Acute abdomen: CT or ultrasound?

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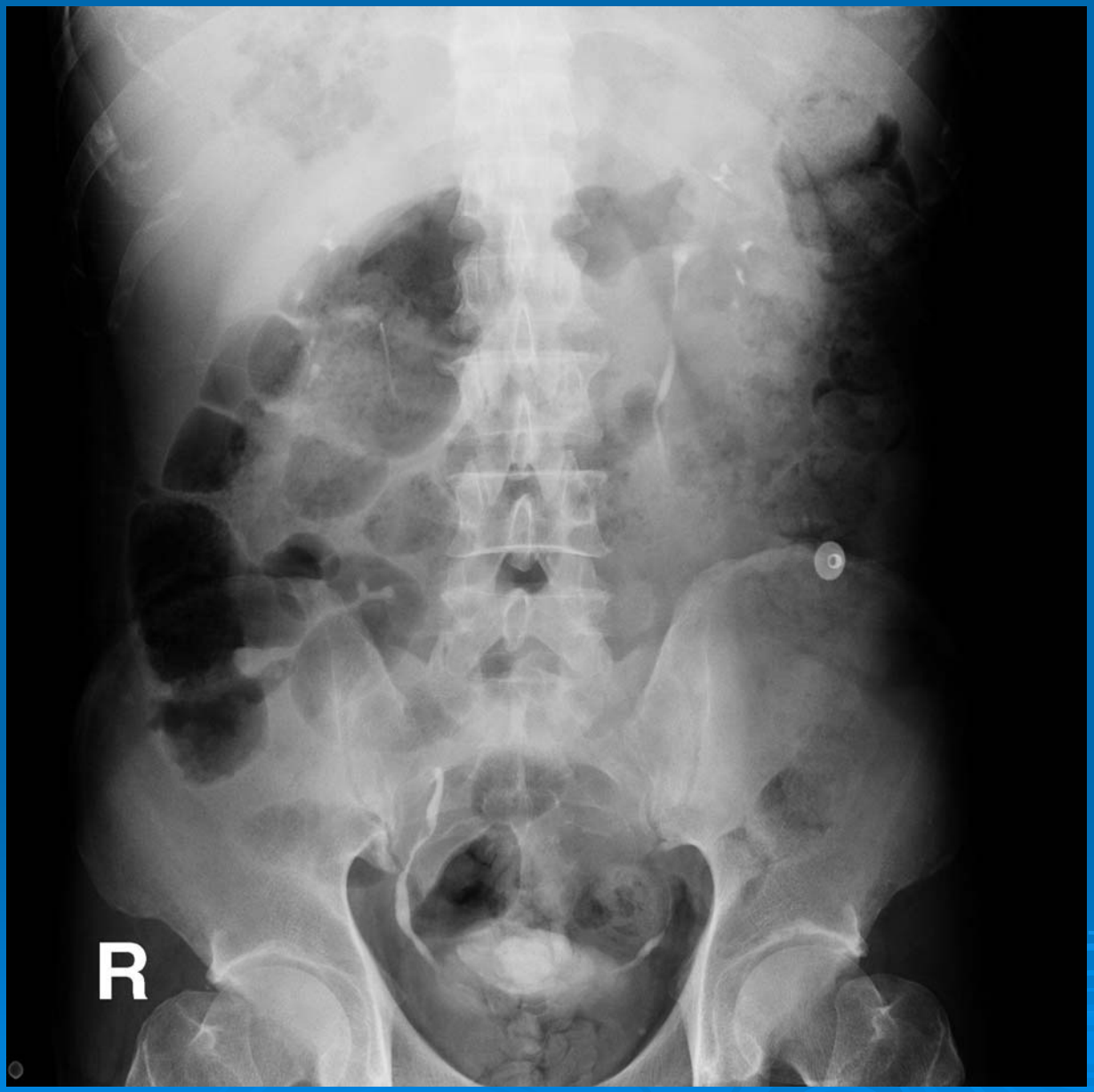
Learning objective

- Benefits of CT in the patient present with acute abdomen
- When do you need the CT scan?
- When do you need ultrasound?

