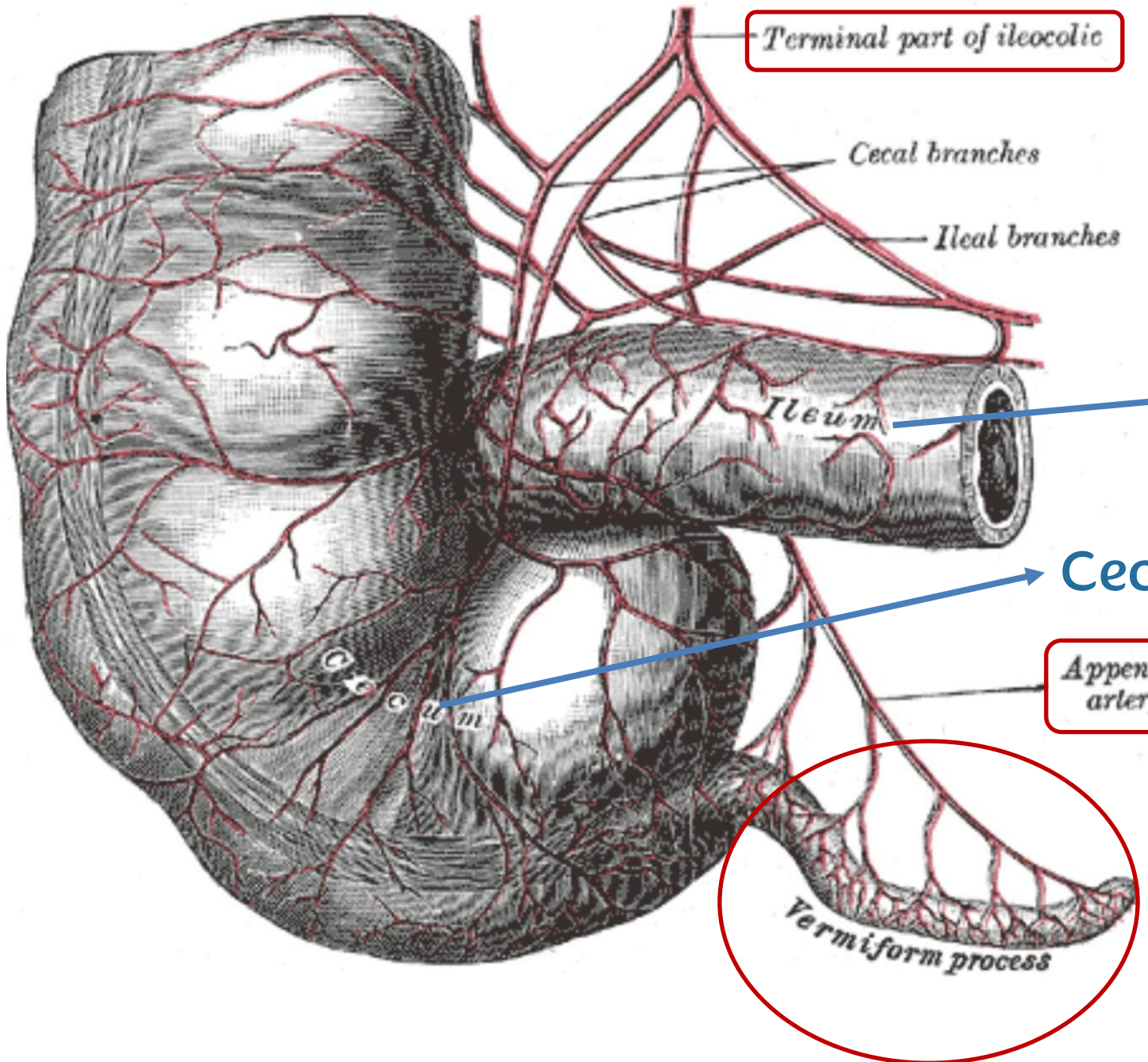
- Acute appendicitis is the most common surgical emergency in the pediatric and adolescent age groups.
- Caused by inflammation of the vermiform appendix الدوديّة
- Peak incidence: adolescence and young adults
- Can occur at any age

Anatomy of the Appendix

- Blind-ended tube arising from the cecum
- Located near the ileocecal junction
- Common positions: retrocecal, pelvic, subcecal
- Blood supply: appendicular artery which usually arises from the **iliocolic artery**, a branch of the Superior Mesenteric Artery.

