



Abnormalities of the GI tract – ultrasound findings and CT correlation

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1. Learning Objectives

Review some of the most frequent iconographic findings on ultrasound (US) of gastrointestinal (GI) tract abnormalities and establish CT correlation

Review some of the most frequent “pitfalls” of both techniques



2. Background

It is fundamental for every radiologist to be familiar with gastrointestinal tract abnormalities, either related to acute or chronic pathology, and the corresponding findings on US and CT.

ULTRASOUND

US is usually the first exam to be performed in patients with abdominal pain or GI symptoms, due to its rapid availability and lack of ionizing radiation. However, sometimes the US findings alone are insufficient for the diagnosis and should be aided with CT examination.

Most radiologists that perform abdominal imaging are extremely familiar with CT findings of gastrointestinal pathology. However, the same can't be said for US findings. US tends to be a more difficult evaluation due to the patient's body type, bowel gas and peristalsis. Nevertheless, the diseased intestine elicits certain key characteristics that aid the diagnosis, such as:

- thickened bowel wall
- narrowed lumen
- decreased peristalsis

Abdominal Ultrasound

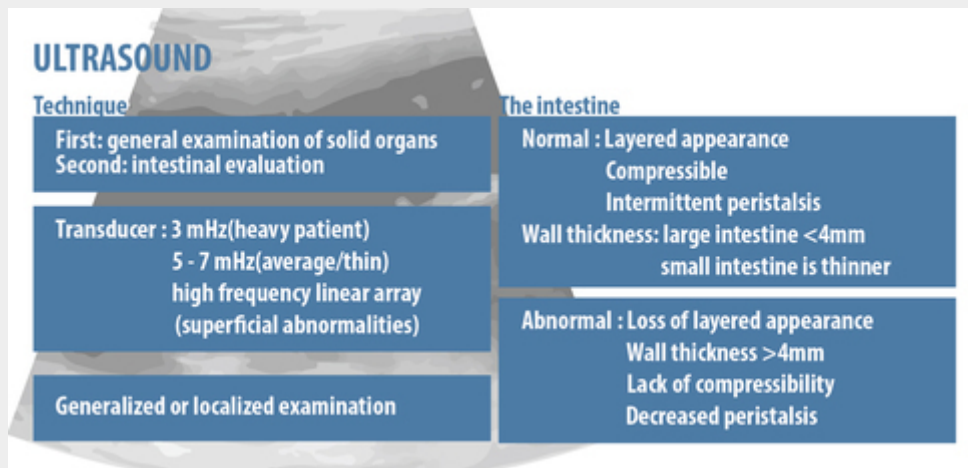


Fig.1 - Basic principles of abdominal ultrasound imaging.

During US evaluation of the intestine one should keep in mind that it is important to assess the degree and distribution of wall thickness to try to establish an underlying cause. Also, if a focal mass is noted, it's important to determine the relationship to the bowel wall, either intraluminal, mural or exophytic, which is not always easy with this imaging modality.

Another key feature to keep in mind is that the pericolic fat when inflamed or infiltrated by an infectious process, becomes hyperechoic and can even produce a mass effect.

COMPUTED TOMOGRAPHY

Without any doubt, CT has become an important modality in the evaluation of gastrointestinal pathology, specially acute pathology. It is a time-effective and accurate tool providing important information and sometimes yielding alternative diagnosis to the main clinical suspicion.

The following scheme demonstrates some of the advantages of CT in abdominal imaging and a simplified protocol for abdominal evaluation. It is important to keep in mind the the protocol should be adapted to the patients' clinical setting and laboratory findings.

MULTI DETECTOR CT

Advantages

Shorter acquisition time
Less respiratory artifacts
Thinner collimation
Better contrast exploitation

Protocol

Adapt to the clinical-laboratory findings of each patient
Acquire non-enhanced images
(depict haemorrhage or calcified stones)
Contrast enhancement : Iodinated agents(portal phase)
Oral contrast agents(GI perforation)

Fig.2 - Schematic representation of key aspects in CT abdominal imaging: advantages of MDCT and simplified protocol.

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3. Imaging Findings/Procedure Details

Although there are many ways to subdivide gastrointestinal abnormalities, most of them, being inflammatory or infectious, manifest as an acute pathology. Figure 3 proposes a simple approach to abdominal pain and most frequent underlying causes.

Acute Abdominal Pain

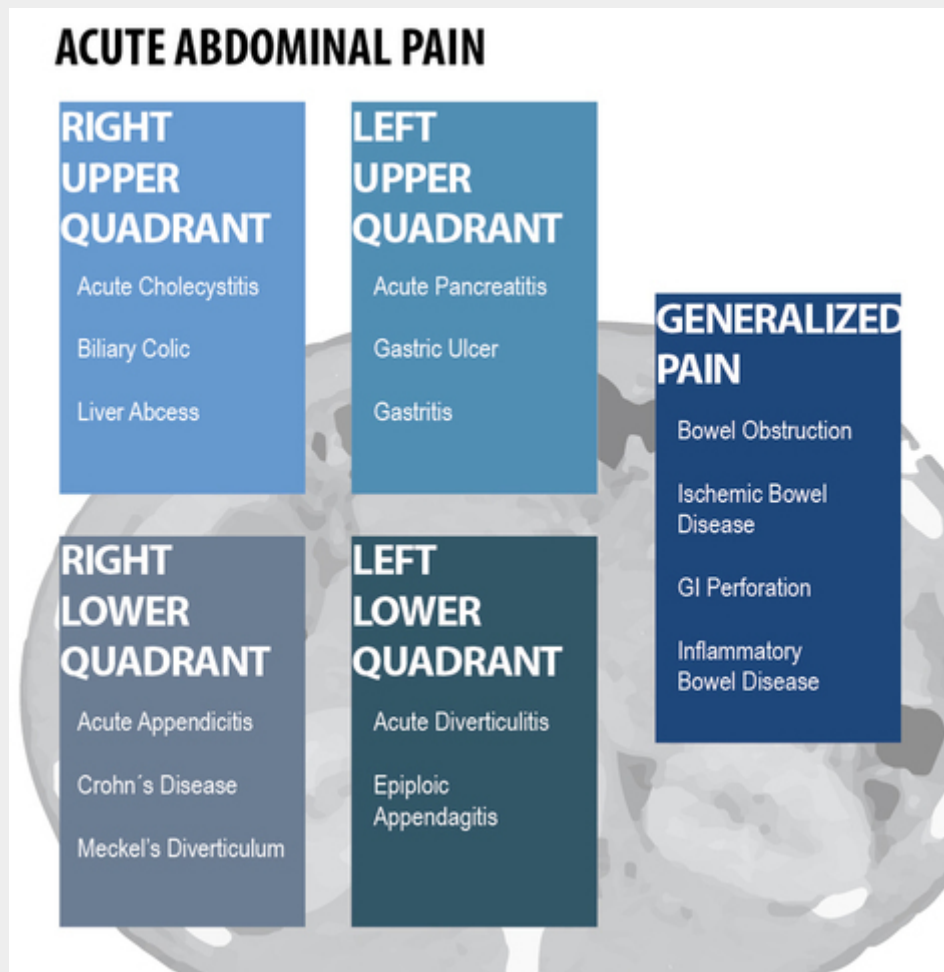


Fig.3 - Schematic representation of possible underlying causes for abdominal pain, according to topographic location of the pain.

The following section will focus on most frequent underlying GI tract abnormalities, causing acute abdominal pain, with regards to its topographic location in the abdomen. The images displayed are from cases seen at our department.

RIGHT UPPER QUADRANT

ACUTE CHOLECYSTITIS

Gallbladder disease is a common cause of abdominal pain. Acute cholecystitis is without any doubt one of the most frequent causes of hospital admission and right upper quadrant pain. Usually, it results from a gallstone impaction (95%) in the gallbladder neck or cystic duct, while in a limited number of patients (5%) it is acalculous, related to bile stasis, gallbladder ischemia or systemic infection, occurring in critically ill patients. This latter form of cholecystitis poses a difficult diagnosis due to less specific imaging findings.

US represents the preferred method of evaluation of acute gallbladder disease and gallstone

detection, when compared with CT. CT is better suited to evaluate complicated cholecystitis.

On US, acute cholecystitis should be suspected when:

- gallbladder wall thickening (>3mm)
- wall edema
- gallbladder distention
- positive sonographic Murphy sign
- pericholecystic/ perihepatic fluid

On CT, the first three changes described with US can also be seen. Also, other findings are detected, such as:

- increased attenuation of bile
- perycholecystic inflammatory fat stranding
- transient hepatic attenuation difference (THAD), secondary to edematous hyperattenuation of the gallbladder fossa.
- complications: emphysematous cholecystitis, gangrenous cholecystitis, hemorrhage and gallstone ileus.

Acute Cholecystitis

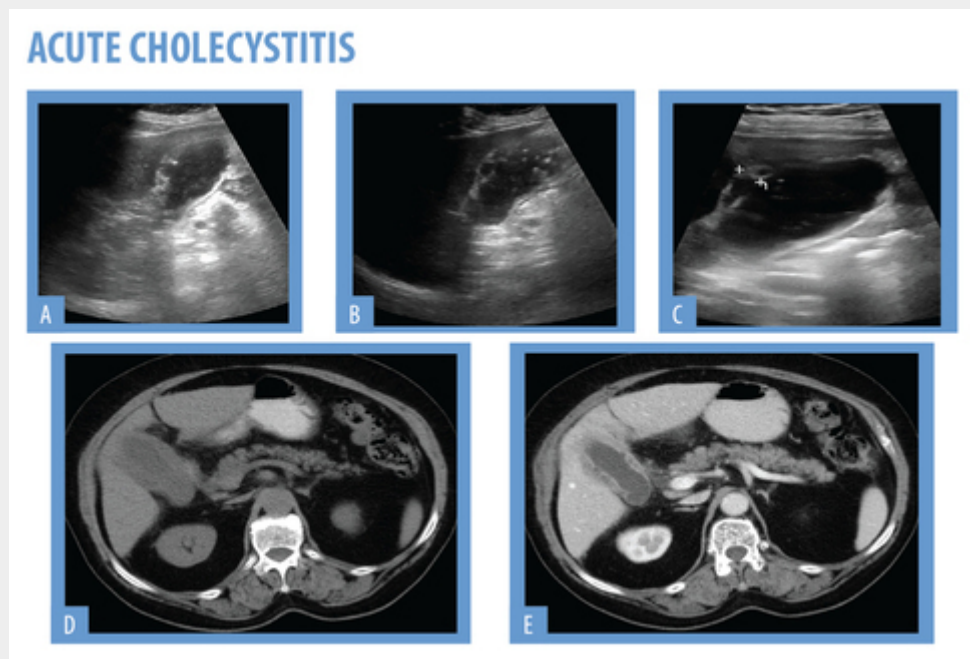


Fig.4 - 52 year-old patient presenting with RUQ pain. On US (A,B,C) the gallbladder is distended, with wall thickening, edema and stratification. CT images before intravenous contrast (E) and after (D) also demonstrate wall thickening and discrete pericholecystic fat stranding.