Case: abdominal pain for 10 days

- 58 y/o male patient present with RUQ pain for 10 days, no fever
- Blood WBC: 11200, Seg.: 86%
- Past history: DM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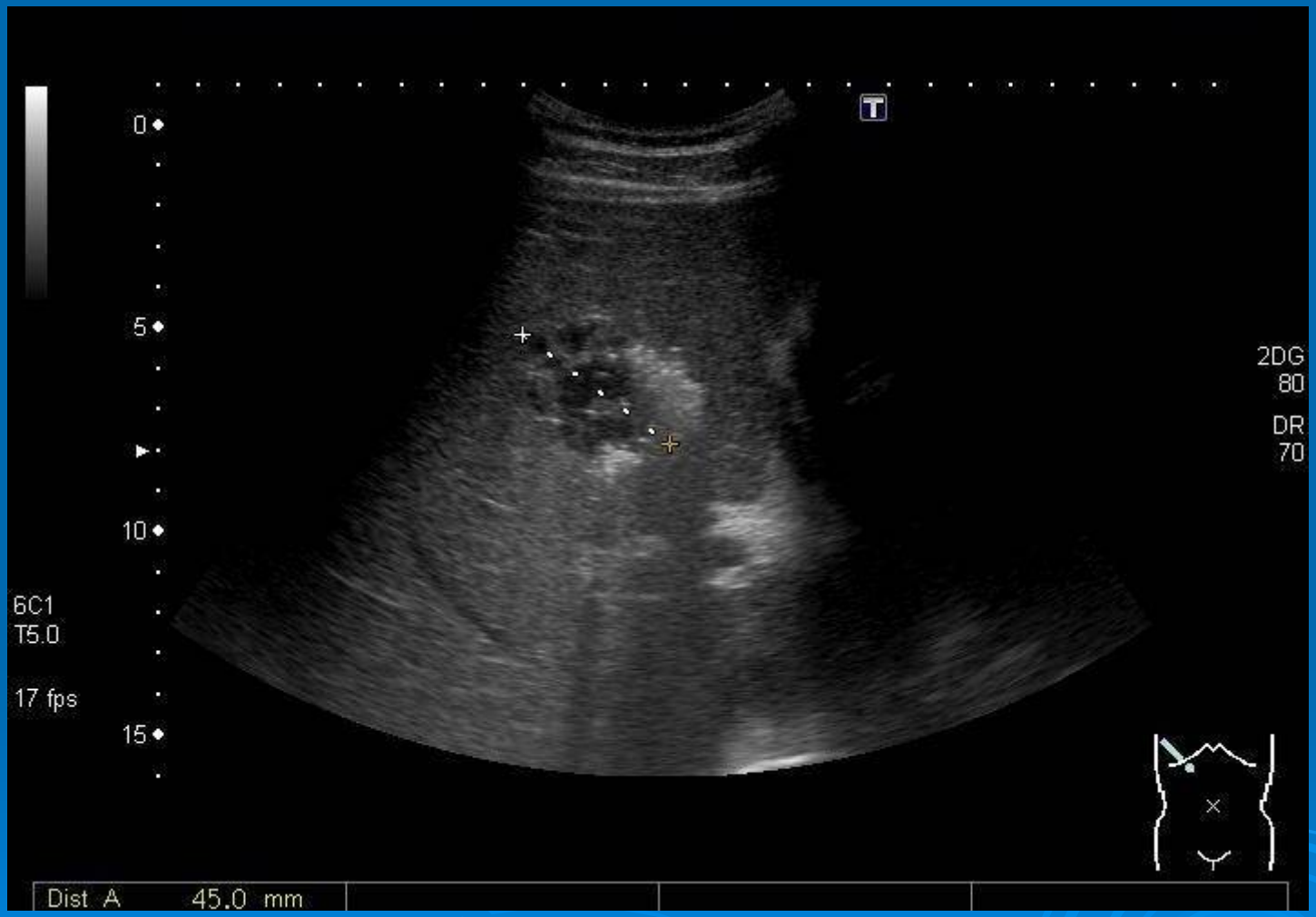