The appendix has several anatomical positions, including para-ileal, retrocecal, and pelvic positions, all of which are considered normal anatomical variations.
During surgery, the position of the appendix may differ from one patient to another, making it difficult to find it in the same location every time. However, the base of the appendix is usually fixed at the lower pole of the cecum, while **the tip and the length may vary**.





A surgeon must understand the innervation and, more importantly, the vascular supply of the appendix, as safe appendectomy requires ligation of the appendicular vessels before removing the appendix.

During surgery, the appendicular artery runs within the **mesoappendix**, which is the peritoneal fold connecting the appendix to the ileocecal region. The surgeon ligates the mesoappendix to control the appendicular artery before cutting the appendix.

Terminal ilium

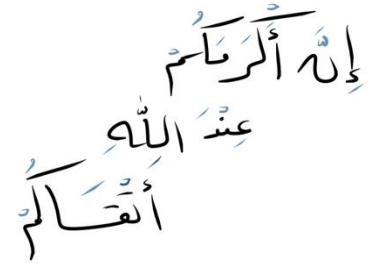
Cecum (the lower pole of the ascending colon)

Acute appendicitis is the inflammation of the appendix, a blind-ended tubular structure arising from the lower pole of the cecum.

First Advice from doctor Tarawneh

As medical students – وجه البكسة – we were selected based on our high academic performance; therefore, we should always express and discuss our clinical reasoning and knowledge, even when the answer may already be known. It is also important to understand how a disease develops from the beginning rather than memorizing only its final presentation. This approach strengthens clinical thinking and helps build a deeper understanding of medicine, which is essential for clinical years and OSCE examinations.

Flashback: Elite of the elite | Dr. Mohammad Hussein



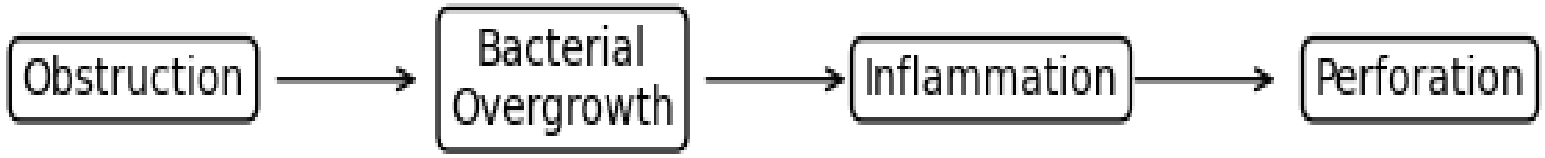
Pathophysiology

- Luminal obstruction is the usual initiating event
- Causes: fecalith, lymphoid hyperplasia, parasites, tumors
- Obstruction → bacterial overgrowth → inflammation
- Progression may lead to ischemia, perforation, and abscess

Any blind-ended structure is susceptible to obstruction; therefore, the pathophysiology of acute appendicitis usually begins with obstruction of the appendiceal lumen.

What Can Obstruct the Appendix??

Several factors may obstruct the appendix, including fecaliths, solidified stool, or food particles. A fecalith is a hard fecal mass that resembles a stone and can easily obstruct the lumen of the appendix. Since the appendiceal lumen is normally very narrow, measuring only a few millimeters in diameter, even a small obstructing material may be sufficient to cause blockage.