Emphysematous Cholecystitis

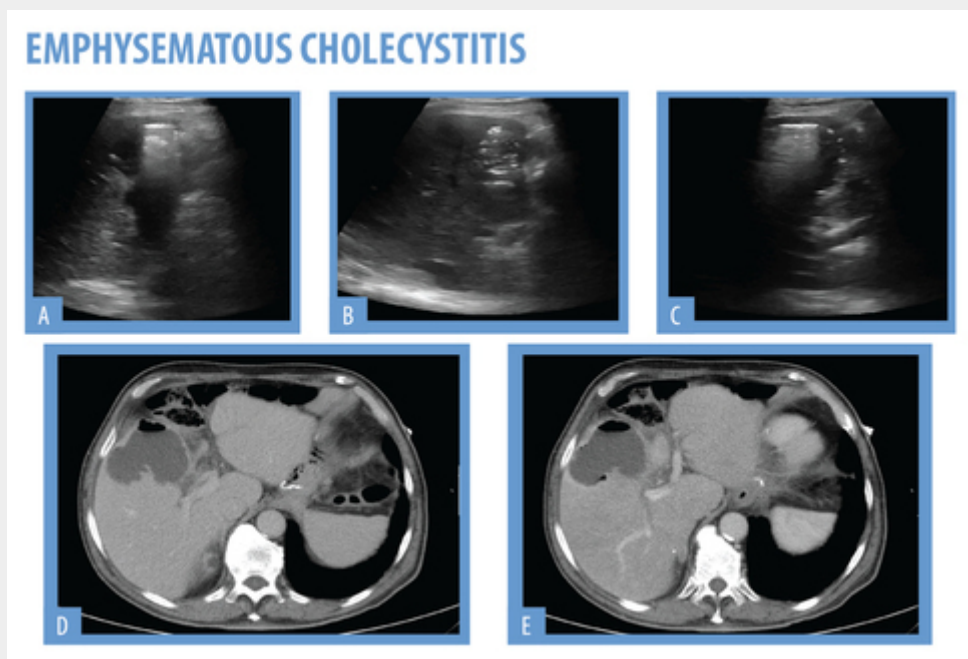


Fig5. 74 year-old diabetic patient. Presented with intense RUQ pain, fever and hypotension. On US (A,B,C) the gallbladder is filled with heterogeneous content, containing multiple foci that cast a "dirty shadow". There appears to be air in the gallbladder wall. The patient underwent CT (D, E) which corroborates the US findings.

LIVER ABSCESS

Hepatic abscesses might have multiple causes. The causative agent can be divided according to the demographics of the affected population. In developed countries, they tend to occur in immunocompromised patients. They can be subdivided in pyogenic, fungus and amoebic abscesses, but in most cases the abscess is polymicrobial, with the most frequent gram negative aerobic and anaerobic agents being *E.coli*, *Klebsiella bacterioides* and *bacteroides*. As for gram positive agents, the most common are streptococci and enterococci.

A typical clinical presentation is RUQ pain, fever and jaundice.

As for imaging, on US liver abscesses appear as poorly demarcated lesions with variable appearance, ranging from predominantly hypoechoic (with some internal echoes) to hyperechoic. Gas bubbles can also be seen. When aided with Doppler, there is usually no central perfusion.

On CT, they also have a variable appearance. Generally, they appear as peripherally enhancing, centrally low density lesions. Occasionally, they appear solid or gas containing.

Liver Abscess

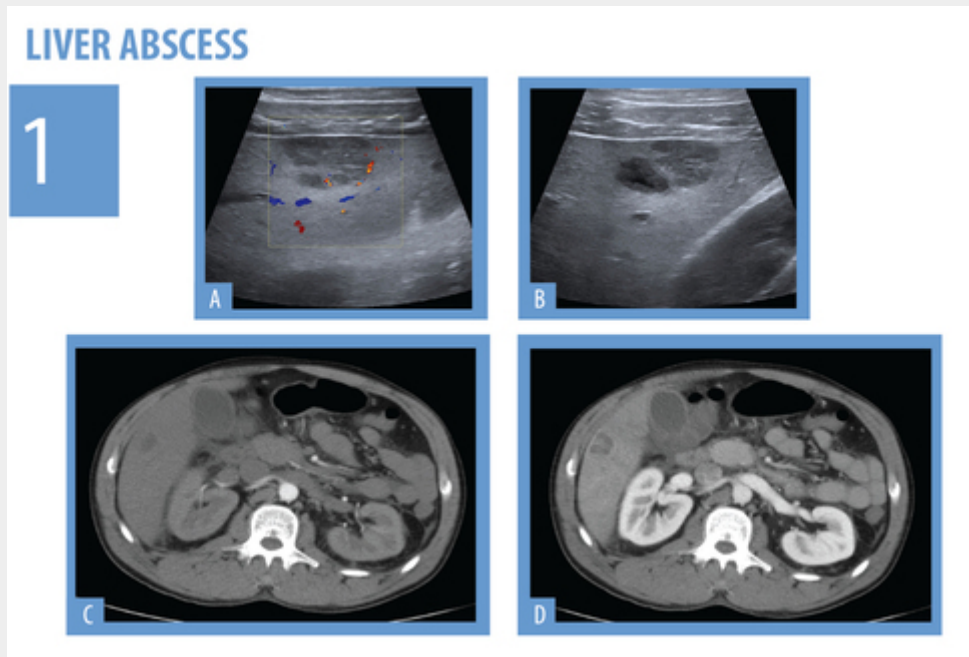


Fig.6.1 - 64 year-old patient presenting with high grade fever and RUQ pain. On US (A,B) there is an apparent heterogeneous image on the right liver lobe. It had no internal Doppler signal. Due to rapidly deterioration, CT (C,D) was performed before and after intravenous contrast which demonstrated a heterogeneous lesion, with irregular contours and peripheral enhancement. There seem to be some thin septa within the abscess.

Liver Abscess

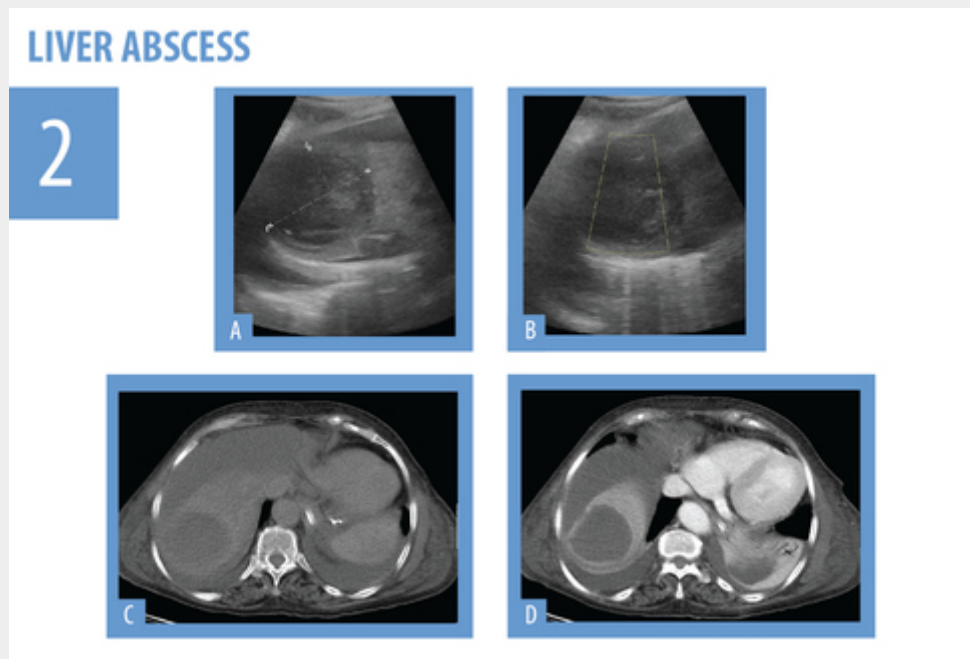


Fig.6.2. - 37 year-old intravenous drug user. He presented with fever, RUQ, loss of appetite. On US (A,B) there is a heterogeneous mass in the right liver lobe, in subcapsular location. This lesion also showed no internal Doppler sign. CT images (C,D) confirm the US findings, and also demonstrate perihepatic and perisplenic fluid.

LEFT UPPER QUADRANT

ACUTE PANCREATITIS

Acute pancreatitis can be caused by a wide variety of causes. Usually, it is either due do alcohol consumption or gallstones. Typically, it presents as upper abdominal and back pain, with elevated levels of pancreatic enzymes. It can either be mild or progress to severe multisystem failure. This entity has no pathognomonic imaging findings.

Ultrasound is usually employed to evaluate the biliary tract for gallstones, exclude liver disease or detect important causes of biliary obstruction.

One must keep in mind that in mild cases of acute pancreatitis, the pancreas might appear normal and therefore US does not exclude this diagnosis. In these cases, US is important to exclude other causes of upper abdominal pain.

Some of the US findings considered hallmarks for acute pancreatitis are:

- pancreatic enlargement
- decrease or heterogeneous pancreatic echogenicity
- peripancreatic, periduodenal, perivascular and perirrenal fluid collections
- identifying local complications: pancreatic necrosis, abscess and pseudocyst formation

CT is useful for staging of acute pancreatitis. It has no real value in within the first 72 hours. In fact, early CT can be misleading concerning the severity of the disease. Therefore, this should be reserved

for cases of known acute pancreatitis and evaluation of complications, which can have variable appearances.