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2DG
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T5.0
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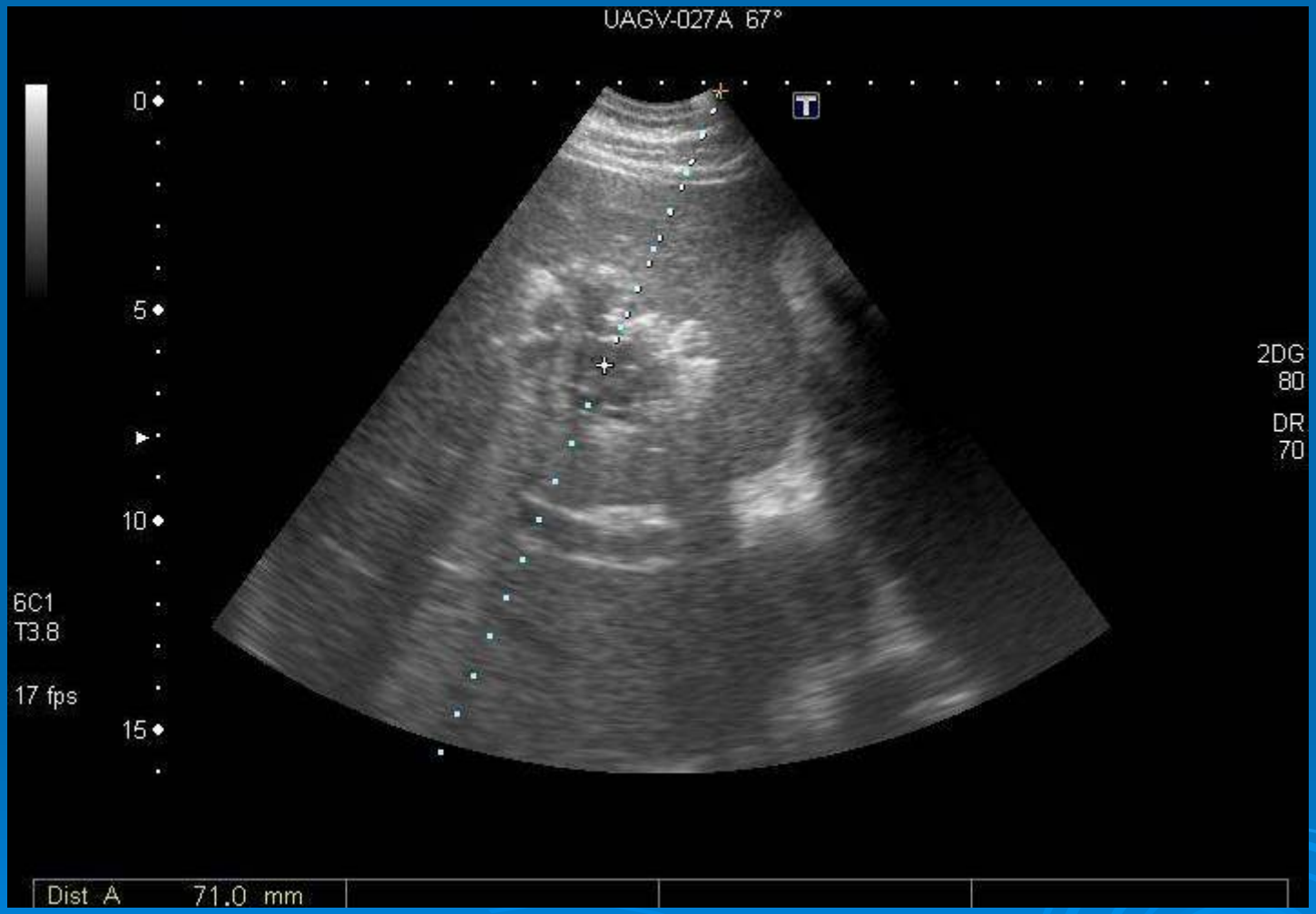
Dist A 45.0 mm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Dist A 71.0 mm

