الجامعة التقنية الوسطى
كلية التقنيات الصحية والطبية/ بغداد
قسم : قسم تقنيات الاشعة المرحلة: الرابعة
المادة: التصوير المقطعي المحوسب للصدر والبطن والحوض

Title: **العنوان:**

CT of small intestine & large bowel

Name of the instructor: **اسم المحاضر:**

م. حيدر عبد القادر

Target population: **الفئة المستهدفة:**

طلبة المرحلة الرابعة لكلية التقنيات الصحية والطبية في قسم تقنيات الاشعة

Introduction: المقدمة:

Computed Tomography (CT) is widely used for evaluation of the small intestine, large intestine, and appendix due to its ability to provide detailed cross-sectional visualization of bowel loops and surrounding abdominal structures. CT imaging supports assessment of bowel wall appearance, luminal configuration, and adjacent mesenteric tissues.

In this educational package, CT of the bowel is presented as a tool for anatomical demonstration and technical image understanding, with emphasis on visual recognition rather than clinical decision-making. The purpose of this context is to enable students to:

- Recognize normal CT appearance of the small and large intestine
- Understand how technical and physiological factors influence bowel appearance
- Identify descriptive CT appearances associated with appendicitis

Pretest: الاختبار القبلي:

1. What's indication CT imaging of the small intestine?

Scientific Content: المحتوى العلمي:

Indications

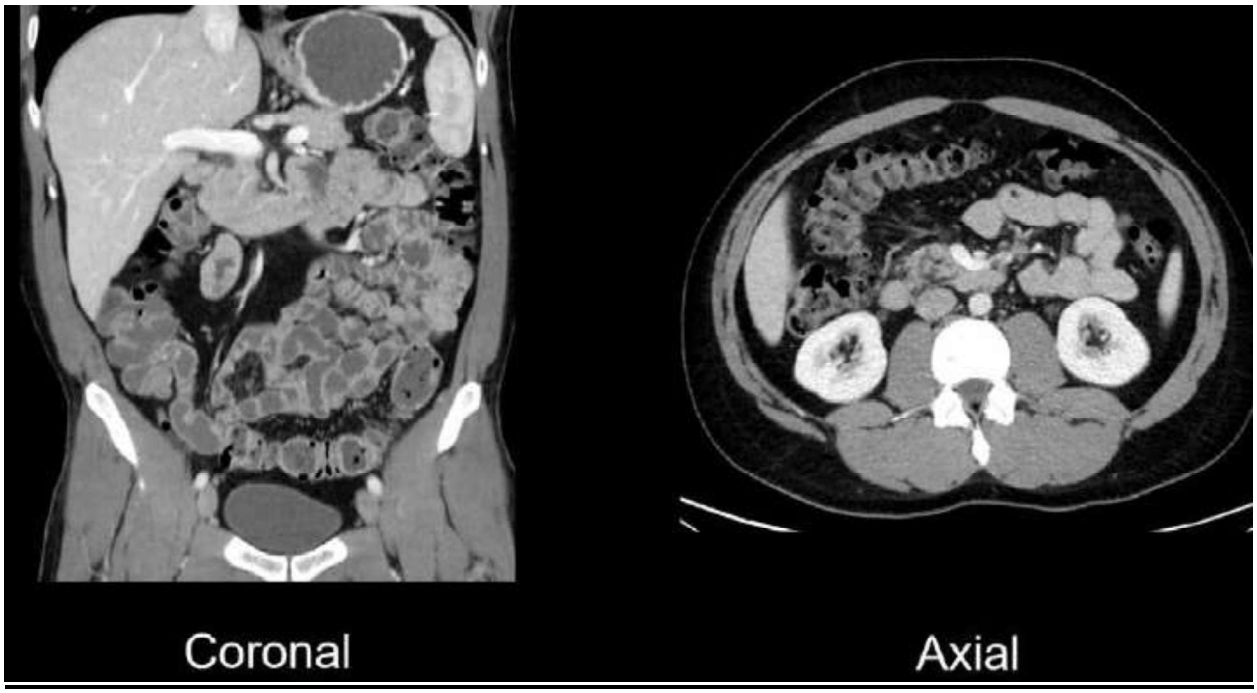
CT imaging of the small and large intestine is performed when detailed cross-sectional anatomical evaluation of the bowel and adjacent abdominal structures is required. It is commonly used in the assessment of acute or chronic abdominal pain when intestinal pathology is suspected, allowing evaluation of bowel wall thickness, luminal configuration, and surrounding mesenteric structures.

