

Appendicitis USG vs CT

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My Talk includes

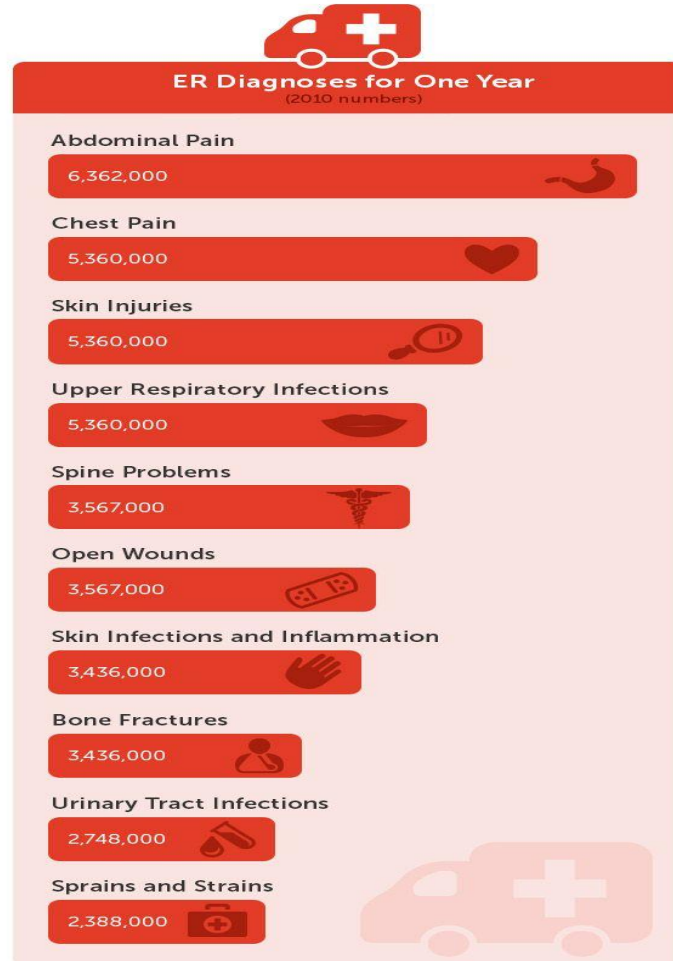
- Fact sheets – Pain / abdominal pain / USG / CT Scan etc
- Why we need Imaging
- Ultrasound – detection / pros / cons
- CT Scan –detection /Pros / Cons
- Cases – if time permits
- Recommendations
- Take Home points