Choice of computed tomography (CT) versus ultrasound

- Radiation dose
- Operator's level of training
- Patient's age and sex
- Condition of patient’s cooperation
- Obesity or not
- Other situations

CT scan

- High sensitivity
- High specificity
- Accuracy
- Availability
- Not real-time, but dynamic study by artery-vein-delayed phase
- Lack of operator dependence

Table 1. Typical Organ Radiation Doses from Various Radiologic Studies.

Study Type	Relevant Organ	Relevant Organ Dose* (mGy or mSv)
Dental radiography	Brain	0.005
Posterior–anterior chest radiography	Lung	0.01
Lateral chest radiography	Lung	0.15
Screening mammography	Breast	3
Adult abdominal CT	Stomach	10
Barium enema	Colon	15
Neonatal abdominal CT	Stomach	20

* The radiation dose, a measure of ionizing energy absorbed per unit of mass, is expressed in grays (Gy) or milligrays (mGy); 1 Gy=1 joule per kilogram. The radiation dose is often expressed as an equivalent dose in sieverts (Sv) or millisieverts (mSv). For x-ray radiation, which is the type used in CT scanners, 1 mSv=1 mGy.

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Ultrasound

- Inexpensive
- Portable
- Safe
- No requirement for radiation
- Dynamic and real-time survey
- Operator dependence: solid or hollow organ, experiences

CT for appendicitis

- CT for appendicitis has a higher sensitivity (90%-100%) and specificity (95%-97%)
  Radiology 2000;215:337-48
- CT use in suspected acute appendicitis has greatly increased over the past several years. The dramatic increase in CT use at our institution has not resulted in dramatic decreases in negative appendectomy rate or statistically significant changes in perforation rate.

  Am Surg. 2001 ;67(11):1017-21.

Table 1. Sensitivity and Specificity of Clinical Findings for the Diagnosis of Acute Appendicitis.

Finding	Sensitivity	Specificity	Study
	percent		
Signs			
Fever	67	69	Wagner et al.[8]
Guarding	39–74	57–84	Wagner et al.,[8] Jahn et al.[9]
Rebound tenderness	63	69	Wagner et al.[8]
Indirect tenderness (Rovsing's sign)	68	58	Jahn et al.[9]
Psoas sign	16	95	Wagner et al.[8]
Symptoms			
Right-lower-quadrant pain	81	53	Wagner et al.[8]
Nausea	58–68	37–40	Wagner et al.,[8] Jahn et al.[9]
Vomiting	49–51	45–69	Wagner et al.,[8] Jahn et al.[9]
Onset of pain before vomiting	100	64	Wagner et al.[8]
Anorexia	84	66	Wagner et al.[8]

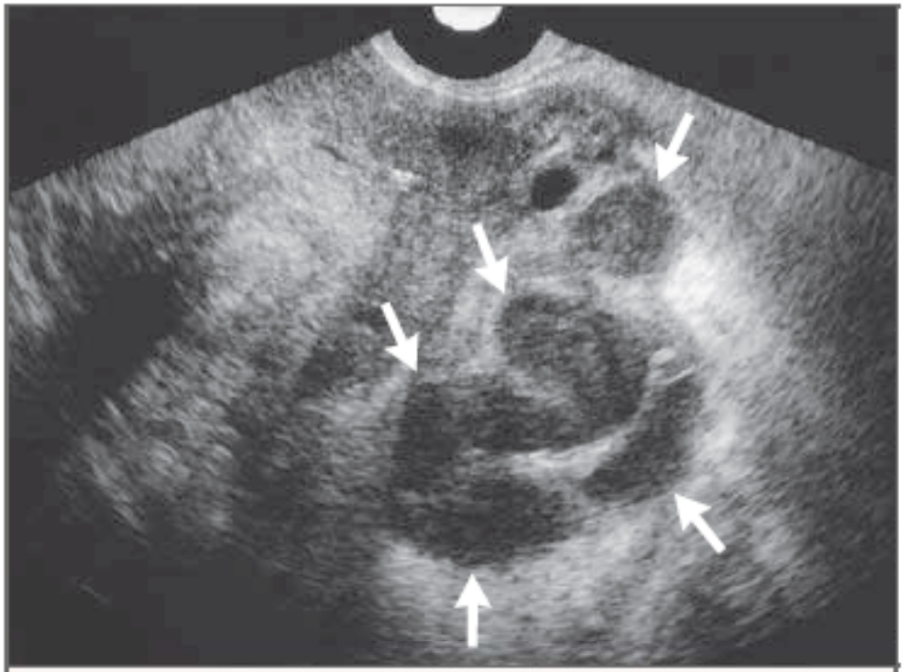


Figure 1. Endovaginal Ultrasonogram in a 46-Year-Old Premenopausal Woman with Right-Lower-Quadrant Pain, Adnexal Tenderness, and an Elevated White-Cell Count.