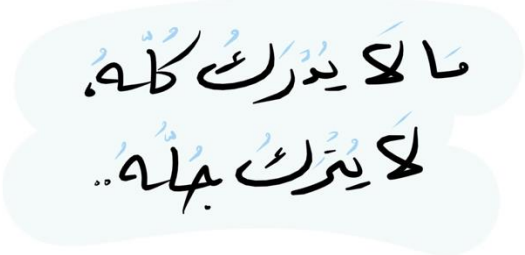


Second Advice from doctor Tarawneh

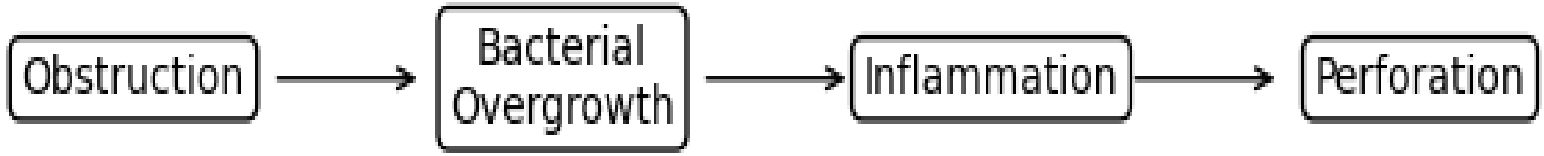
While progressing through the six-year medical journey- with four years still ahead of us- we gradually develop strategies for clinical thinking and problem-solving.

الطبّ عمو ما بتقدر تحطّه كلّه في دماغك،

Medicine is too vast to memorize in its entirety; therefore, it is important to build personal algorithms and systematic approaches to analyzing and answering clinical problems.



Pathophysiology



What Can Obstruct the Appendix??

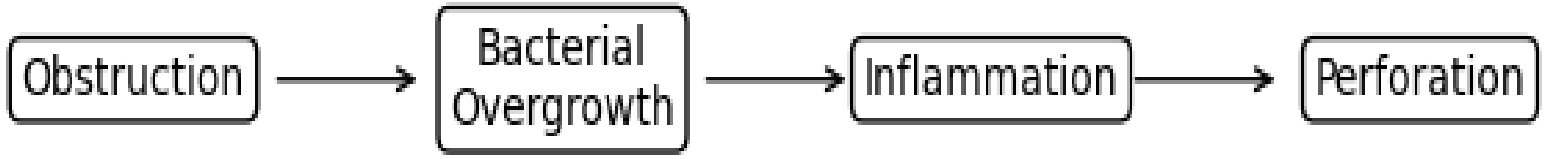
Other than a fecalith, tumors may also obstruct the lumen of the appendix and lead to acute appendicitis.

When do you suspect a tumor??

A tumor should be suspected in elderly patients presenting with appendicitis-like symptoms. In such cases, it is not appropriate to simply perform an appendectomy and discharge the patient without further evaluation.

SOOO, one useful clinical algorithm is: whenever you encounter an elderly patient, always consider the possibility of a tumor or underlying malignancy as part of your differential diagnosis.

Pathophysiology



We do not fully understand the appendix; however, one theory suggests that it functions as a **lymphoid** organ, containing aggregations of lymphoid tissue.

What Can Obstruct the Appendix??