CT is widely indicated in the evaluation of inflammatory bowel conditions, including appendicitis, diverticulitis, enteritis, and colitis, where bowel wall changes and pericolic or mesenteric involvement can be demonstrated. In suspected appendicitis, CT provides clear visualization of the appendix and surrounding fat planes, supporting anatomical assessment.
In addition, CT is useful for assessing bowel obstruction or ileus, demonstrating bowel dilatation, transition points, and distribution of affected segments. It also plays an important role in evaluating ischemic bowel disease, where changes in bowel wall appearance and mesenteric vessels may be identified.

CT imaging is commonly used to assess neoplastic conditions of the small and large intestine, including benign and malignant tumors, by demonstrating masses, wall thickening, and their relationship to adjacent organs. It is also valuable in the detection of bowel perforation, abscess formation, and inflammatory complications, often indicated by extraluminal air or fluid collections. Furthermore, CT allows evaluation of congenital or anatomical abnormalities, intussusception, and postoperative bowel changes, providing comprehensive anatomical information. Assessment of surrounding mesenteric fat, lymph nodes, and peritoneal spaces adds important contextual information to bowel-related findings.

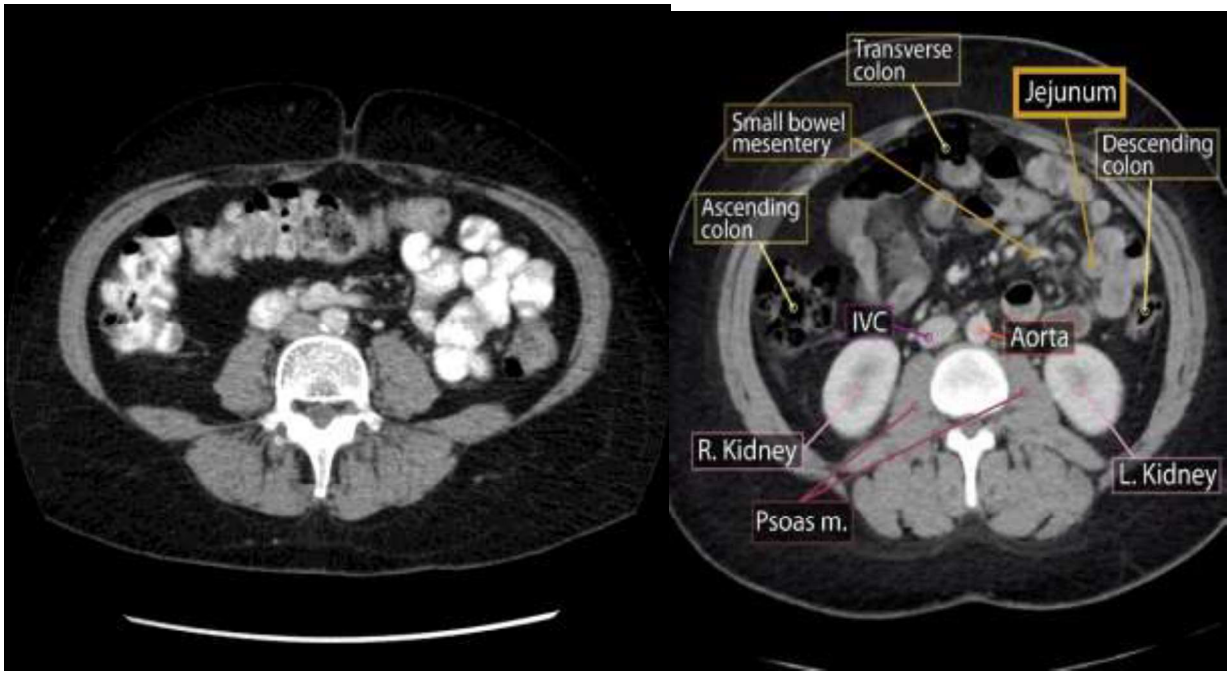
Normal CT Anatomy of the Small Intestine