A carefully performed ultrasonographic examination of the right lower quadrant failed to show the appendix or the cause of pain. Endovaginal ultrasonographic examination of the right adnexa shows a fluid-filled, dilated, tubular structure (arrows), which is consistent with the presence of a hydrosalpinx or pyosalpinx. The patient underwent exploratory laparotomy, and a pyosalpinx was identified. Salpingo-oophorectomy was performed, and the patient had an uneventful recovery.

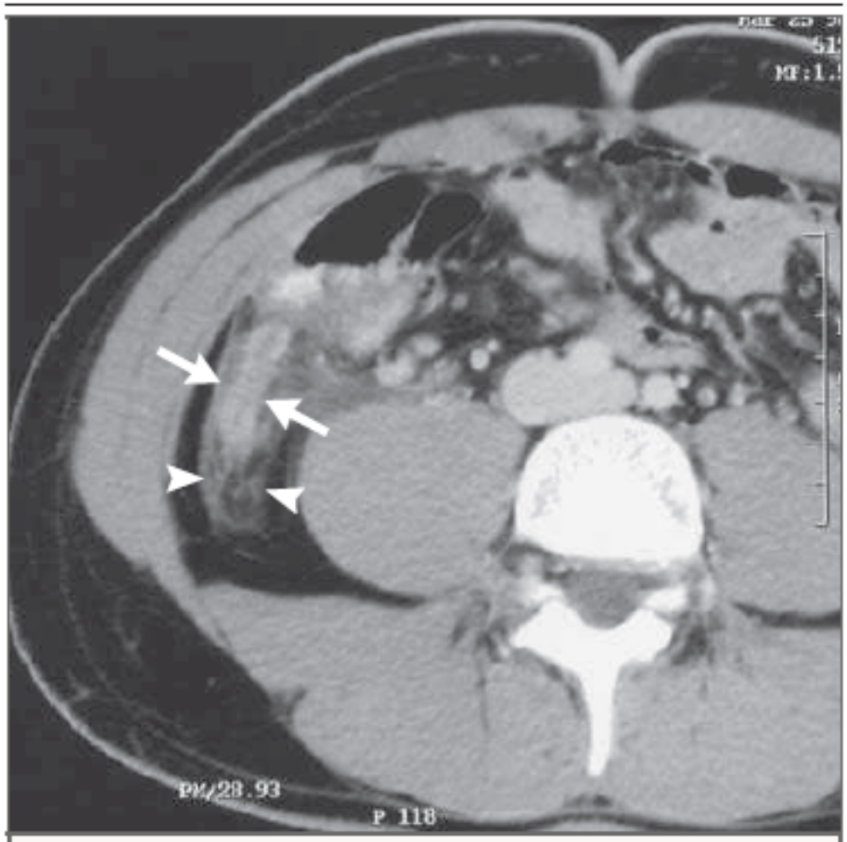


Figure 2. CT Scan in an 18-Year-Old Man with Abdominal Pain and Nausea.

CT examination of the right lower quadrant after the administration of intravenous and enteric contrast material shows a dilated, fluid-filled appendix with a thickened wall (arrows). There are inflammatory changes in the adjacent fat tissue (arrowheads). Laparotomy confirmed the diagnosis of acute appendicitis, and an appendectomy was performed. The patient had an uneventful recovery.