**What is the most
presentation of patients
coming to ED ?????**

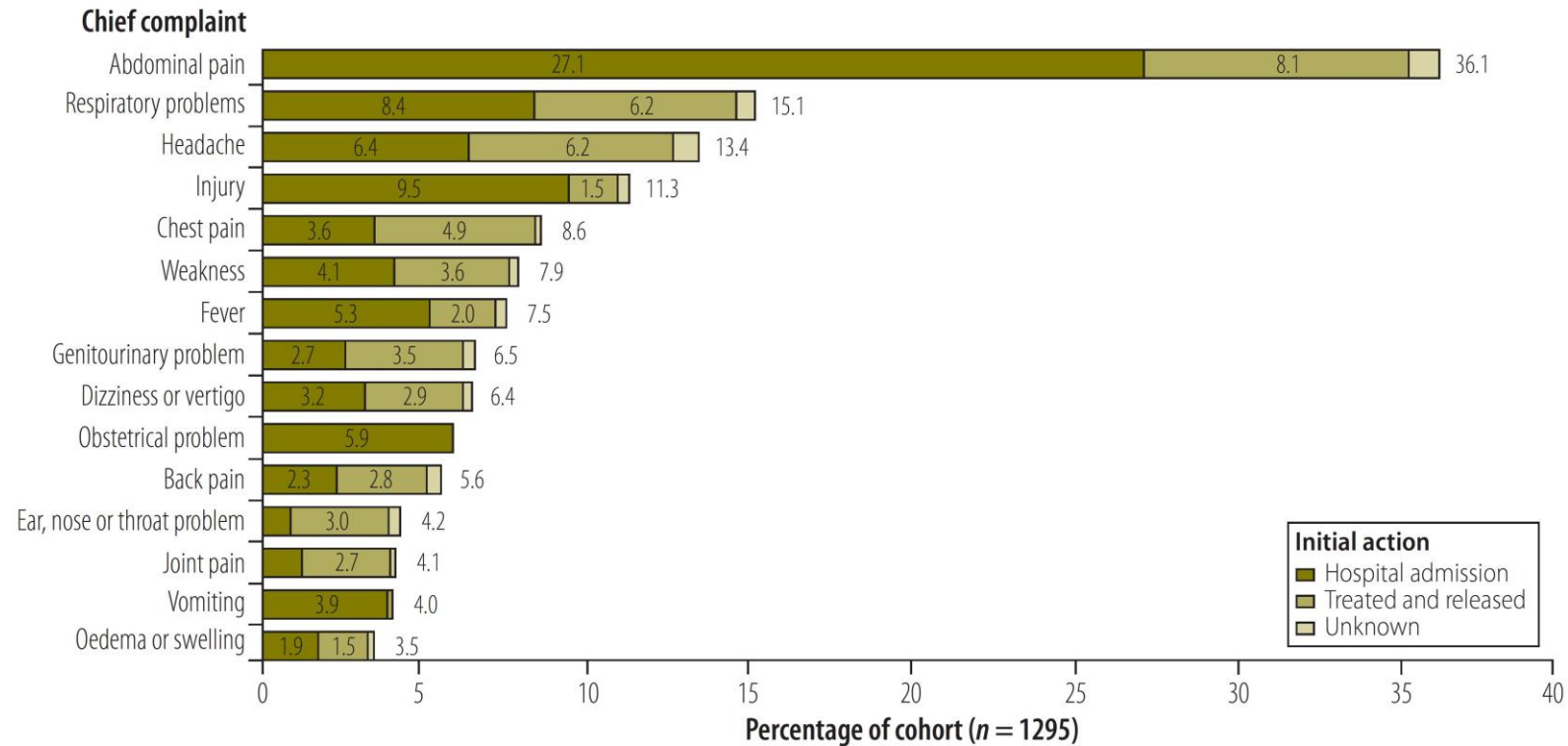


TOP 10 DIAGNOSES FROM E.R. VISITS

U.S. emergency rooms log about **130 million visits** every year.



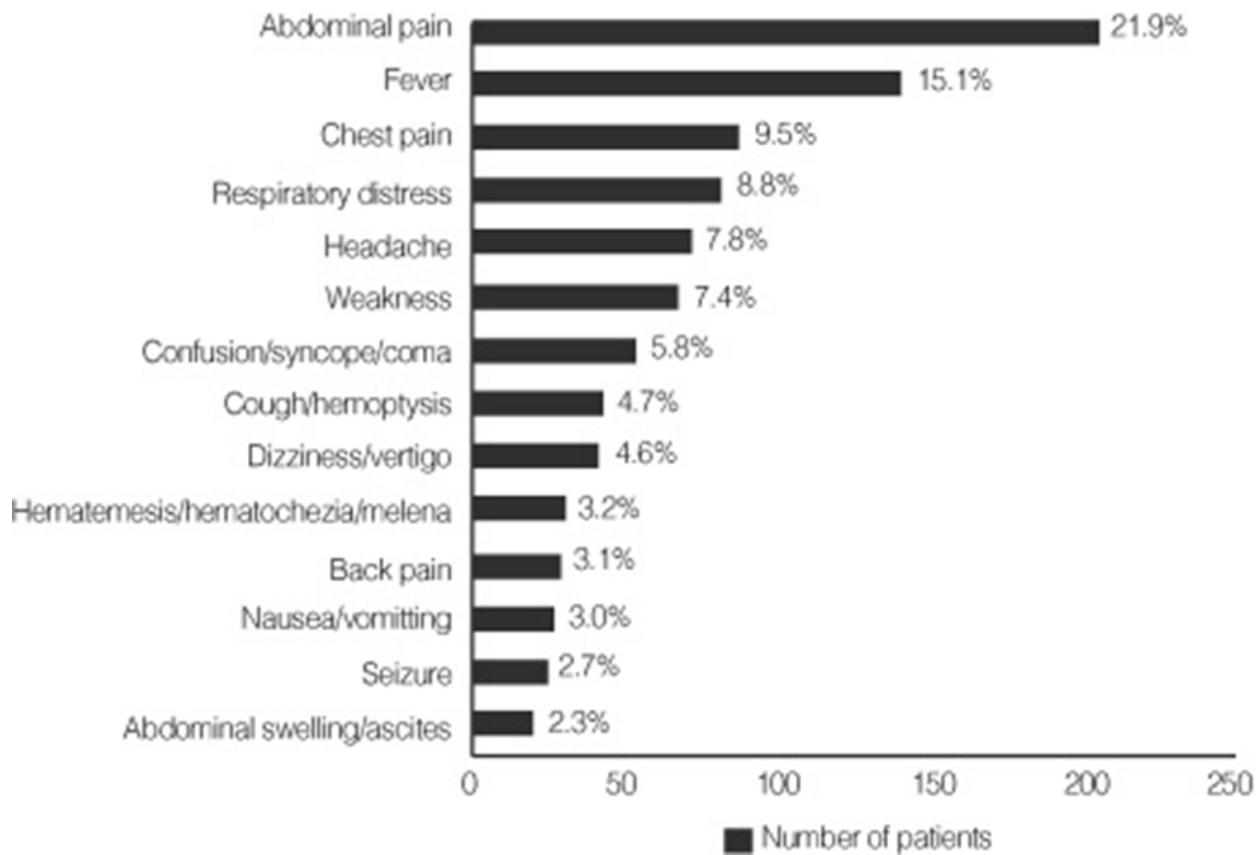
Source: The CDC's National Hospital Ambulatory Medical Care Survey