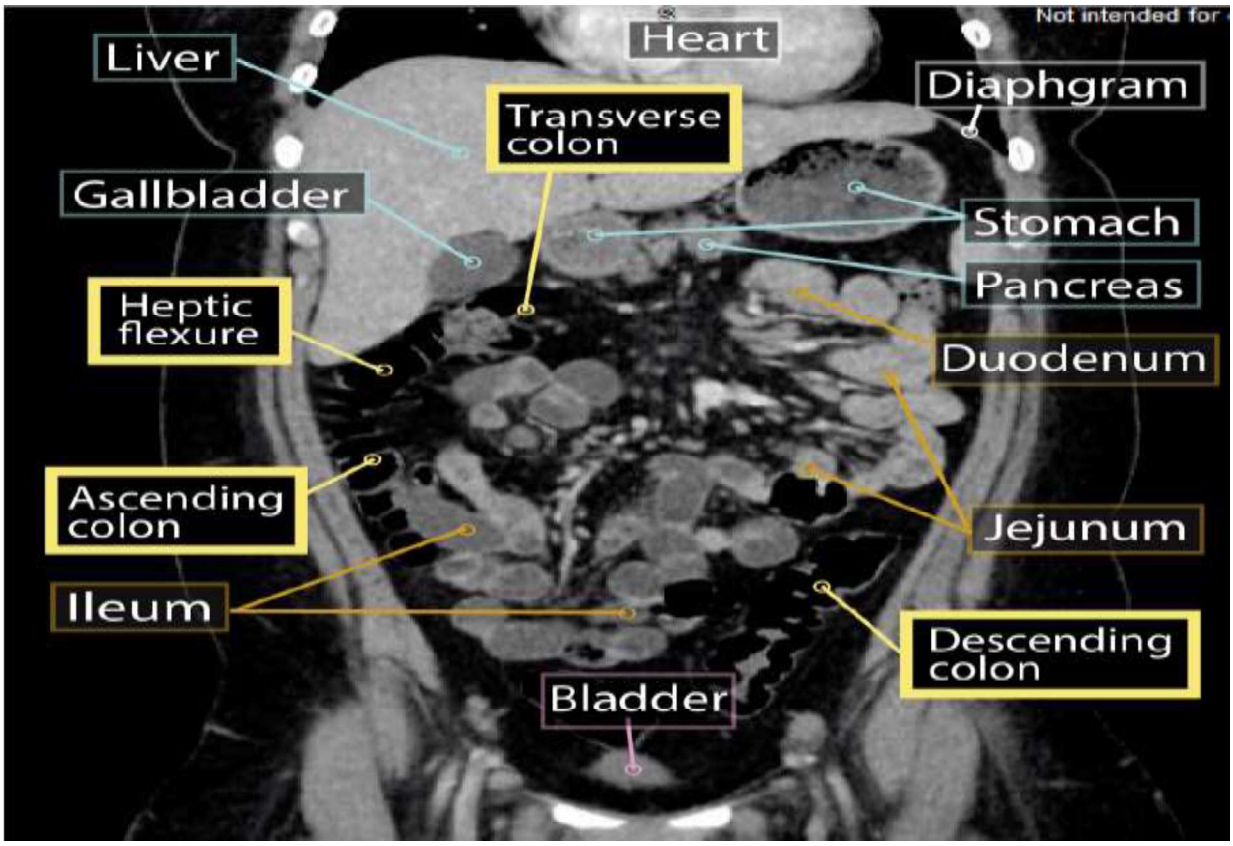
On CT images, the small intestine typically appears as centrally located bowel loops with thin, uniform walls. The lumen may contain variable amounts of fluid or gas, and the folded appearance reflects normal peristalsis and bowel configuration.
The surrounding mesenteric fat usually appears clear and well defined, providing an important landmark for normal bowel assessment.