1. Swelling blinded-end loop
2. Swelling of cecum
3. Perifocal inflammation

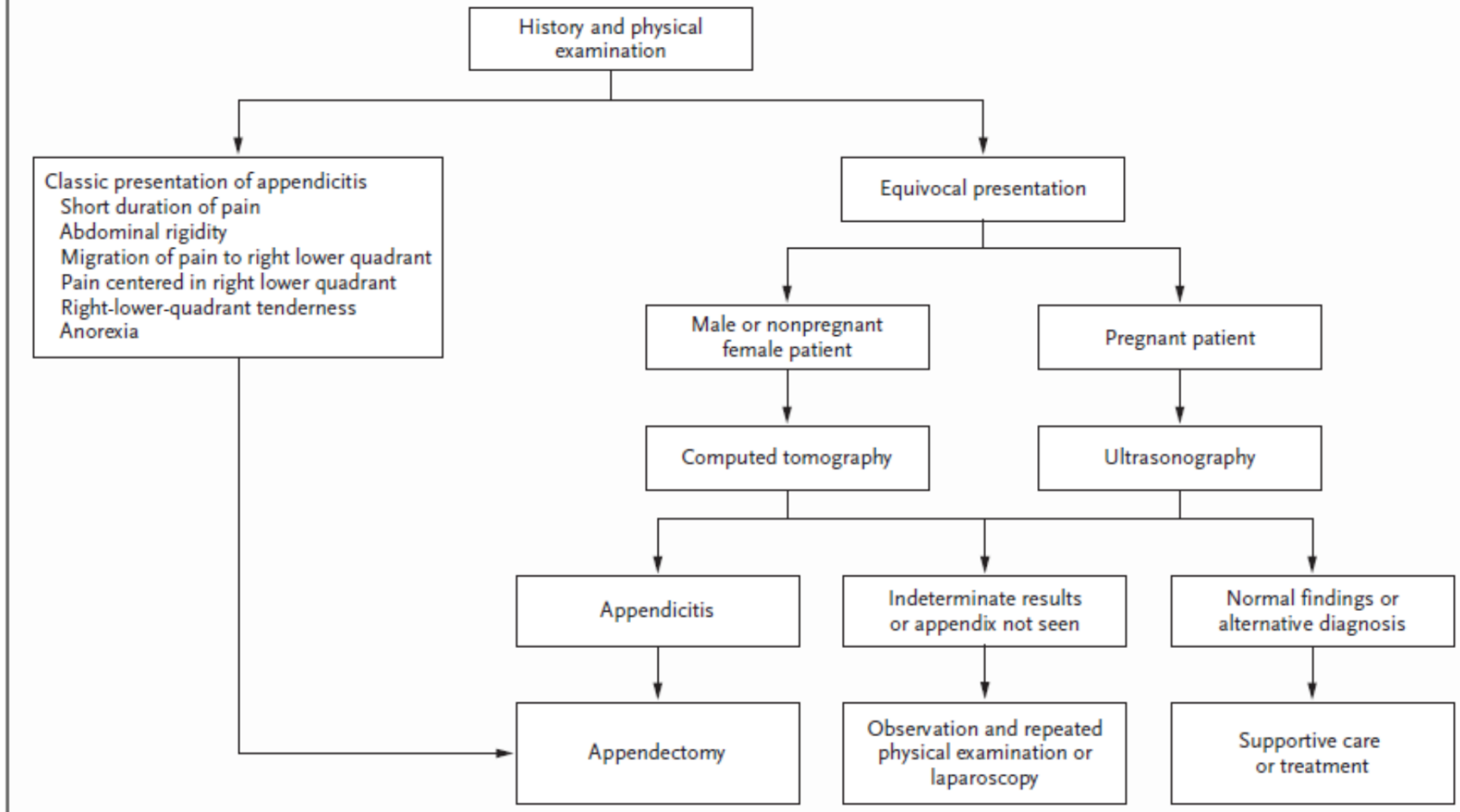


Figure 3. Clinical Algorithm for the Evaluation of Pain in the Right Lower Quadrant.

The algorithm is for suspected cases of acute appendicitis. If gynecologic disease is suspected, a pelvic and endovaginal ultrasonographic examination should be considered.

Choice CT or ultrasound

- Diagnosis
- Surveillance
- Monitoring disease response to therapy
- Exacerbation or dynamic survey: ultrasound

Abdominal CT

Abdominal CT can reveal:

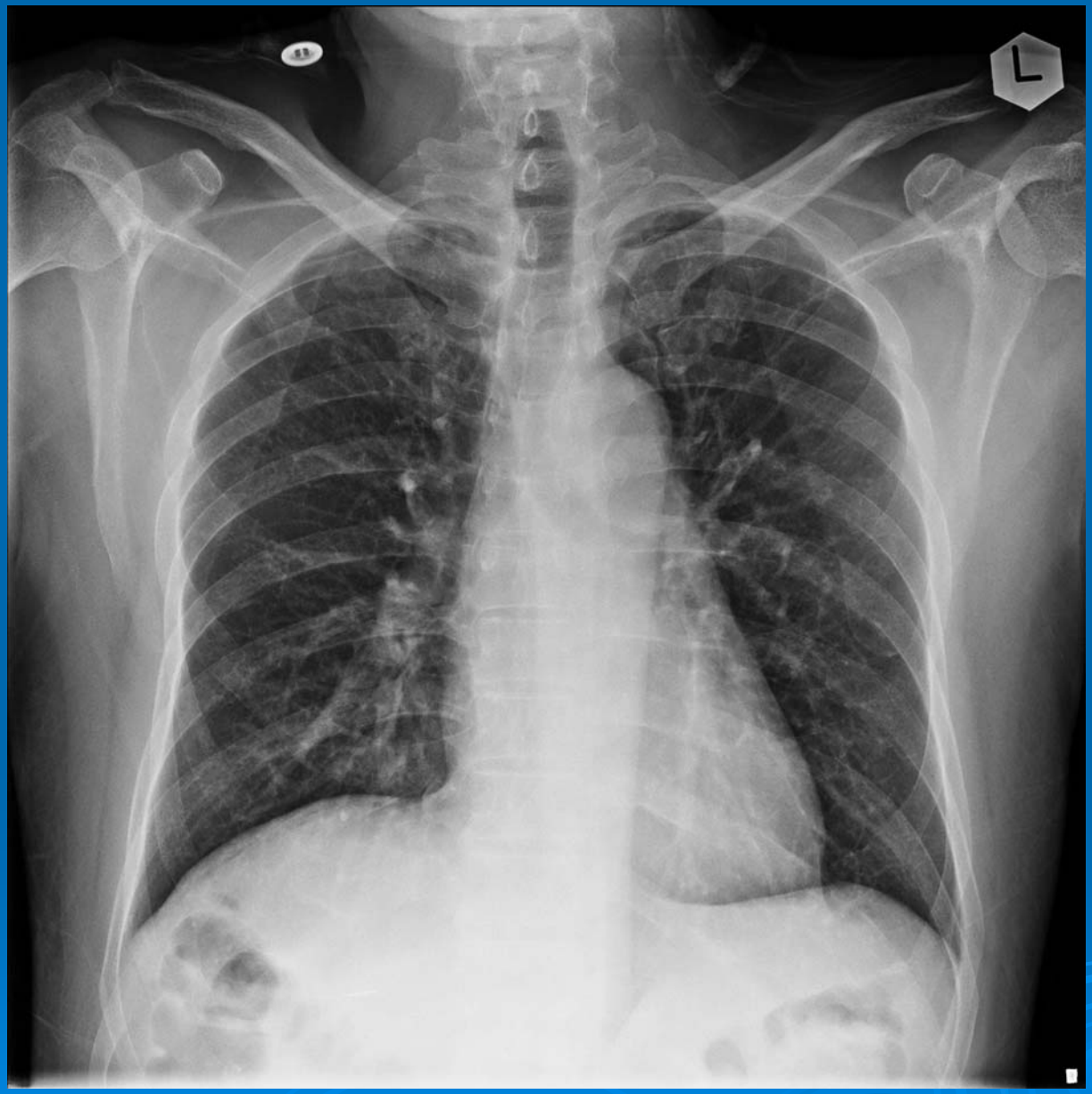
- Appendicitis
- Gallstones or biliary sludge in the gallbladder or bile ducts
- Kidney stones
- Enlarged lymph nodes anywhere in the abdominal cavity
- Thickened intestinal wall, like in lymphoma
- Diverticulosis
- Abdominal tumors
- Enlarged liver, spleen or kidneys
- Location and spread of abdominal cancers

However, DDx is concerned (CT)

- Mis- or delayed diagnosed?
- Unknown diagnosis?
- Young female patient, GI or GYN problem?
- Intractable abdominal pain (infarction or vascular lesion?)
- High risk patient (sometimes…VIP)
- With or without contrast medium?

Case: abdominal pain for 1 day

- 62 y/o male patient present with upper abdominal pain for 1 day, no fever
- Blood WBC: 9600, Seg.: 86%
- Past history: lymphoma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Choice of ultrasound

- Solid organ lesion
- Hollow organ lesion (training and education)– operator dependence
- Trauma patient survey and follow-up
- Ascites localization

Non-contrast abdominal CT's can detect:

- Renal/ureteral stones
- Bowel obstruction (SBO and LBO)
- Perforated viscus
- Appendicitis
- Cholecystitis
- Pancreatitis
- Diverticulitis
- AAA or rupture

Take home message

- Emergency CT scan for acute abdomen: peritonitis, suspect bowel obstruction, vascular lesion (SMA occlusion etc)
- Ultrasound: FAST, solid organs, hollow organ (need training and education)