Acute Pancreatitis

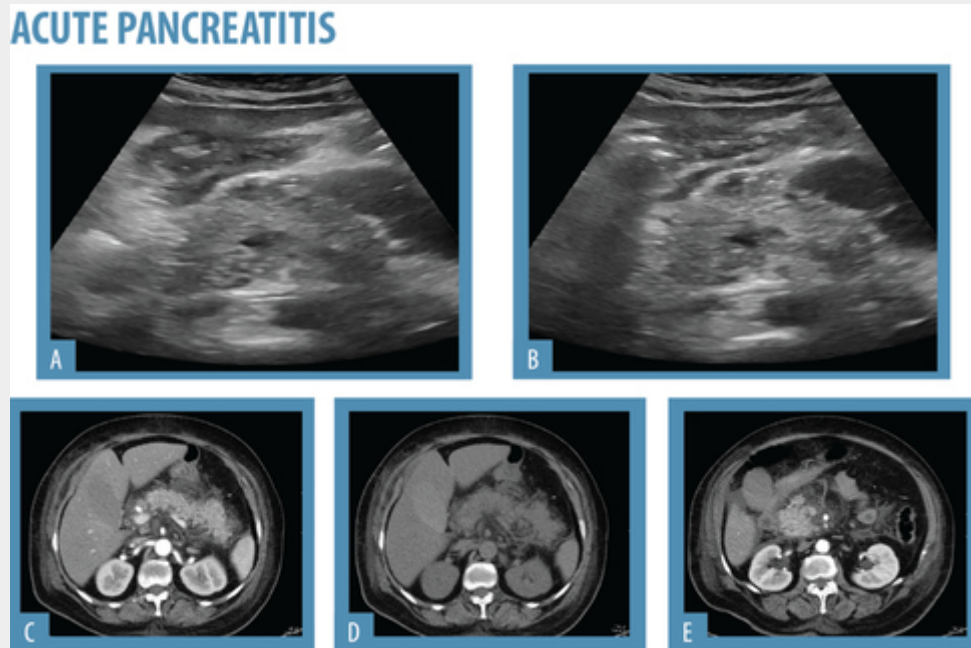


Fig.7 - A) and B) are US images of the pancreas. There is marked enlargement of the pancreatic gland and irregular contours. The patient underwent CT (C,D and E) which corroborates the US findings. There is marked pancreatic enlargement and fat densification, but no collections are apparent.

Complicated Acute Pancreatitis

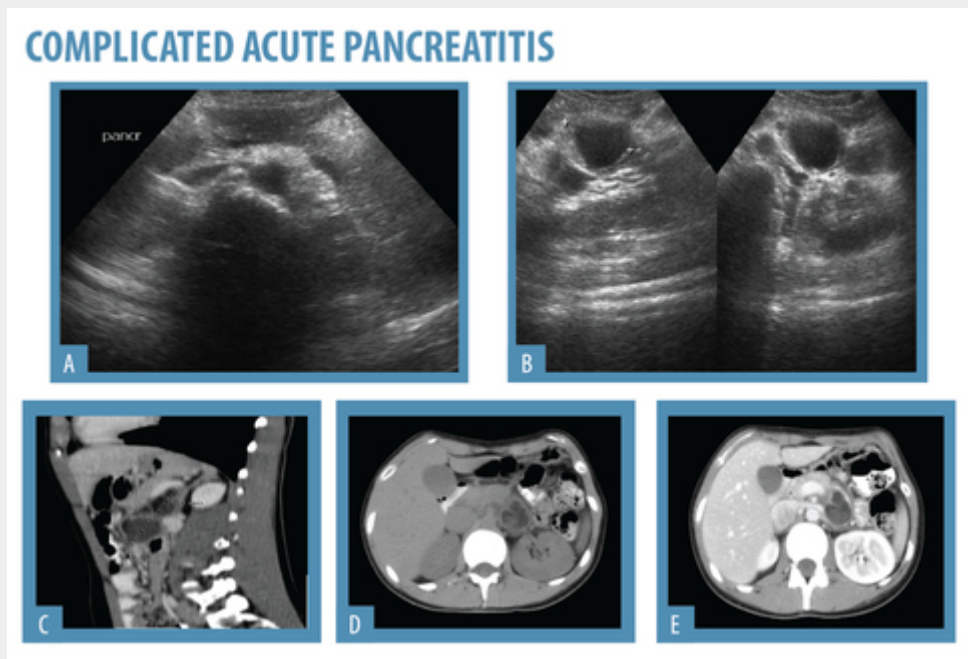


Fig.8 - 55 year-old patient with history of acute pancreatitis. The patient was hospitalized following yet another episode of acute pancreatitis. Due to worsening of abdominal pain, the patient underwent US (A,B) which revealed an anechoic, oval image, adjacent to the pancreatic tail and afterwards CT (C,D,E) that also shows an enlarged pancreas and a fluid-filled collection adjacent to the pancreatic tail, with some peripheral enhancement.

RIGHT LOWER QUADRANT

ACUTE APPENDICITIS

Without any doubt, acute appendicitis is the most frequent cause of right lower quadrant pain. On ultrasound examination, the diagnosis of appendicitis is established when a distended, non compressible appendix is seen. As said before, the inflamed periappendiceal fat becomes hyperechogenic. On seldom occasions, described in some series as 30%, an appendicolith can be seen as an echogenic, shadow casting structure within the lumen of the appendix.

In equivocal cases, CT can reveal the following changes:

- fluid filled and enlarged appendix
- focal wall thickening
- periappendiceal fat stranding
- appendiceal wall enhancement
- appendicolith
- periappendiceal fluid

If perforation occurs, it can either cause an abscess or phlegmon. Non visualization of the appendix on CT, virtually excludes acute appendicitis.

Acute Appendicitis

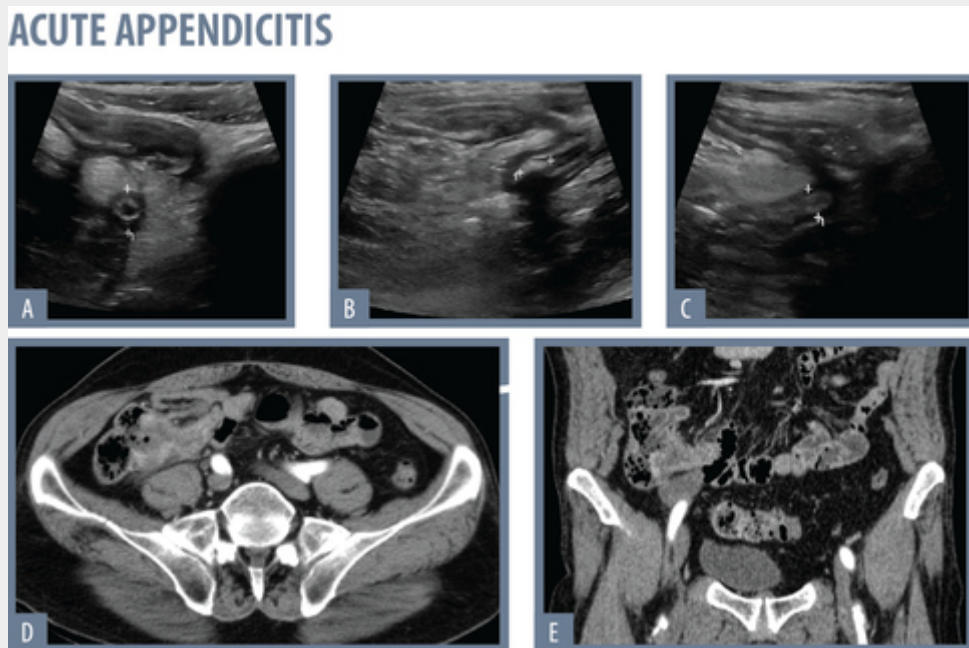


Fig.9 - A),B) and C) ultrasound revealing appendiceal wall thickening, as well as periappendiceal fluid. There is also a hyperechoic shadow-casting image corresponding to an appendicolith. D) and E) are the corresponding CT images

CROHN'S DISEASE

The inflammatory changes in Crohn's disease produce a very straightforward image in US: bowel wall thickening. This mainly occurs due to transmural inflammation of the affected bowel. The perienteric fat, also inflamed, becomes hyperechogenic and thickened, leading to separation of adjacent bowel loops. With time, the perienteric fat can proliferate causing a mass-like appearance ("creeping fat" sign).

In the active phase of the disease the submucosa appears thickened and hyperechoic. In the chronic phase, there is still wall thickening, but the bowel wall is hypoechoic due to fibrosis.

Fistulas, a common complication in Crohn disease, can be seen as hypoechoic tracts extending to adjacent structures.

CT is useful in the acute phase of the disease, revealing diffuse wall enhancement after contrast administration. This examination allows for a better characterization of mesenteric involvement, which usually exhibits hypervascularity.

Crohn's Disease

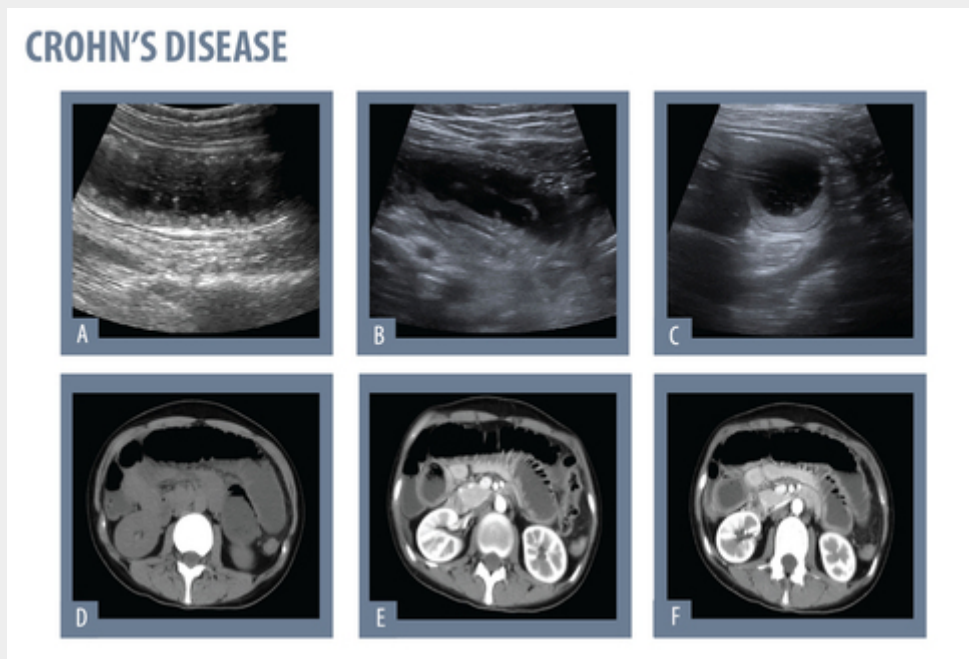


Fig.10 - 26 year-old patient presenting with RLQ pain, with a recent history of weight loss and diarrhea. On US (A,B, C) there were dilated bowel loops, with wall thickening and fluid-filled. On CT (D,E,F) there was apparent jejunum, ileum and ascending colon distention, and densification of the pericolic fat. She was admitted and diagnosed with Crohn's disease.