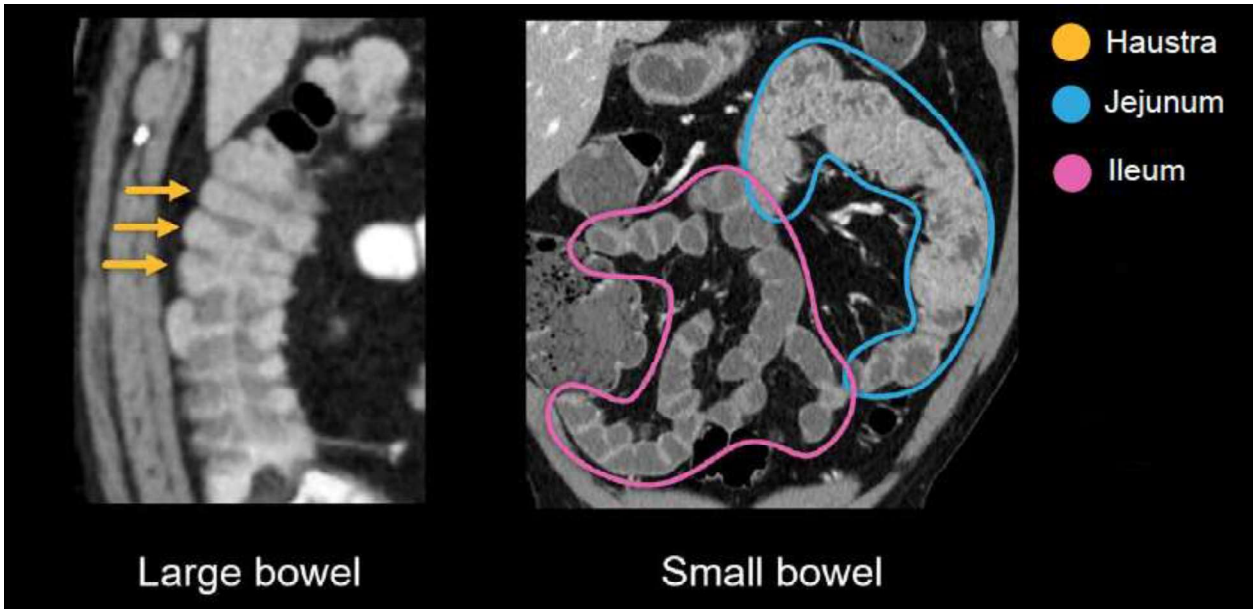


Normal CT Anatomy of the Large Intestine

The large intestine follows a more peripheral abdominal course and is characterized by its haustral pattern. On CT images, the colonic wall appears thin and smooth when adequately distended. Recognition of normal colonic anatomy helps distinguish technical variation from abnormal appearance.