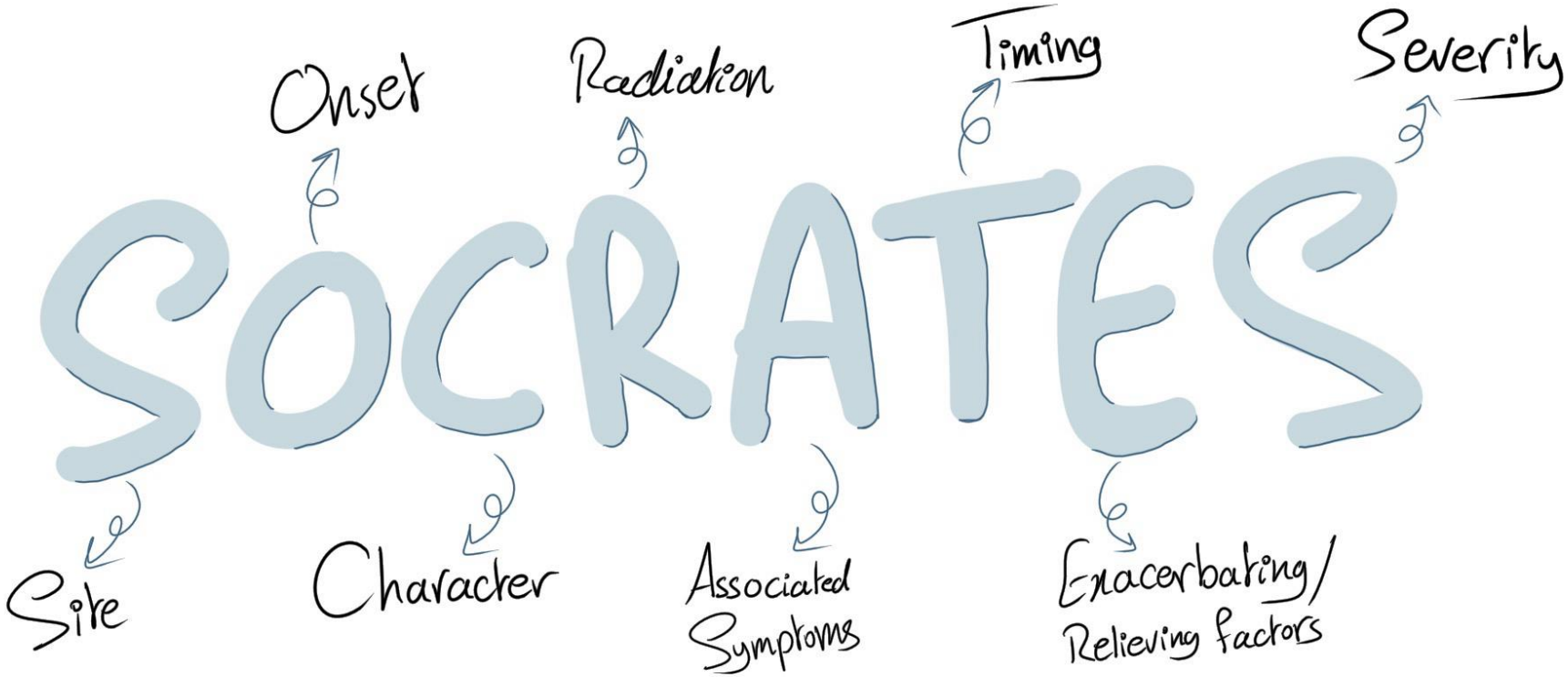
This leads to another possible cause of appendiceal lumen obstruction: inflammation and hypertrophy of the underlying lymphoid tissue, which can narrow or block the lumen and contribute to the development of acute appendicitis.

Epidemiology and Risk Factors

- Lifetime risk approximately 7–8%
- More common in males
- Peak age: 10–30 years
- There are some theories say that Low-fiber diet may predispose to the formation of fecaliths, which can obstruct the appendiceal lumen and increase the risk of developing acute appendicitis.

Clinical Presentation

During history taking and clinical examination, whenever a patient reports pain, we should use the **SOCRATES framework** to systematically characterize it:



Clinical Presentation Regarding acute appendicitis::

Site: the pain is classically **migratory**. It typically begins as a vague, poorly localized **periumbilical** pain, which reflects visceral pain from the **midgut**. As the inflammation progresses and the parietal peritoneum becomes involved, the pain then shifts and localizes to the right iliac fossa (right lower quadrant).

Onset: the pain is typically **gradual in onset**, as it initially represents visceral pain. However, it is important to note that pain descriptions are subjective, and some patients may report a more sudden onset of symptoms.

Character: The pain in acute appendicitis is typically described as a **dull, aching,** and poorly localized pain, reflecting its visceral origin. A **throbbing** or pulsatile quality may suggest progression of the disease with complications such as abscess formation or localized pus collection.

Clinical Presentation

- Periumbilical pain migrating to the right lower quadrant
- Anorexia, nausea, vomiting
- Low-grade fever
- Pain worsens with movement or coughing

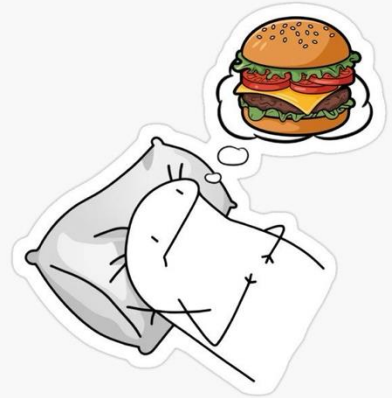
Clinical Presentation Regarding acute appendicitis::

Associated Symptoms: Commonly include a feeling of fever or hotness, nausea and vomiting, and anorexia (loss of appetite), which is sometimes referred to as the "hamburger sign."