MIMICKER

PSEUDOMEMBRANOUS COLITIS

Caused by *Clostridium difficile*, pseudomembranous colitis most frequently occurs as a result of antibiotic therapy. Usually, it leads to a pancolitis, but segmental involvement can occur. The wall of the affected bowel becomes markedly thickened, causing narrowing of the lumen. As these changes can be seen with other causes of colitis, diagnosis is based on clinical history and stool cultures.

On US examination, the following changes can be seen:

- wall thickening (segmental or not)
- gyrated pattern of the mucosa

On CT, the following changes are characteristic:

- wall thickening (from 3mm to 32mm), irregular and shaggy
- marked enhancement of the colonic wall and mucosa after intravenous contrast
- "target sign" (mucosal hyperemia and submucosal edema or inflammation)
- "accordion sign" (entrapment of oral contrast on thickened haustral folds, with alternating folds of high attenuation and low attenuation)
- pericolic stranding (usually mild)

Pseudomembranous Colitis

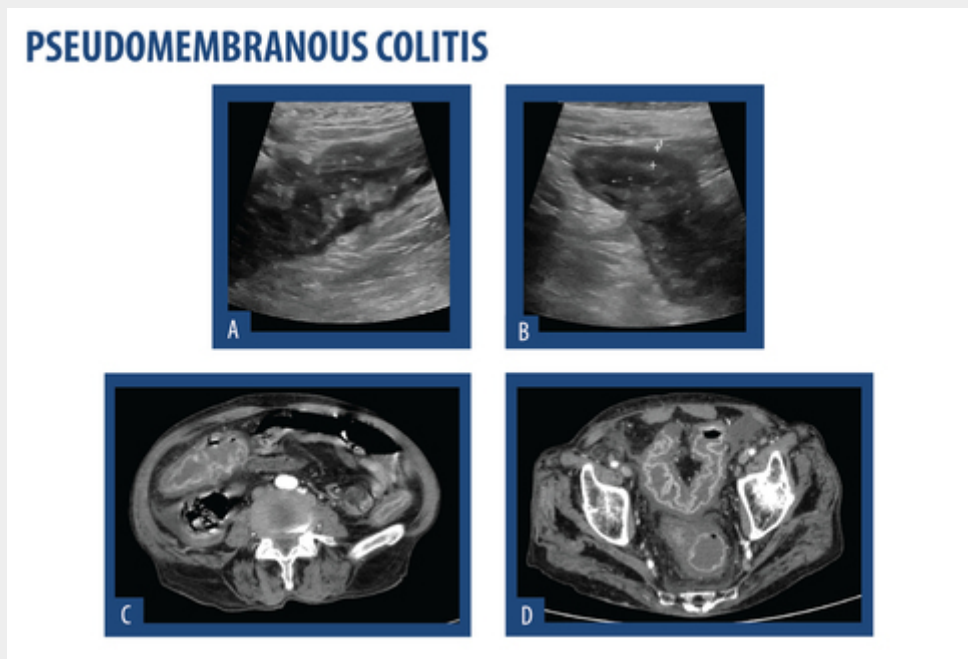


Fig.11 - 35 year old patient with recent diarrhea and presenting with acute RLQ pain. On US (A,B) there was marked thickening of bowel loops and some fluid within and surrounding the bowel. There was high suspicion for inflammatory bowel disease. The patient underwent CT (C,D) which demonstrated an irregular and "shaggy" wall thickening and enhancement of the luminal surface, indicating hyperemia.

MECKEL'S DIVERTICULUM

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract. Seen in about 2% of the population, it results from a failure of the omphalomesenteric duct to regress. Most diverticula (75%) are found within 100cm from the ileocecal valve. Although equally occurring in both sexes, complications are more frequent in male patients. They are usually asymptomatic and an incidental finding. When complications occur, the most frequently seen are hemorrhage, small bowel obstruction and diverticulitis.

On US, they usually appear as fluid-filled structure in the RLQ, with a typical "gut signature" (hyperechoic mucosa) and a clear connection to a peristaltic, normal, small bowel loop. They can contain enteroliths, identified as echogenic shadow-casting foci.

On CT, Meckel's diverticulum is usually difficult to distinguish from normal bowel, unless complications are present. The most common appearance is a blind-ending fluid or gas filled structure, in continuity with small bowel. CT is useful to identify the possible complications of this diverticulum, namely diverticulitis, appearing as a:

- fluid or gas filled blind pouch
- wall thickening
- surrounding mesenteric inflammation

Meckel's Diverticulum

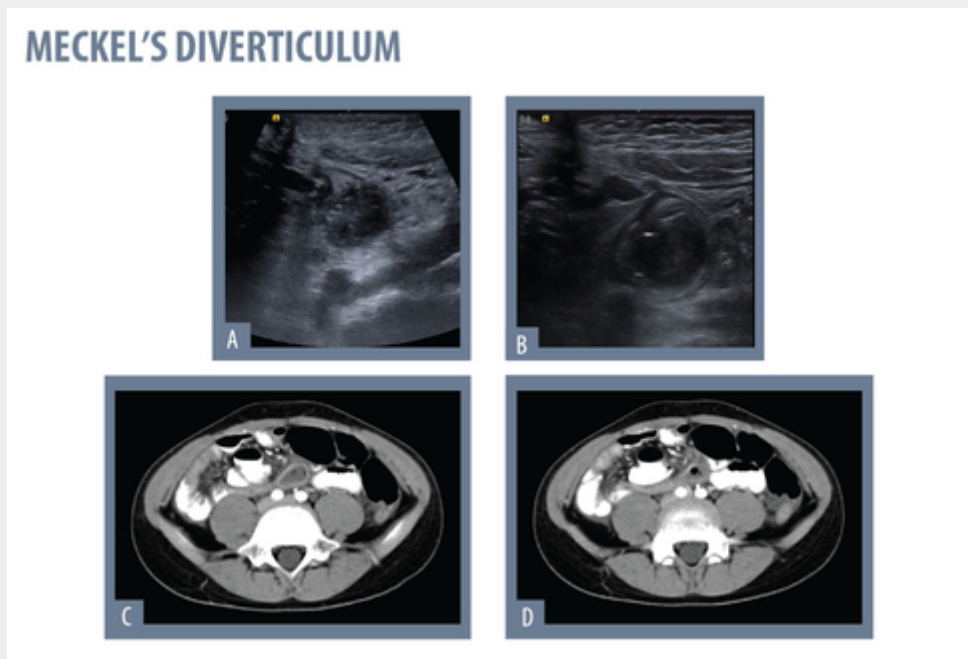


Fig.12 - 20 year-old patient presenting with acute RLQ pain. On US (A,B) there a rounded image, which appeared fluid filled some echogenic foci casting a "dirty shadow", suggestive of air. It was adjacent to the bowel wall, and seemed continuous with it through a pedicle. CT (C,D) revealed that the rounded image seen on US was actually a finger-like projection that extended from the right iliac fossa, fluid and air filled. There was some adjacent fat stranding. An inflammation of a Meckel's diverticulum was diagnosed.

LEFT LOWER QUADRANT

ACUTE DIVERTICULITIS

Diverticulitis is an inflammation that results from perforation of a diverticulum. Diverticula are outpouchings of the bowel wall that occur when there's increased pressure in the intestinal lumen, being more common in the left colon, namely the sigmoid.

At US, the diverticula may contain echogenic material, which is believed to be air and fecal material. Usually, the muscular hypertrophy and inflammation produce segmental hypoechoic bowel wall thickening. As stated before, when the pericolic fat becomes inflamed, it appears hyperechoic. When complicated, the most easily recognized abnormality is the abscess, with appears as a fluid collection that contains echogenic foci and produces "dirty shadowing" due to contained air.

Although not fundamental for the diagnosis, CT can become helpful in the cases where no diverticulum is seen. It also fundamental in the evaluation of complicated diverticulitis. On CT, the most frequent findings are:

- peri-colonic fat stranding
- segmental wall thickening (>4mm)
- fluid collections
- engorgement of mesenteric vessels

- complications: perforation (either "walled off" or free, the latter leading to pneumoperitoneum), abscess, fistula and obstruction.