^a Up to three chief complaints were recorded per patient.

^b Only the 15 most common chief complaints are shown.

Bulletin of the World Health Organization 2015;93:84-92. doi:
<http://dx.doi.org/10.2471/BLT.14.143917>



Korean J Lab Med. 2010 Aug;30(4):444-450. Korean.
Published online August 30, 2010.

<https://doi.org/10.3343/kjlm.2010.30.4.444>

Fact Sheet

- **Pain is the Most common Complaint of the patients presents to the ER**
- **Abdominal pain is one of the most common presentation which needs lot of attention**

TABLE 1. COMMON CAUSES OF PAIN IN EMERGENCY ROOM PATIENTS ALL AGE GROUPS

NOTE: Prevalence varies in other series

CAUSE OF PAIN	%
Unknown	41.3%
Gastroenteritis	6.9%
Pelvic inflammatory disease	6.7%
GU infection	5.2%
Ureteral stone	4.3%
Appendicitis	4.3%
Cholecystitis	3.7%
Intestinal obstruction	2.5%
Constipation	2.3%
Duodenal ulcer	2.0%
Other A and B	22.0%

After Brewster RJ et al. Am J Surg 1976;131:219.[1]

A: 1% to 2%: Pregnancy, dysmenorrhea, pyelonephritis, gastritis, ovarian cyst, incomplete Ab

B: Less than 1%: Pancreatitis, aortic aneurysm, epididymitis

Used with permission from Dachman et al[16]

TABLE 2. CONDITIONS REQUIRING SURGERY EMERGENCY ROOM PATIENTS

CAUSE OF PAIN	%
Acute appendicitis	36.9%
Intestinal obstruction	35.2%
Perforated ulcer	8.0%
Acute cholecystitis	6.2%
Abscess	4.4%
Pancreatitis	2.1%
Diverticulitis	1.5%
Colon perforation	1.1%
Other	4.4%

After Jordan G. Adv Surg 1980;14:259.[2]

Used with permission from Dachman et al[16]

Fact Sheet

- **Acute appendicitis is the most common reason for emergency abdominal surgery and must be distinguished from other causes of abdominal pain.**

Fact Sheet

- **Acute appendicitis is typically a disease of children and young adults with a peak incidence in the 2nd to 3rd decades of life .**

Fact Sheet

- The diagnosis of appendicitis traditionally has been based on clinical features found primarily in the patient's history and physical examination.
- *The classical history in acute appendicitis is that of initial colicky central abdominal pain that moves after 6-12 hours to the right iliac fossa where it is constant in nature (1). This classic history is only normally present in half of the patients that present to the ED with appendicitis (1). Other common symptoms include anorexia (which tends to be present in 80% of patients with appendicitis), nausea, vomiting (which starts after the pain) and constipation (2). Appendicitis often presents with an atypical history particularly in the elderly, children and pregnant patients and can make these a very difficult diagnostic group, where the diagnosis may be made late and the risk of perforation is higher*

Fact Sheet

- All Hospitals / Institutes will not have Expert Radiologist in house all the time .
- Most of the times after 5pm Junior most doctors will be available in the departments (applies more to Radiology)