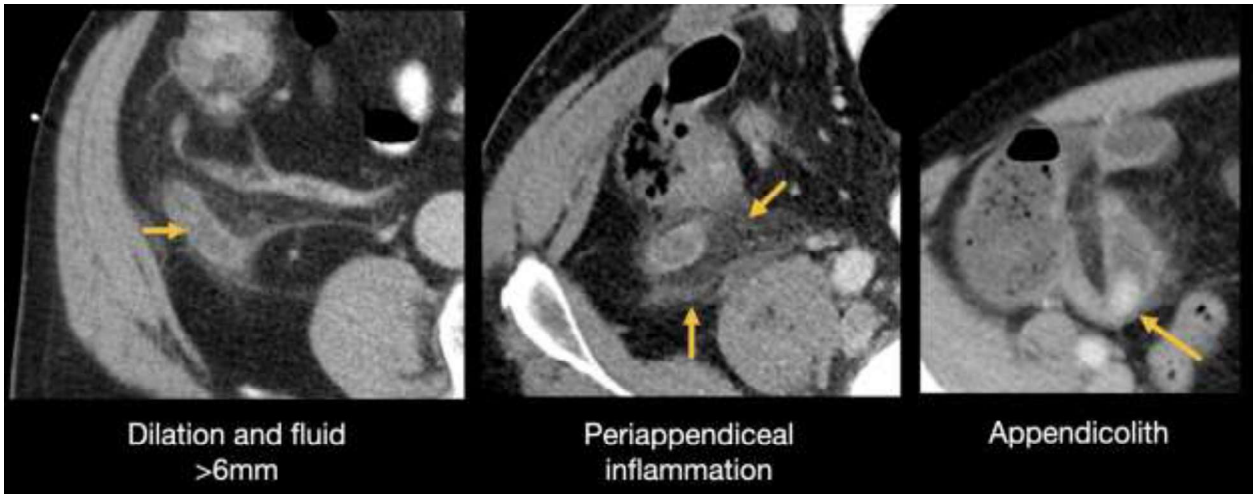


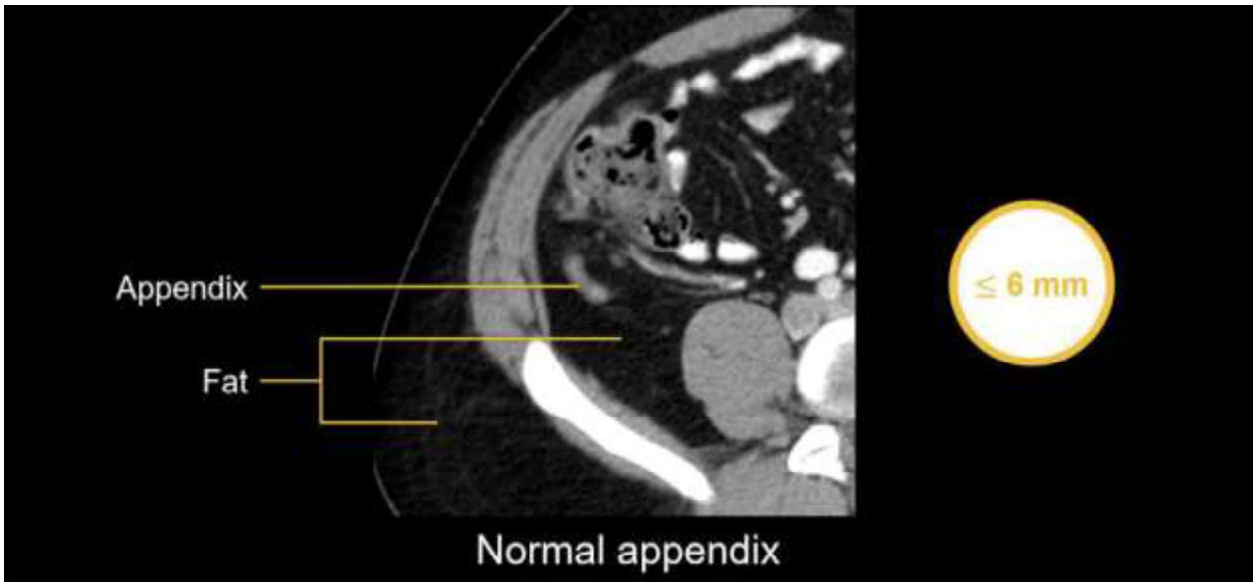

Not intended for
Liver
Heart
Diaphgram
Transverse colon
Gallbladder
Stomach
Pancreas
Heptic flexure
Duodenum
Ascending colon
Jejunum
Ileum
Descending colon
Bladder


Haustra
Jejunum
Ileum
Large bowel
Small bowel

Normal CT Appearance of the Appendix

The appendix appears as a blind-ending tubular structure arising from the cecum. Its position may vary, and its appearance on CT depends on luminal contents and degree of distension at the time of imaging. Understanding normal appendix anatomy is essential for technologist recognizing variations in appearance.





Contraindications

CT examination of the small and large intestine has several contraindications and precautions that should be considered to ensure patient safety and optimal image quality. Pregnancy represents a major contraindication due to exposure to ionizing radiation, unless the potential diagnostic benefit clearly outweighs the associated fetal risk. The use of intravenous iodinated contrast media requires careful evaluation. Patients with a known history of severe contrast allergy or significant renal impairment may be at increased risk of adverse reactions, and alternative imaging techniques or non-contrast CT protocols should be considered when appropriate. Oral contrast administration, which is commonly used in bowel CT examinations, may be contraindicated in patients with suspected bowel perforation, high risk of aspiration, or severe bowel obstruction, as oral contrast may worsen clinical condition or lead to complications. In such cases, modified protocols or omission of oral contrast may be required. Patients who are unable to cooperate with the examination, particularly those who cannot remain still or follow breath-holding instructions, may produce motion-degraded images that limit diagnostic usefulness. Severe abdominal pain or critical illness may also restrict the feasibility of routine CT bowel preparation. CT of the small and large intestine should be used cautiously in patients requiring frequent follow-up imaging, especially younger patients, due to concerns related to cumulative radiation dose. Careful justification of each examination is essential to minimize unnecessary radiation exposure. These contraindications and precautions should be assessed prior to CT imaging, with protocol modification or alternative imaging modalities considered when clinically appropriate, in accordance with established radiologic practice.

PatientPreparation

Proper patient preparation contributes to optimal bowel visualization on CT images by reducing intraluminal contents and improving assessment of bowel wall appearance. Fasting prior to the examination helps minimize residual bowel contents and supports clearer differentiation between the bowel lumen and wall structures. Inadequate preparation may affect bowel distension and influence the apparent thickness or contour of the bowel wall. Breath-holding instructions are important to minimize motion-related artifacts, particularly in the lower abdomen and pelvis, where respiratory and voluntary movement can affect image clarity. Patient cooperation plays a significant role in achieving consistent image quality throughout the examination. Selective use of oral contrast agents may be considered to improve bowel lumen distension and delineation when clinically indicated, while intravenous contrast administration may be utilized to enhance evaluation of bowel wall and adjacent structures. Bladder status may also influence visualization of pelvic bowel loops and is adjusted according to the area of interest. In this educational package, patient preparation is presented at a conceptual level, with detailed practical implementation addressed during supervised hands-on training.

Scancoverage

CT evaluation of the small and large intestine typically includes coverage of the abdomen and pelvis to ensure adequate visualization of the entire bowel. This scan range allows assessment of:

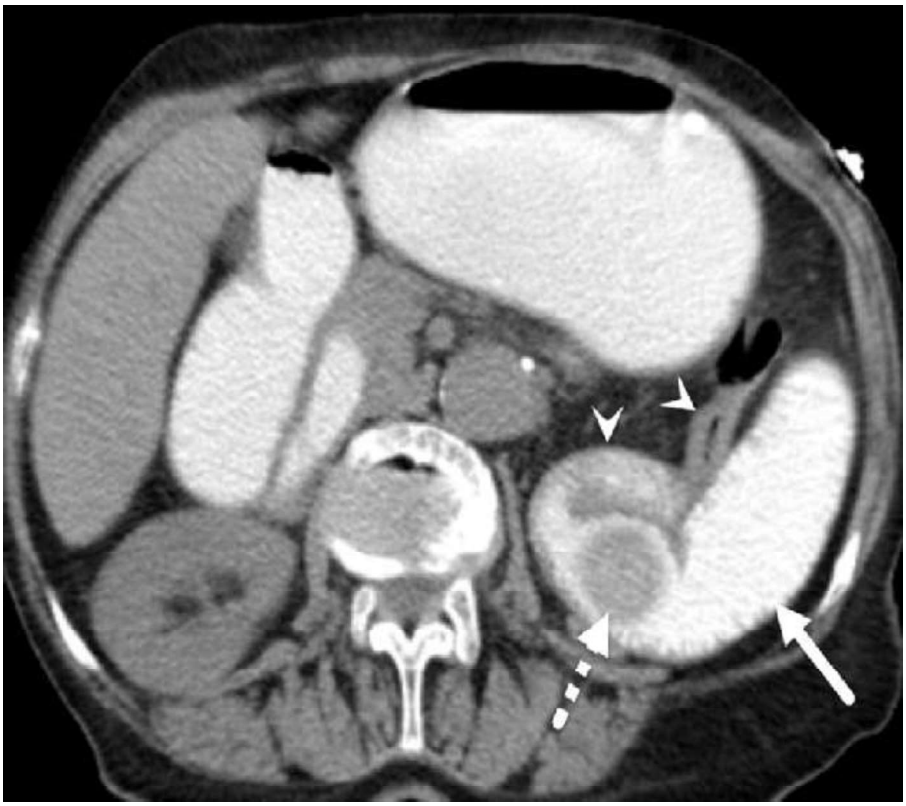
- **Small bowel loops**
- **Largebowelsegments**
- **Cecum and appendix**

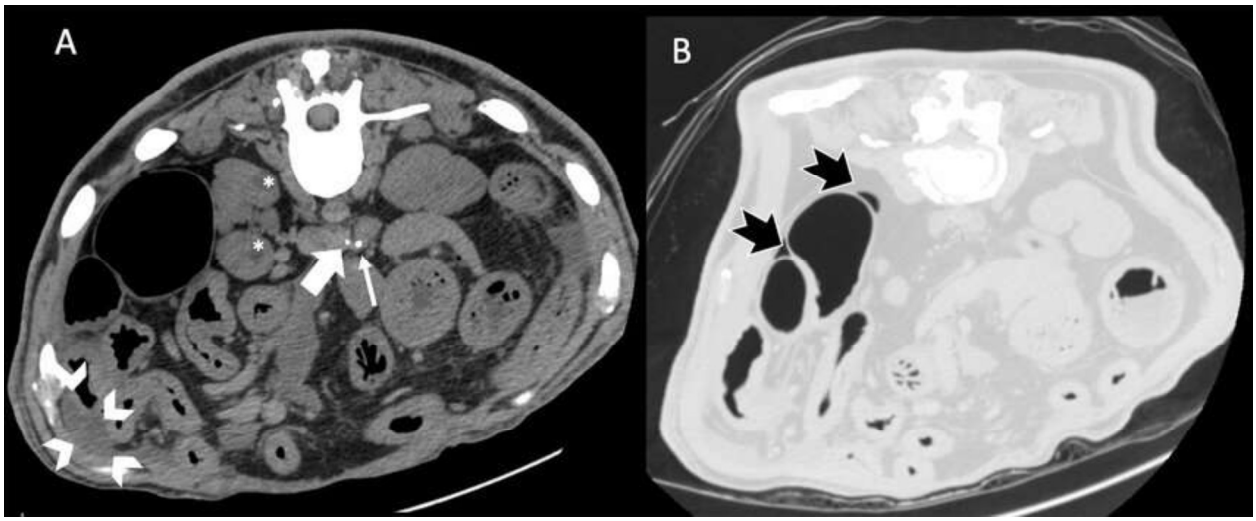
Appropriate scan coverage ensures continuous anatomical evaluation of the gastrointestinal tract and supports accurate assessment of bowel morphology and spatial relationships with surrounding abdominal and pelvic structures.

Image Display and Windowing

Bowel CT images are primarily reviewed using soft-tissue window settings, which allow clear visualization of bowel wall thickness, wall contour, and surrounding fat planes. Axial images serve as the primary reference standard for bowel assessment, while coronal reformatted images assist in evaluating bowel course, continuity, and anatomical relationships within the abdomen and pelvis.