Acute Diverticulitis

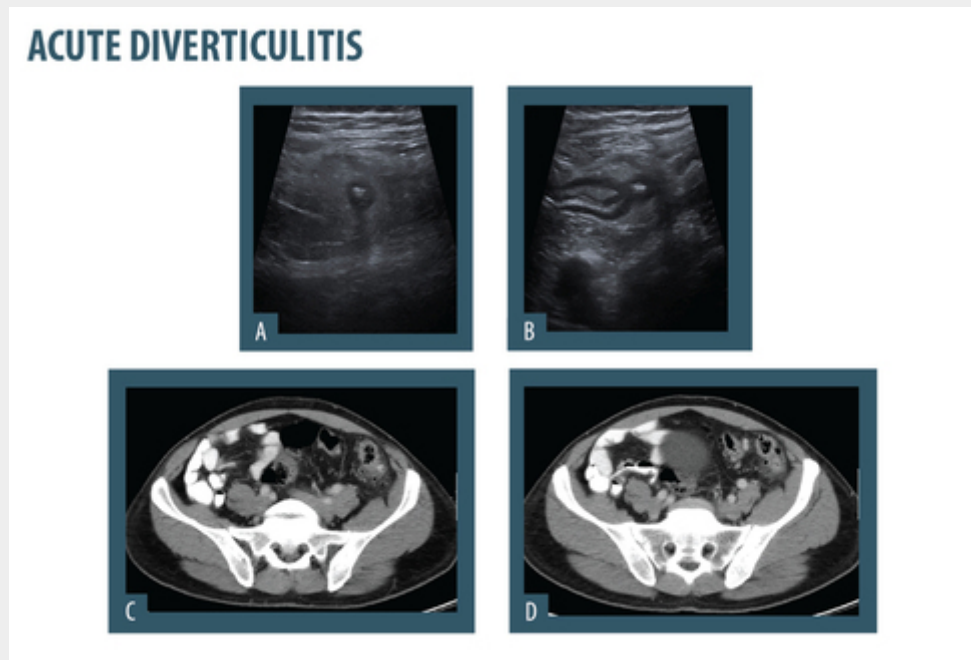


Fig.13 - 63 year-old patient presenting with acute lower quadrant pain. On US (A,B) there is apparent thickening of the bowel wall, which was also aperistaltic. There seems to be some pericolonic fluid. On CT (C,D) there are some air filled "finger-like" projections on the sigmoid wall, suggestive of diverticula. There is enhancement of the mucosal wall, compatible with inflammation.

EPIPLOIC APPENDAGITIS

Epiploic appendages represent fat tags that line the serosal surface of the colon. Inflammation can occur if there's torsion or venous thrombosis that lead to ischemia or infarction.

Like right-sided diverticulitis, this entity is also a great mimicker and should be kept in mind, since there's no need for surgical treatment.

At US, the inflamed appendage appears as a hyperechoic finger-like projection in the bowel wall. The pericolonic fat adjacent to the epiploic appendage may also become inflamed, and appear highly echogenic,

On CT, these finger-like projections usually appear as structures of fat attenuation, arising from the colonic wall.

Epiplonic Appendagitis

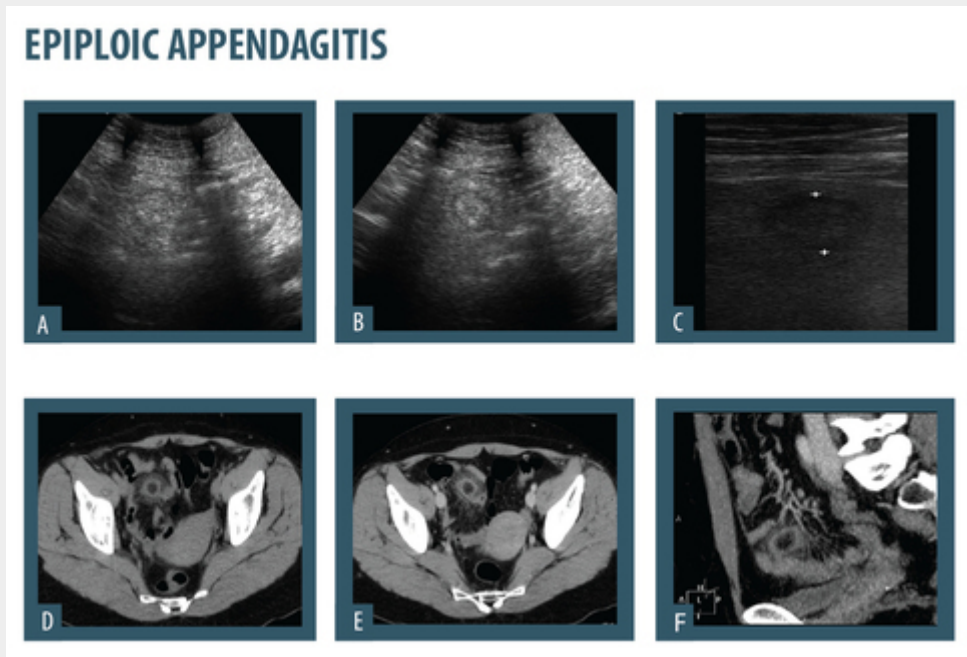


Fig. 14- 49 year-old patient presenting with lower quadrant pain, irradiating to the LLQ. On US (A,B,C) there is a rounded image, with thickened walls, non-compressible and painful with applied pressure of the transducer. On CT, this rounded lesion was localized in the antimesenteric surface of the colon and had central fat attenuation and showed peripheral enhancement. This was diagnosed as an epiplonic appendagitis.

GENERALIZED PAIN

BOWEL OBSTRUCTION

Bowel obstruction is a frequent cause of generalized abdominal pain, which can be either acute or chronic, mechanical or functional. Regardless of its underlying cause, it leads to a lack of transit in intestinal contents. There are many ways to classify bowel obstruction, either due to **pathology** (dynamic vs adynamic), **anatomy** (small bowel vs large bowel), **nature of presentation** and **pathological changes seen in the bowel**.

It is a frequent cause of hospitalization and represents up to 20% of all surgical admissions due to acute abdominal pain.

The clinical presentation will vary according to the onset of obstruction, if it's acute, subacute or chronic, the site of obstruction (small bowel vs large bowel), the duration and cause of obstruction and the presence or absence of strangulation.

In adults, the most frequent causes of bowel obstruction, specially in the small bowel, are extrinsic: adhesions, which can be either post-inflammatory, post-operative, post-radiation or due to drugs, and hernias. Therefore, the following images illustrate bowel obstruction due to these causes.

The imaging findings vary according to the site of obstruction. US shouldn't be the first line modality to evaluate small bowel obstruction, mainly because the bowel loops are filled with gas, producing non diagnostic sonograms. However, if the loops are filled with fluid and dilated, the level and

underlying cause can be seen. The sonographic criteria for obstruction are:

- dilated bowel loops (>3cm)
- length of involved segment >10cm
- increased peristalsis of the dilated segment (whirling motion of the bowel)
- if there's bowel infarction: aperistalsis, free fluid between dilated bowel loops and wall thickening (>3mm) in the dilated loops.

Without any doubt, CT is the modality of choice in case of acute obstruction. It has several advantages:

- doesn't require oral contrast (the fluid within the bowel serves as a negative contrast agent)
- it allows a better characterization of mural (intra ou extra) areas
- helps distinguish between bowel obstruction and ileus
- informs if there is strangulation or not

Its main disadvantage is low-grade obstruction, considered a "blind spot" for this modality.

The most frequent findings with CT are:

- dilated loops of bowel proximally (diameter >2,5cm from outer wall to outer wall)
- normal or collapsed loops (distally)
- identification of the transition sign ("beak sign")
- identification of adhesions or bands (rare)
- demonstrates stasis and mixing of bowel contents ("small-bowel feces sign")
- ischemia:

- thickened bowel wall
- ascites
- "target sign" (enhancement of the mucosal and muscularis layers, with submucosal edema, after contrast)
- poor or absent wall enhancement after intravenous contrast
- pneumatosis intestinalis
- "whirl sign" (twisting of the mesenteric vasculature)
- tortuous, engorged mesenteric vessels
- mesenteric hemorrhage
- increased attenuation of bowel wall on noncontrast scans

Individually, these signs have a low sensitivity for ischemia. However, they are quite suggestive of ischemia when used together.

Bowel Obstruction - Hernias

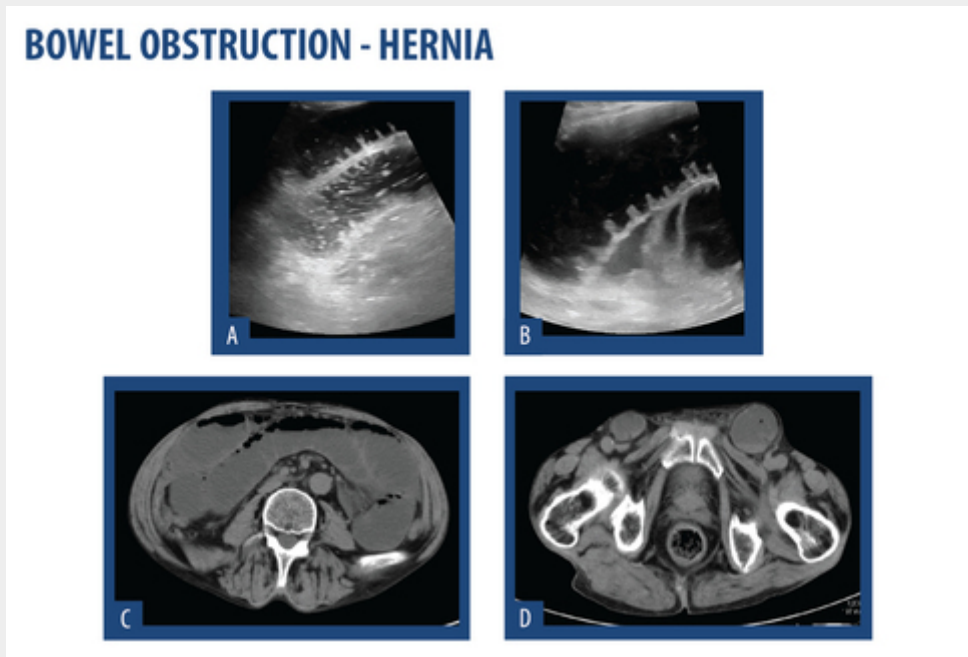


Fig.15 - 53 year-old that present with generalized abdominal pain, drowsiness and altered bowel habits. He had a history of alcoholism. On US (A,B) there was marked bowel distention, involving the small and large bowel. The loops were filled with fluid. No cause of obstruction was identified. He underwent CT (C,D) which revealed two internal hernias, filled with bowel (notice the fluid within the bowel loop), causing the obstruction.