Patients do not typically present with changes in bowel habits. However, in some cases, they may report mild loose motion, especially when the appendix is in a para-ileal position.

This occurs due to the inflammatory process irritating the adjacent ileum, leading to increased bowel activity. Nonetheless, this is an uncommon finding.

The "hamburger sign" ☺
refers to anorexia (loss of appetite). It is based on the assumption that most people would normally want to eat a burger; therefore, if a patient refuses it or has no desire to eat, it suggests anorexia.



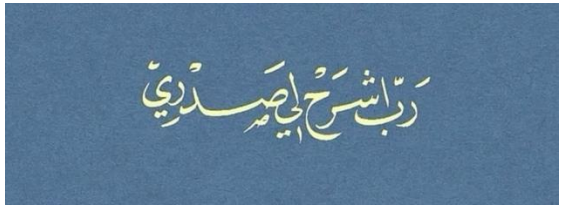
Clinical Presentation Regarding acute appendicitis::

Timing: Some surgical conditions have characteristic timing of pain occurrence, such as pain after meals or between meals. However, acute appendicitis does not usually have a specific timing pattern for pain.

Exacerbating/relieving factors: There are no specific exacerbating or relieving factors associated with appendicitis. However, movement or palpation may worsen the pain due to localized **tenderness**.

Severity: Pain severity varies from one patient to another. Some patients may describe the pain as extremely severe, while others may report only mild to moderate discomfort. The severity often depends on the stage and progression of the appendicitis.

Physical Examination



- Tenderness at McBurney's point (a specific spot on the abdomen, located about one-third of the distance from the anterior superior iliac spine to the umbilicus. It is commonly used as a clinical landmark. Tenderness at McBurney's point is a classic sign of acute appendicitis).
- Rebound tenderness and guarding
- Rovsing sign
- Psoas and obturator signs in selected cases

Physical Examination

- Rebound tenderness and guarding

On general inspection, the patient may appear uncomfortable, distressed, or irritable because of the pain (المريض منكّد ☹).

During abdominal examination, the main clinical steps include inspection, auscultation, percussion, and palpation. Patients with acute appendicitis usually present with localized abdominal tenderness, particularly in the right iliac fossa.

Why Inspection of the abdomen is important?? because it may reveal significant findings. For example, a patient may be referred for evaluation of suspected appendicitis, but the presence of an oblique surgical scar in the right iliac fossa may indicate a previous appendectomy, making recurrent appendicitis highly unlikely unless the appendix was incompletely removed.

On palpation, the abdomen is typically tender. This occurs because pressure on the abdominal wall compresses the parietal peritoneum, which has somatic innervation. When the inflamed appendix irritates the parietal peritoneum, palpation produces localized tenderness and pain.

- Rovsing sign
- Psoas and obturator signs in selected cases

Physical Examination

- Rovsing sign (a clinical sign seen in acute appendicitis. It is considered positive when palpation of the **left lower quadrant** of the abdomen causes pain in the **right iliac fossa**.) occurs because pressure on the left side increases stretching and irritation of the inflamed peritoneum around the appendix, resulting in referred pain to the right lower quadrant.
- Psoas and obturator signs in selected cases

Psoas sign: a clinical sign caused by irritation of the psoas muscle by an inflamed appendix, leading to pain when the hip is extended or flexed against resistance.

Obturator sign: a clinical sign caused by irritation of the obturator internus muscle by a pelvic inflamed appendix, leading to pain during internal rotation of the flexed hip.

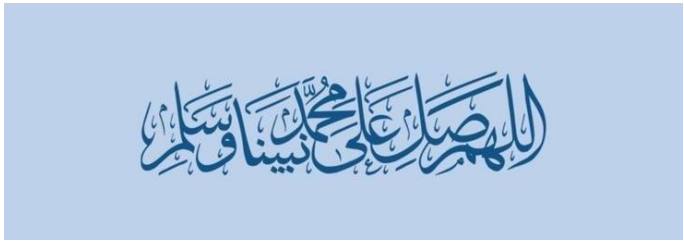
Investigations – Laboratory

Blood tests performed in suspected acute appendicitis include a complete blood count (CBC) to assess the white blood cell (WBC) count, which may be elevated as an indicator of inflammation or infection:

- Leukocytosis (elevated WBCs) with neutrophilia.