Assessment of the surrounding mesenteric fat planes is an important component of bowel CT evaluation, as changes in these areas may reflect altered anatomical appearance related to inflammation, edema, or technical factors affecting image acquisition. In this educational context, image review focuses on recognizing normal anatomical patterns and variations rather than establishing specific diagnoses.

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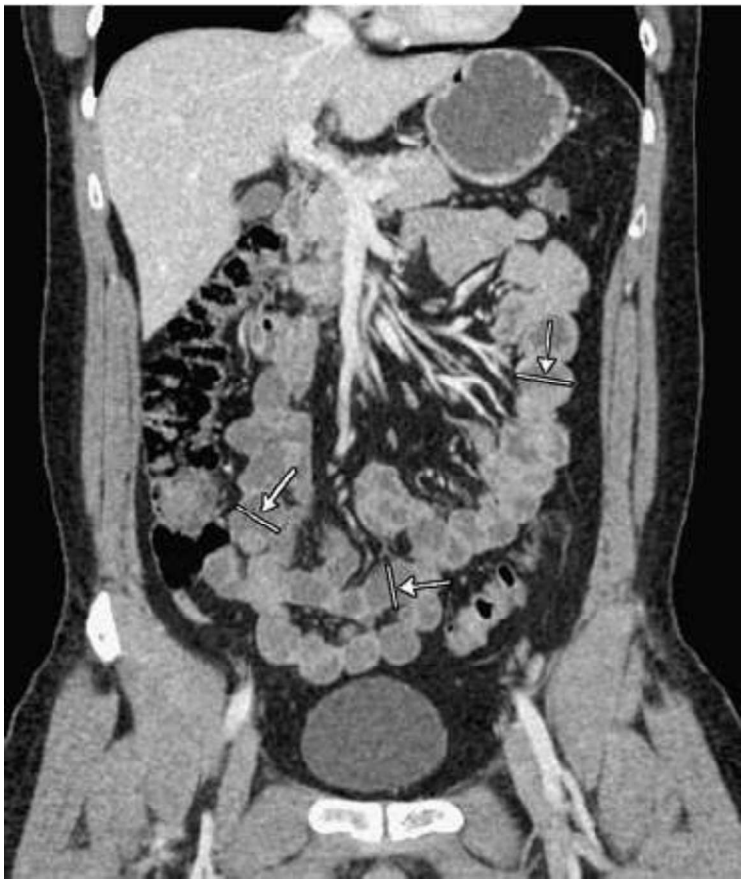
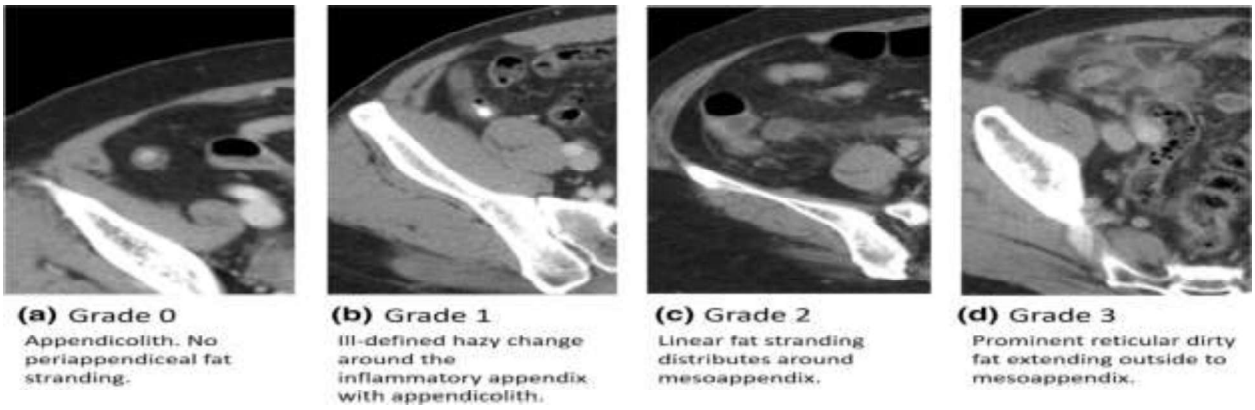


CT Appearance of Appendicitis

On CT images, appendicitis may be associated with characteristic morphological changes involving the appendix and adjacent structures. The appendix may appear enlarged with a tubular configuration that exceeds the expected appearance on normal CT imaging. Apparent wall thickening may be observed, reflecting alterations in wall morphology as demonstrated on cross-sectional images. Luminal distension of the appendix may also be present, contributing to changes in its normal contour and internal appearance.