Bowel Obstruction - Adhesions

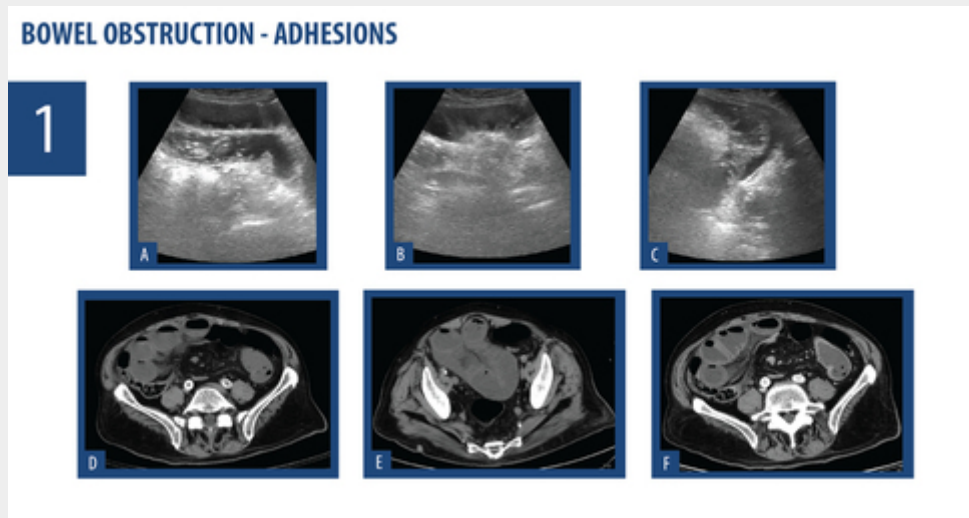


Fig. 16.1 - 80 year-old patient presenting with diffuse abdominal pain. This patient had a recent history of abdominal surgery. On US (A,B,C) there was small bowel distention, with some degree of wall thickening and fluid distended loops. No cause of obstruction was identified. On CT (D,E,F) there is a "whirling" of the mesentery and vascular engorgement. No cause for obstruction was identified, and given the recent history of surgery, this patient was diagnosed with adhesions, surgically confirmed.

Bowel Obstruction - Adhesions

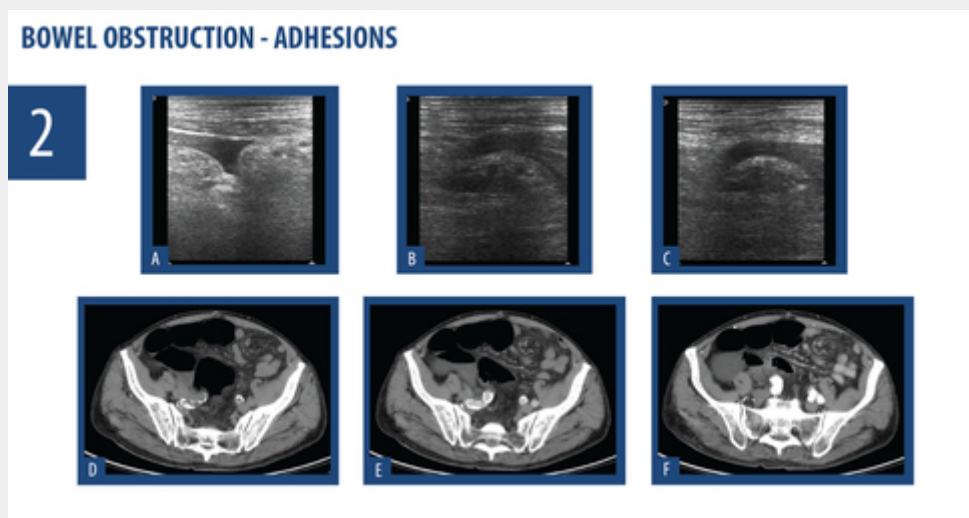


Fig. 16.2 - 83 year-old patient with a history of partial gastrectomy and subtotal colectomy. He was admitted with diffuse abdominal pain. On US (A,B,C) there was bowel distention and wall thickening. He underwent CT (D,E,F) which demonstrated marked fluid distention of the small bowel. There was an image of mesentery rotation which was attributed to adhesions or bands.

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4. Conclusion

US is frequently the first imaging exam performed in case of gastrointestinal (GI) disease and is still a valuable one, mainly because most GI diseases cause changes in the bowel wall which can be detected with this imaging modality. Its lack of ionizing radiation and low cost, make it an appealing imaging modality for GI tract evaluation.

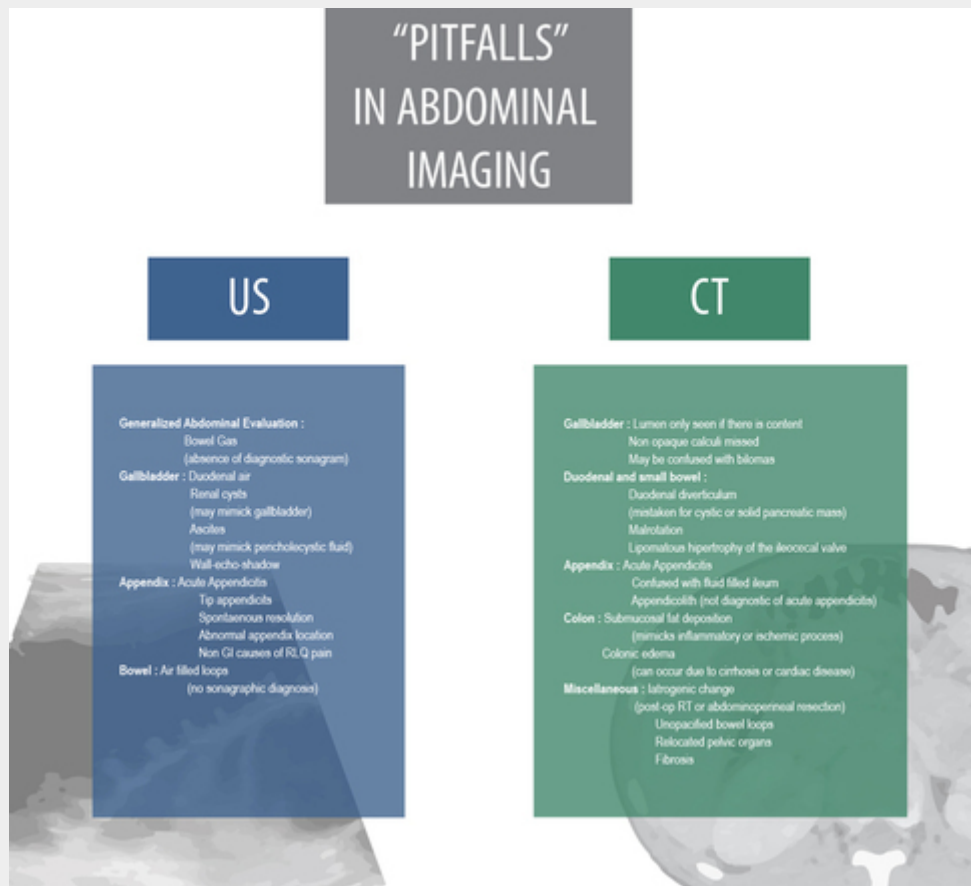
Nevertheless, CT also plays an important role in aiding the diagnosis specially in complicated cases and in case of bowel disease, where this imaging modality provides fundamental diagnostic information, not available through other modalities.

The purpose of this educational exhibit was to review some of the most iconographic characteristics of gastrointestinal pathology, mostly acute, seen on ultrasound and CT. While doing so, we have demonstrated that ultrasound is an effective imaging modality allowing for a rapid diagnosis of acute pathology.

In equivocal cases, or if there's a high suspicion of complications, CT should serve as a complementary examination. If bowel obstruction is the suspected underlying cause for abdominal pain, CT plays a key role in this evaluation since it can answer fundamental questions that determine the adequate clinical treatment of these patients, not possible with other imaging modalities.

Nevertheless, both techniques have some "pitfalls" that are illustrate as follows.

Pitfalls in Abdominal Imaging



Some "pitfalls" seen in ultrasound and CT imaging of the abdomen.

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7. Mediafiles

Abdominal Ultrasound

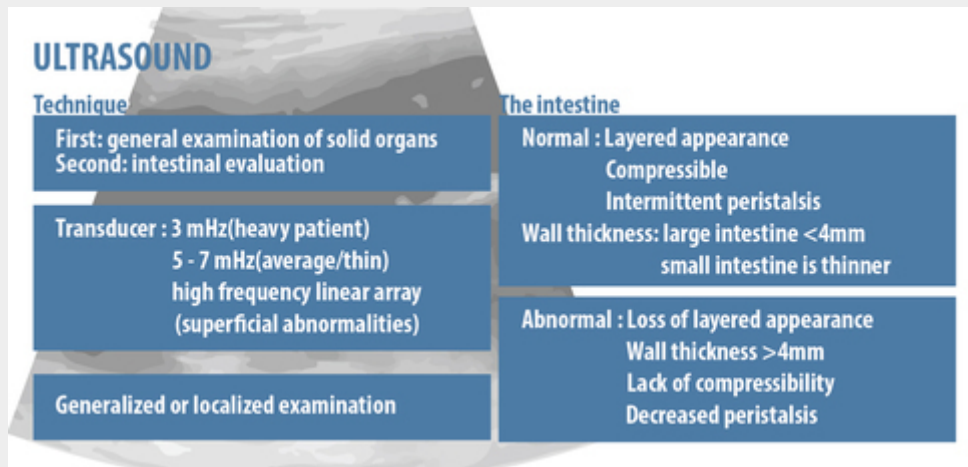


Fig.1 - Basic principles of abdominal ultrasound imaging.