Fact Sheet



Radiation by the Numbers

Certain kinds of imaging diagnostics use ionizing radiation, which is associated with an increased risk of cancer. Here are estimated radiation levels for some procedures:

SOURCE	ESTIMATED DOSE (MILLISIEVERTS)
Chest X-ray	0.01-0.1 mSv
Mammogram	0.8 mSv
Head CT	2 mSv
Chest CT	8-10 mSv
Abdomen-pelvis CT	10mSv
Full-body screening CT	12-25 mSv
World War II atom bomb (mean)	20 mSv

Factsheet

CT scan with a dose of say 10 mSv is equivalent to 500 chest X rays assuming a dose of 0.02 mSv per chest X ray ($0.02 \times 500 = 10$)

Fact Sheet

The effective doses from diagnostic CT procedures are typically estimated to be in the range of 1 to 10 mSv. This range is not much less than the lowest doses of 5 to 20 mSv estimated to have been received by some of the Japanese survivors of the atomic bombs. These survivors, who are estimated to have experienced doses slightly larger than those encountered in CT, have demonstrated a small but increased radiation-related excess relative risk for cancer mortality.

Appendicitis - 1

- **Primary symptom: abdominal pain**
- **½ to 2/3 of patients have the classical presentation**
- **Pain beginning in epigastrium or periumbilical area that is vague and hard to localize**
- **Associated symptoms: anorexia, nausea, vomiting , abdominal discomfort**
- **As the illness progresses RLQ localization typically occurs**
- **RLQ pain was 81 % sensitive and 53% specific for diagnosis**

Appendicitis – 2

- **McBurney's Point:** just below the middle of a line connecting the umbilicus and the ASIS
- **Rovsing's:** pain in RLQ with palpation to LLQ
- **Rectal exam:** pain can be most pronounced if the patient has pelvic appendix
- **Additional components that may be helpful in diagnosis:** rebound tenderness, voluntary guarding, muscular rigidity, tenderness on rectal examination

Appendicitis – 3

- **Psoas sign:** place patient in L lateral decubitus and extend R leg at the hip. If there is pain with this movement, then the sign is positive.
- **Obturator sign:** passively flex the R hip and knee and internally rotate the hip. If there is increased pain then the sign is positive

MANTREL SCORE

Appendicitis – 4

SYMPTOMS	FREQUENCY (%)
Abdominal Pain	97-100
Migration of Pain to RLQ	49-61
Nausea	67-78
Vomiting	49-74
Anorexia	70-92
Fever	10-20
Diarrhea	4 -16
Constipation	4 -16

SIGNS	
Abdominal tenderness	95-100
RLQ tenderness	90-95
Rebound tenderness	33-68
Rectal tenderness	30-40
Cervical motion tenderness	30
Rigidity	12
Psoas sign	5-3
Obturator sign	5-8
Rovsing's sign	5
Palpable mass	< 5
Mean Temperature	37.9°C

Ultrasonography in suspected Appendicitis

Graded Compression Technique

- **Non compressible structure – Most Sensitive & Specific Finding**
- **Diameter of Appendix > 6mm – 2nd Most Sensitive & Specific finding**

Imaging Findings on Ultrasound

Table 2

Direct and indirect (secondary) signs of acute appendicitis in graded-compression, real-time and contrast-enhanced US (CEUS; adopted according to references 7, 9, 20 and 21)

Real-time US signs of acute appendicitis	
Direct signs	Indirect signs
Non-compressibility of the appendix	Free fluid surrounding appendix
Perforation: appendix might be compressible	Local abscess formation
Diameter of the appendix > 6 mm	Increased echogenicity of local mesenteric
Single wall thickness ≥ 3 mm	Enlarged local mesenteric lymph nodes
Target sign:	
Hypoechoic fluid-filled lumen	
Hyperechoic mucosa/submucosa	
Hypoechoic muscularis layer	
Appendicolith: hyperechoic with posterior shadowing	Thickening of the peritoneum

Images of Appendicitis on Ultrasound



Accuracy / Sensitivity / Specificity

Overall Accuracy : less than 90%

Adult - Sensitivity – 74-83%, Specificity – 93-97%

Pediatrics – Sensitivity -88%, Specificity – 94%

An USS can rule in appendicitis but cannot rule it out, i.e. in the presence of a normal scan the patient will still need to be closely observed

Variables: Body habitus, Location, Skill

Pro s

- Inexpensive
- Non Invasive
- Portable
- Very safe
- No radiation exposure
- Nocontrast required
- Patient Cooperation less required – especially children
- USS is of particular value in trying to identify other pathologies, especially in women of childbearing age, when the diagnosis may unclear. It is also of benefit in patients with atypical signs, such as the elderly, children or pregnant patients.