In addition to appendicular changes, CT images may demonstrate increased attenuation of the surrounding mesenteric fat, representing inflammatory involvement of adjacent tissues. These features are described based on their anatomical appearance and spatial relationships on CT images and are presented in this educational context to support anatomical recognition and image interpretation.



(a) Grade 0 Appendicolith. No periappendiceal fat stranding.

(b) Grade 1 Ill-defined hazy change around the inflammatory appendix with appendicolith.

(c) Grade 2 Linear fat stranding distributes around mesoappendix.

(d) Grade 3 Prominent reticular dirty fat extending outside to mesoappendix.

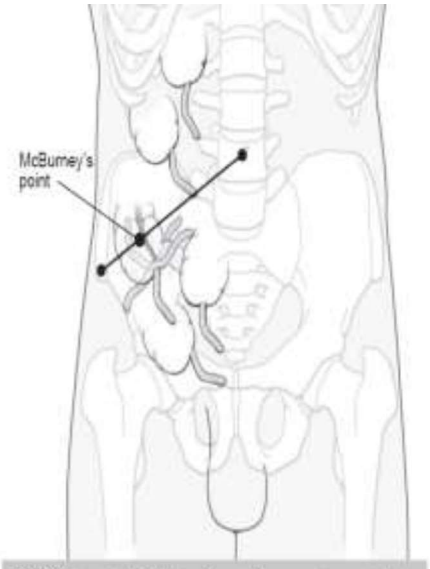


FIGURE Variable locations of the normal appendix.

TABLE Prevalence of Common Signs and Symptoms of Appendicitis[2]

Symptom	Frequency (%)
Abdominal pain	99–100
Anorexia	99
Right lower quadrant pain or tenderness	96
Nausea	90
Vomiting	75
Low-grade fever	67–69
Classic symptom sequence (vague periumbilical pain to anorexia/nausea/unsustained vomiting to migration of pain to right lower quadrant to low-grade fever)	50
Rebound tenderness	26
Right lower quadrant guarding	21

CT Colonography

It is a specialized CT technique used to evaluate the large intestine by generating two- and three-dimensional images of the colonic lumen after bowel preparation and gas distension. It is primarily performed for the detection of colonic polyps, masses, and structural abnormalities, particularly when conventional colonoscopy is incomplete or contraindicated. The examination involves colon insufflation with air or carbon dioxide and image acquisition in different patient positions, followed by review using axial images, multiplanar reformations, and 3D endoluminal reconstructions. CT Colonography is minimally invasive and well tolerated; however, it is limited to anatomical assessment and

does not allow biopsy or therapeutic intervention, which requires conventional colonoscopy.

Technical Considerations Affecting Image Appearance

The CT appearance of bowel structures is influenced by a combination of technical and physiological factors that may affect image interpretation. Adequate bowel distension plays a key role in defining wall thickness and luminal configuration, as insufficient distension may exaggerate apparent bowel wall thickness or obscure normal contours. Patient motion and respiratory activity can introduce image blurring or misregistration, particularly in the lower abdomen and pelvis, altering visualization of bowel loops and surrounding structures.

Slice thickness is an important technical factor influencing bowel appearance. Thicker image slices increase partial volume effects, potentially resulting in loss of fine anatomical detail or apparent wall thickening, whereas thinner slices allow clearer visualization of bowel wall morphology and luminal outlines. Intraluminal gas and residual bowel contents may further affect contrast between the bowel lumen and wall. Oral contrast administration may enhance luminal visualization and assist in differentiation between bowel wall and adjacent structures; however, uneven distribution or inadequate filling can modify the apparent bowel shape or thickness. Awareness of these technical and physiological influences is essential to distinguish true anatomical findings from variations related to imaging technique

Advantages and Limitations

CT imaging provides detailed cross-sectional visualization of the bowel and adjacent abdominal structures, allowing clear depiction of anatomical relationships within a short acquisition time. The technique offers consistent assessment of bowel loops, mesentery, and surrounding tissues, supporting comprehensive anatomical evaluation of both the upper and lower abdomen.

Despite these advantages, CT imaging of the bowel has inherent limitations. Variations in bowel distension, patient motion, and respiratory activity may influence image appearance and introduce interpretative challenges. In addition, overlap between technical factors and true anatomical findings may occur. CT primarily provides structural information and does not offer direct assessment of bowel function.

Posttest: الاختبار البعدي:

1. **What's the Advantages and Limitations of CT for small intestine**
2. **Describe the normal CT appearance of the appendix**

References: المصادر:

References

10. Romans, L. E. *Computed Tomography for Technologists: Exam Review*. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2011.
11. Seeram, E. *Computed Tomography: Physical Principles, Clinical Applications, and Quality Control*. 4th ed. St. Louis: Elsevier; 2016.
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