Acute Abdominal Pain

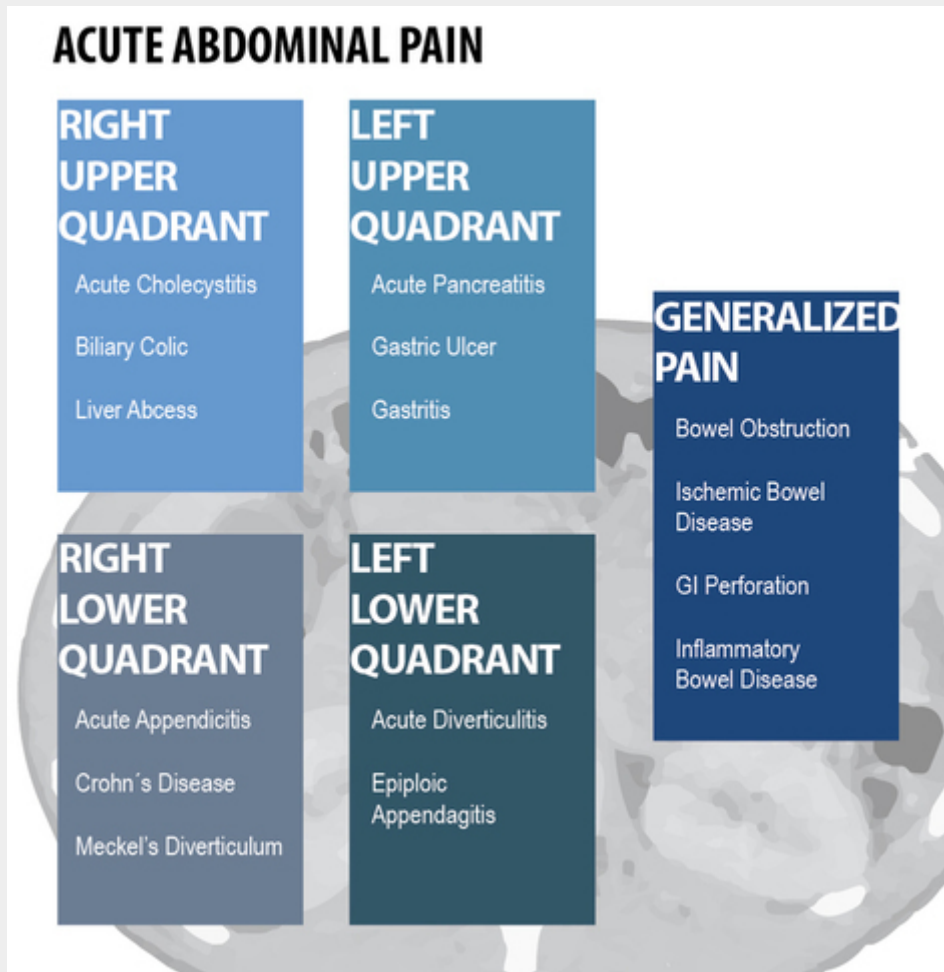


Fig.3 - Schematic representation of possible underlying causes for abdominal pain, according to topographic location of the pain.

Acute Appendicitis

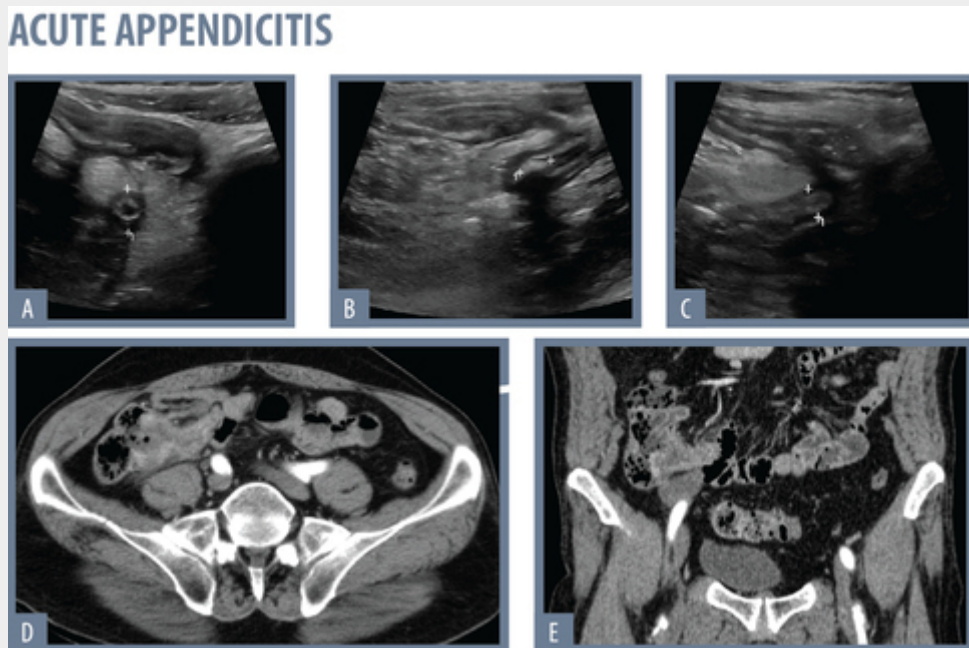


Fig.9 - A),B) and C) ultrasound revealing appendiceal wall thickening, as well as periappendiceal fluid. There is also a hyperechoic shadow-casting image corresponding to an appendicolith. D) and E) are the corresponding CT images

Acute Cholecystitis

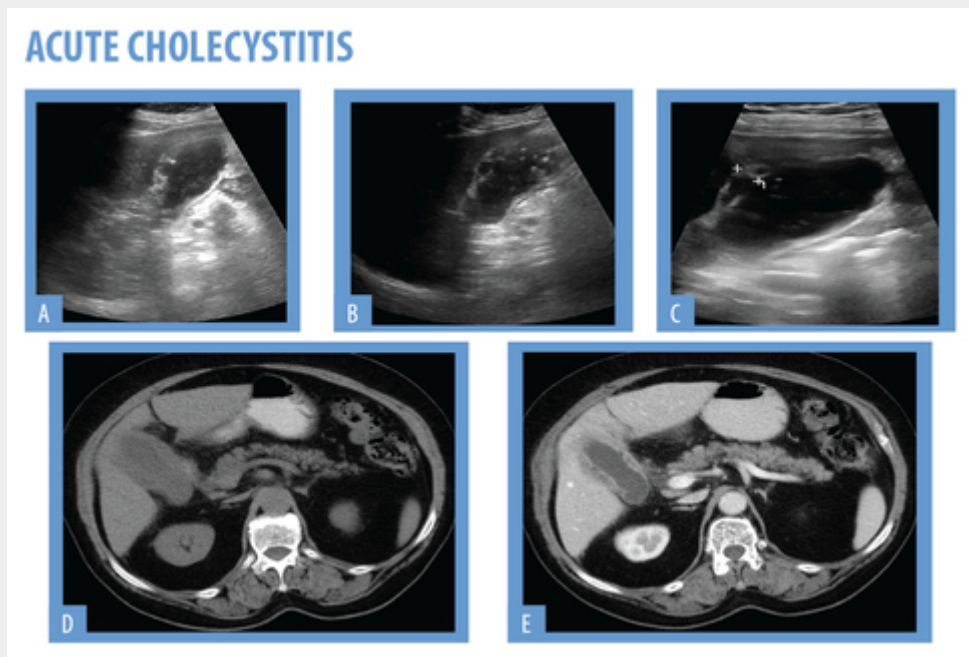


Fig.4 - 52 year-old patient presenting with RUQ pain. On US (A,B,C) the gallbladder is distended, with wall thickening, edema and stratification. CT images before intravenous contrast (E) and after (D) also demonstrate wall thickening and discrete pericholecystic fat stranding.

Acute Diverticulitis

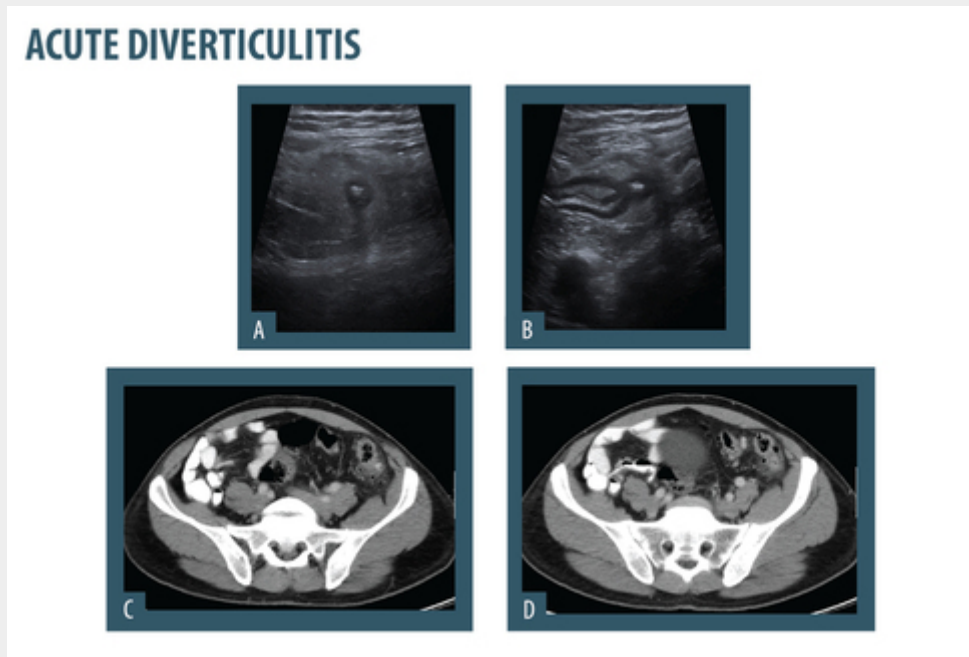


Fig.13 - 63 year-old patient presenting with acute lower quadrant pain. On US (A,B) there is apparent thickening of the bowel wall, which was also aperistaltic. There seems to be some pericolic fluid. On CT (C,D) there are some air filled "finger-like" projections on the sigmoid wall, suggestive of diverticula. There is enhancement of the mucosal wall, compatible with inflammation.

Acute Pancreatitis

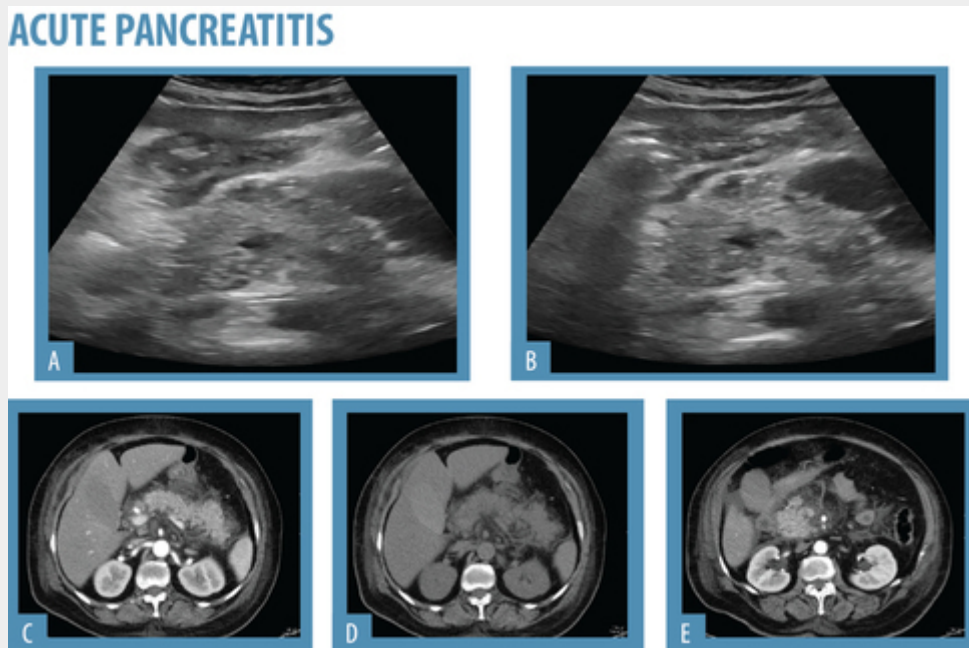


Fig.7 - A) and B) are US images of the pancreas. There is marked enlargement of the pancreatic gland and irregular contours. The patient underwent CT (C,D and E) which corroborates the US findings. There is marked pancreatic enlargement and fat densification, but no collections are apparent.