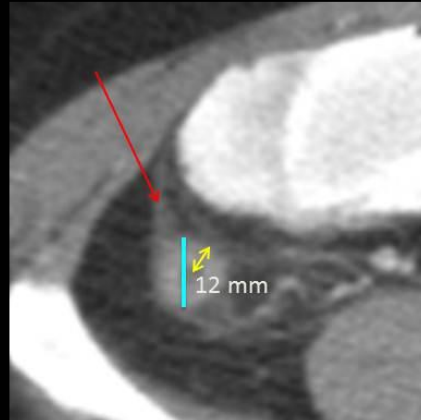
Cons :

- **90% Accuracy**
- **Purely operator Dependent investigation**
- **Specialists will not be available in all the hospitals 24/7**
- **Normal scan doesn't rule out possibility of Appendicitis**

Helical Computed Tomography –CT Imaging

CT Scan findings in Appendicitis – Clear picture

- Appendiceal diameter (>6-8 mm)
- Wall thickening (>3 mm)
- Periappendiceal fat-stranding
- Post-contrast enhancement of appendiceal wall





Accuracy / Sensitivity / Specificity

- Overall Accuracy : 94%
- highly sensitive (94-98%)
- Highly specific (up to 97%) for the diagnosis of acute appendicitis and allows for alternative causes of abdominal pain also to be diagnosed

Pro s

- **High Accuracy**
- **Non operator Dependent**
- **As it provides entire view of abdomen other diagnoses can be made easily**
- **Can be done at any point of time**
- **CT is credited wit drop in Negative appendectomy rate from 20% to 3 % (ref – AJR 2005)**

Cons

- **Expensive**
- **Radiation risk is high**

Case -1

- Young child with abdominal pain
- Radiation from umbilicus to RLQ
- History of Nausea/ vomiting / fever
- RBT + / Rovsing sign +ve
- Raised WBC
- PUS Cells in CUE

Case -2

- Adult male
- h/o Abdominal pain – RLQ
- More than 1 day
- Diarrhoea +
- Outside food intake
- No classical signs of appendicitis
- WBC –Normal / CUE – No pus cells

Case-3

- 35 year old male
- Obese
- Pan abdomen since 6 hours – history not clear
- Known case of renal stones
- Operated twice for it
- Abdominal tenderness all over abdomen
- WBC – Raised / CUE- Plenty of pus cells

European Association of Endoscopic Surgery (EAES) Recommendations

- The EAES has made the following recommendations
- Ultrasound is reliable in increasing the likelihood of acute appendicitis but not reliable in excluding the diagnosis.
- CT scanning with IV contrast is superior to ultrasound for appendicitis diagnosis.
- MRI can provide similar diagnostic accuracy to CT.
- Recommend that ultrasound be performed as a first-level diagnostic imaging, although it has lower diagnostic value if confirmation is desired.
- If after ultrasound, the diagnosis is not confirmed or ruled out, CT or MRI should be performed.
- In obese patients, CT or MRI is more accurate than ultrasound and recommended in cases of doubt of diagnosis.
- In pregnant patients, MRI is recommended if diagnosis is in doubt.
- In children, MRI is recommended if diagnosis is in doubt.
-

American College of Radiology Says :

- For confirmation of appendicitis, the American College of Radiology (ACR) appropriateness rating for CT of the abdomen (intravenous contrast) for acute right lower quadrant pain is 8, compared with 6 for ultrasound (graded compression)

Take Home Points

- **Classical presentation doesn't require imaging – Reserve it for equivocal cases**
- **USG – Choice of imaging in children , women and pregnant ladies**
- **USG & CT Specific enough to rule in But CT Scan is sensitive enough to rule out diagnosis**

Take a clue

- The decision of Imaging depends on your Institutional policy / availability of experts and of course patient factors like age , sex and body habitus .
- Labs & Imaging studies are helpful – but No single investigation can substitute diagnostic accuracy of an Expert physician / surgeon

Thanks my team at Hospital



My life – 3 things



Teşekkür ederim