- Elevated C-reactive protein (CRP), is another inflammatory marker that may support the diagnosis of an ongoing inflammatory process.

- Urinalysis to exclude urinary causes
- Pregnancy test in females of reproductive age



Differential Diagnosis

So, A patient presenting with right lower quadrant abdominal pain, localized tenderness, leukocytosis, and elevated CRP, **Does that suggest a 100% for sure acute appendicitis??** No, this does not confirm the diagnosis with 100% certainty. Other conditions may present with similar clinical and laboratory findings; therefore, **differential diagnosis** must always be considered before establishing the final diagnosis.

- Mesenteric adenitis : inflammation of the mesenteric lymph nodes.
- Gastroenteritis
- Meckel diverticulitis
- Renal colic : severe colicky flank pain caused by obstruction of the urinary tract, usually due to a kidney stone.
- Gynecological causes in females: conditions affecting the female reproductive organs that can cause lower abdominal or pelvic pain and may mimic appendicitis.

Investigations – Imaging

- Ultrasound: useful in children and pregnant patients
- CT scan: high sensitivity and specificity
- MRI may be used in certain group such as in pregnancy women (to avoid the tetratogenic risks that associated with radiation exposure)
- Imaging helps identify complications

Imaging studies are mainly used to confirm the diagnosis and identify complications

Ultrasound is preferred in children, pregnant women, and young females because it avoids ionizing radiation and can also evaluate ovarian pathology.

CT scan has high sensitivity and specificity and is commonly preferred in elderly patients to exclude tumors or other abdominal conditions.

MRI may be used during pregnancy when ultrasound findings are inconclusive, as it is safer than CT scanning and does not expose the fetus to radiation.

In some young male patients with a classic clinical presentation, surgery (laparoscopic Appendectomy)may be performed directly without the need for extensive imaging.

Alvarado Score

- Clinical scoring system aiding diagnosis
- Based on symptoms, signs, and laboratory findings
- Score ≥7 suggests likely appendicitis
- Used as a supportive tool, not a replacement for clinical judgment

To explain the previous slide for more understanding:

The Alvarado score is a clinical scoring system used to support the diagnosis of acute appendicitis. It is based on the patient's symptoms, clinical signs, and laboratory findings, such as right lower quadrant pain, fever, leukocytosis, and neutrophilia. The score helps estimate the likelihood of appendicitis and assists in clinical decision-making. A score of 7 or more strongly suggests acute appendicitis and may indicate the need for surgical evaluation. However, the Alvarado score is considered a supportive tool only and should not replace clinical judgment, as the final diagnosis still depends on the overall clinical picture, physical examination, laboratory tests, and imaging findings.

Complicated Appendicitis

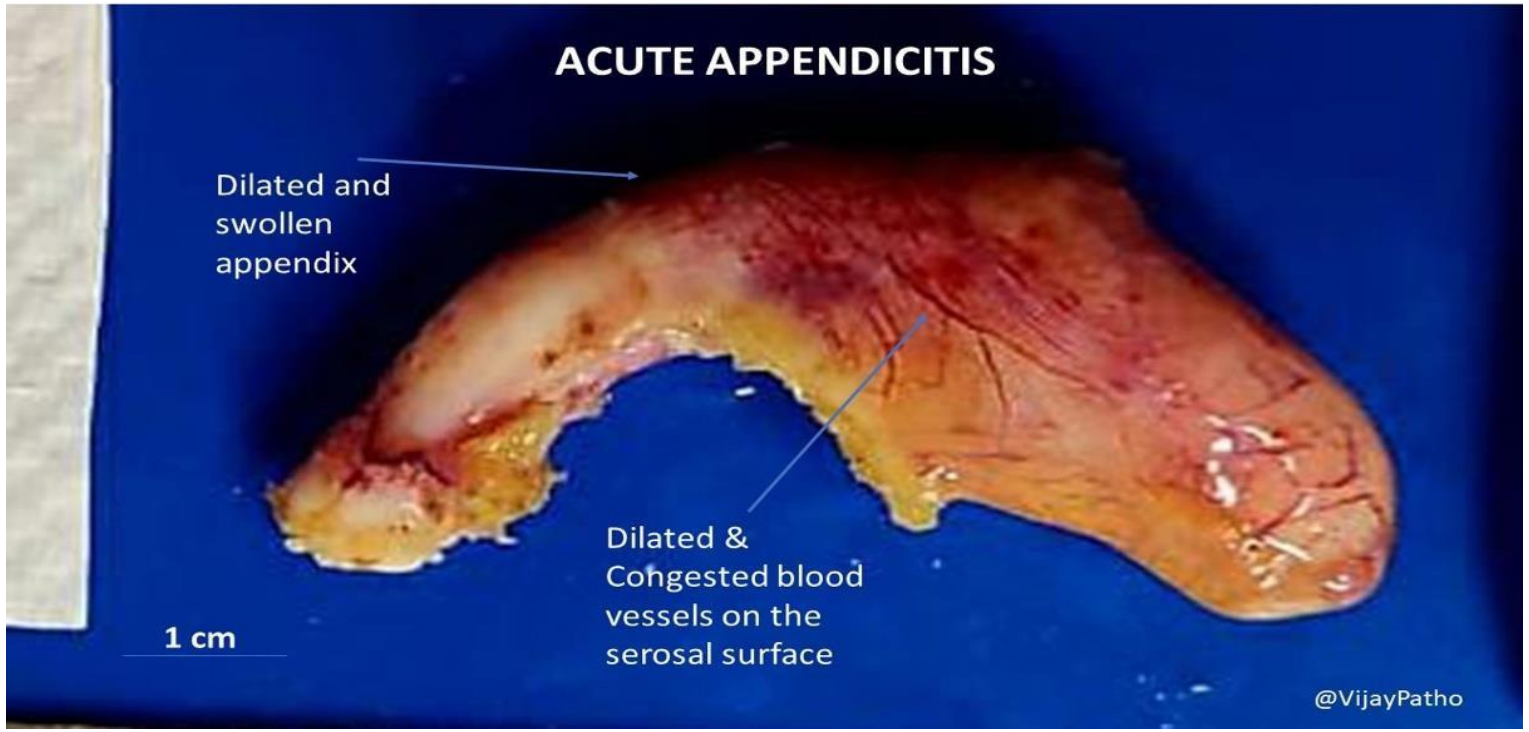
- Perforation
- Appendicular abscess
- Generalized peritonitis
- Sepsis is a severe and potentially life-threatening condition that occurs when the body's response to an infection becomes uncontrolled. sepsis results from an exaggerated immune reaction that begins to damage the body's own tissues and organs, leading to organ dysfunction. Because early management is critical, physicians follow evidence-based guidelines such as the Surviving Sepsis Campaign, including protocols like the "One-Hour Bundle" and "Sepsis Six," to improve patient survival. A useful way to understand sepsis is to imagine an intruder entering a house: while trying to eliminate the intruder, the homeowner causes major destruction to the house itself. Similarly, during sepsis, the immune system attempts to fight the infection but may unintentionally damage the body's organs in the process

Management Principles

- Resuscitation and IV fluids
- Analgesia and antiemetics
- Antibiotics
- Definitive treatment is usually appendectomy

Surgical Treatment

- Laparoscopic appendectomy is commonly preferred
- Open appendectomy remains an option
- Benefits of laparoscopy: less pain and faster recovery
- Specimen sent for histopathology



The definitive treatment for acute appendicitis is appendectomy, with laparoscopic appendectomy being the preferred method.
It is performed under general anesthesia using small ports through which the appendix is identified, clipped, and removed. Laparoscopy is preferred because it causes less postoperative pain, allows faster recovery, and enables inspection of other abdominal organs if needed.
The removed appendix is sent for histopathological examination.

Open appendectomy is an alternative when laparoscopy is unavailable and involves an incision at McBurney's point, but it is associated with greater postoperative pain

 Recommended Video for Better Understanding about laparoscopic appendectomy

Non-operative Management

- Selected uncomplicated cases may be treated with antibiotics
- Requires careful patient selection
- Recurrence remains possible
- Not suitable for all patients

Complications for acute appendicitis

- Wound infection
- Intra-abdominal abscess
- Ileus : a temporary lack of movement in the intestines, causing a stoppage of the normal passage of food and fluids.
- Adhesive bowel obstruction

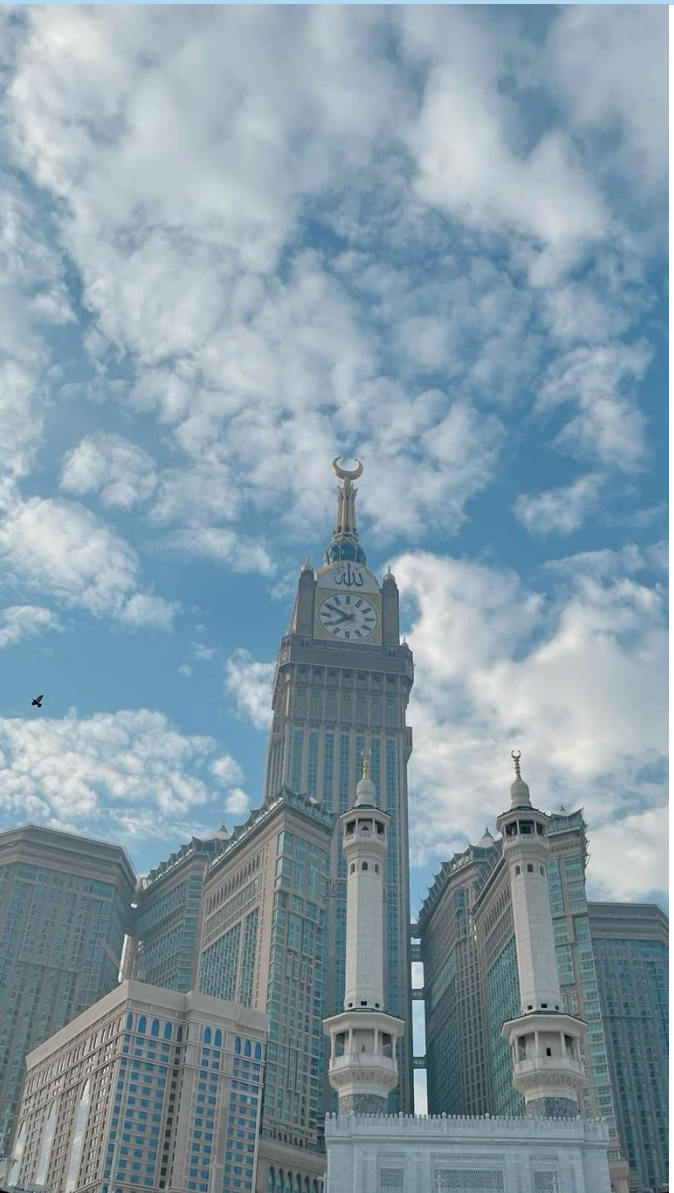
Special Situations

- Children may present atypically
- Elderly patients may have delayed diagnosis
- Pregnancy changes anatomical location and presentation
- Higher perforation risk in extremes of age

Key Take-Home Messages

- Acute appendicitis is a clinical diagnosis supported by investigations
- Early diagnosis reduces complications
- Laparoscopic appendectomy is standard treatment in many centers
- Always consider differential diagnoses

رسالة من الفريق العلمي:



من غروب شمس يوم الأحد يبدأ التكبير المُطلَق لعشر ذي الحجة
وهذه بشارة نبوية لكل من كبّر وهلّل :

قال " : ﷺما أَهَلَّ مُهِلٌّ قطُّ إلَّا بُشِّر ، ولا كَبَّر مُكَبِّرٌ قطُّ إلّا بُشِّر ، قيل يَا رسُولَ اللهِ :بالجنـةِ ؟ قال :نَعَمْ"

قال " : ﷺما مِن أيَّامٍ أعظَمُ عِندَ اللهِ ولا أحَبُّ إليه مِن العَمَلِ فيهنَّ مِن هذه الأيَّامِ العَشرِ ، فأكثِروا فيهنَّ مِن التَّهليلِ والتَّكبيرِ والتَّحميدِ."

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Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			