Bowel Obstruction - Adhesions

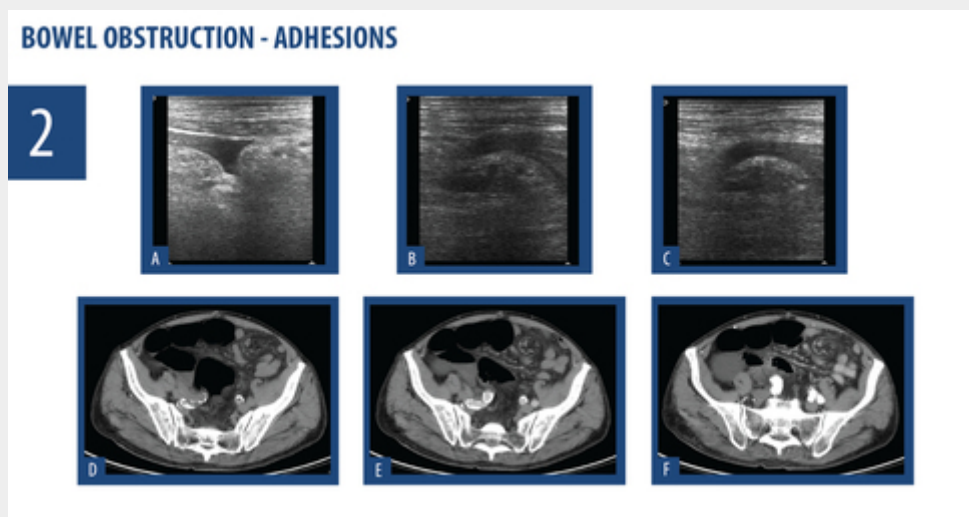


Fig. 16.2 - 83 year-old patient with a history of partial gastrectomy and subtotal colectomy. He was admitted with diffuse abdominal pain. On US (A,B,C) there was bowel distention and wall thickening. He underwent CT (D,E,F) which demonstrated marked fluid distention of the small bowel. There was an image of mesentery rotation which was attributed to adhesions or bands.

Bowel Obstruction - Adhesions

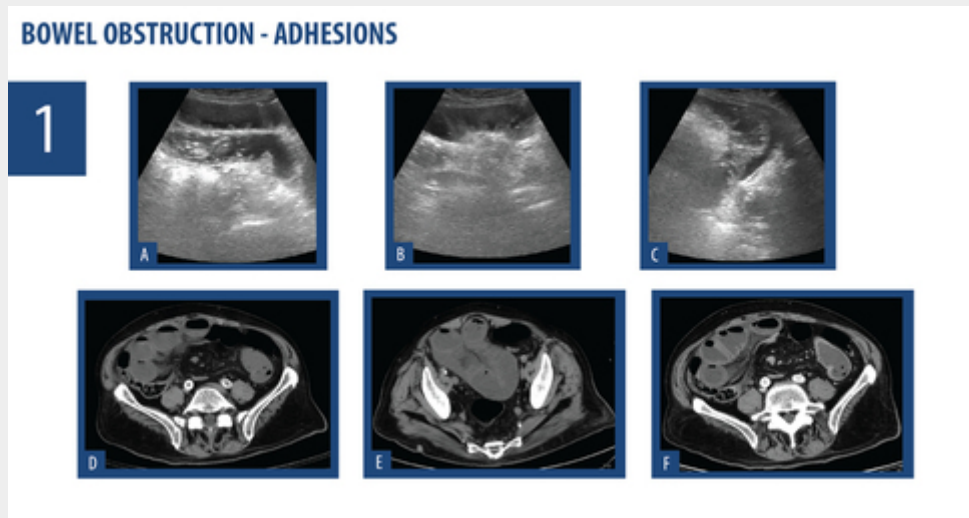


Fig. 16.1 - 80 year-old patient presenting with diffuse abdominal pain. This patient had a recent history of abdominal surgery. On US (A,B,C) there was small bowel distention, with some degree of wall thickening and fluid distended loops. No cause of obstruction was identified. On CT (D,E,F) there is a "whirling" of the mesentery and vascular engorgement. No cause for obstruction was identified, and given the recent history of surgery, this patient was diagnosed with adhesions, surgically confirmed.

Bowel Obstruction - Hernias

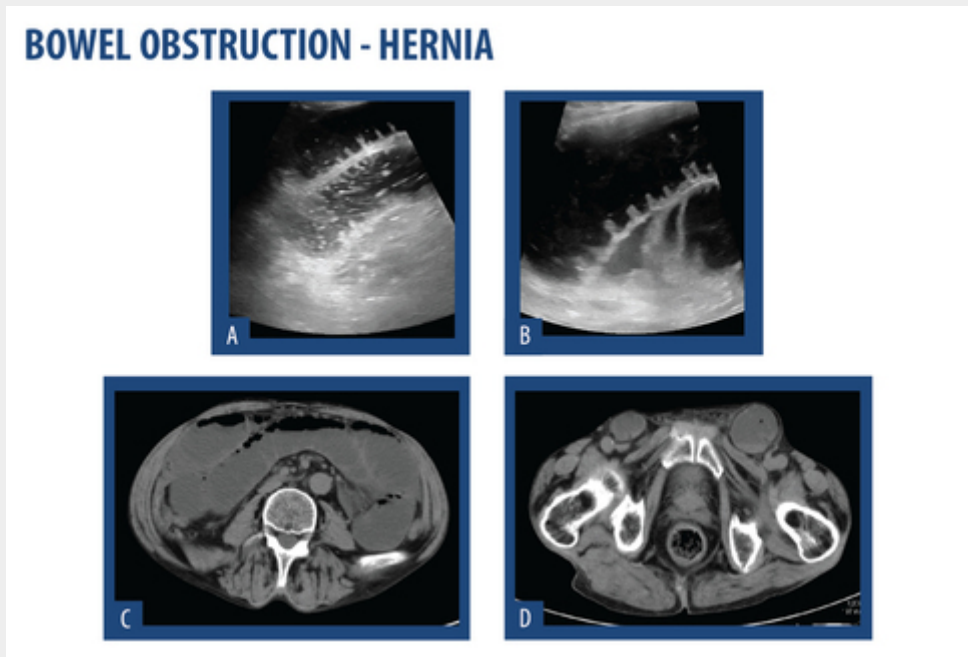


Fig.15 - 53 year-old that present with generalized abdominal pain, drowsiness and altered bowel habits. He had a history of alcoholism. On US (A,B) there was marked bowel distention, involving the small and large bowel. The loops were filled with fluid. No cause of obstruction was identified. He underwent CT (C,D) which revealed two internal hernias, filled with bowel (notice the fluid within the bowel loop), causing the obstruction.

Complicated Acute Pancreatitis

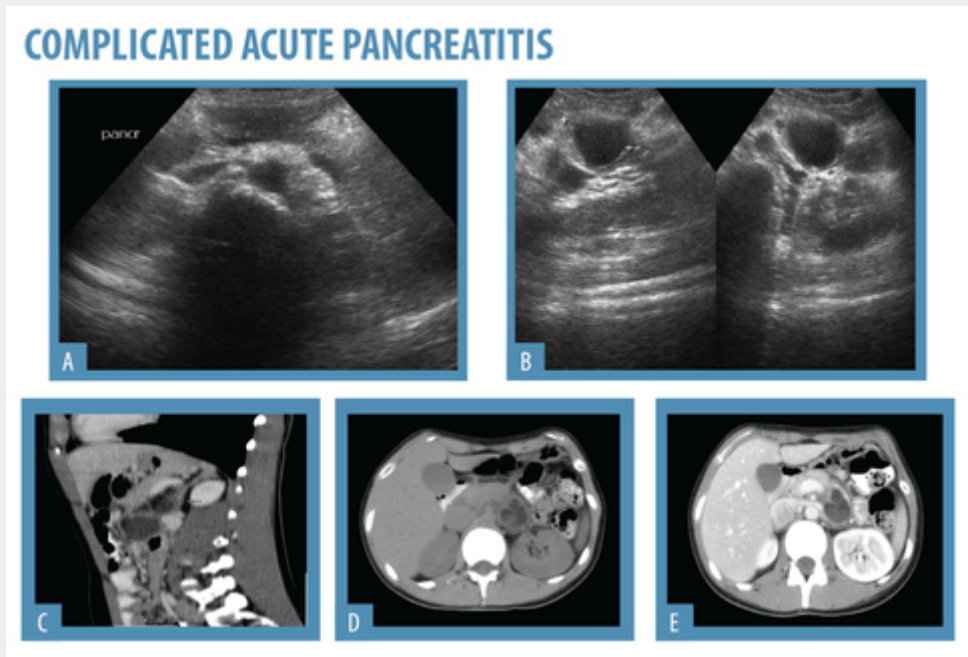


Fig.8 - 55 year-old patient with history of acute pancreatitis. The patient was hospitalized following yet another episode of acute pancreatitis. Due to worsening of abdominal pain, the patient underwent US (A,B) which revealed an anechoic, oval image, adjacent to the pancreatic tail and afterwards CT (C,D,E) that also shows an enlarged pancreas and a fluid-filled collection adjacent to the pancreatic tail, with some peripheral enhancement.

Crohn's Disease

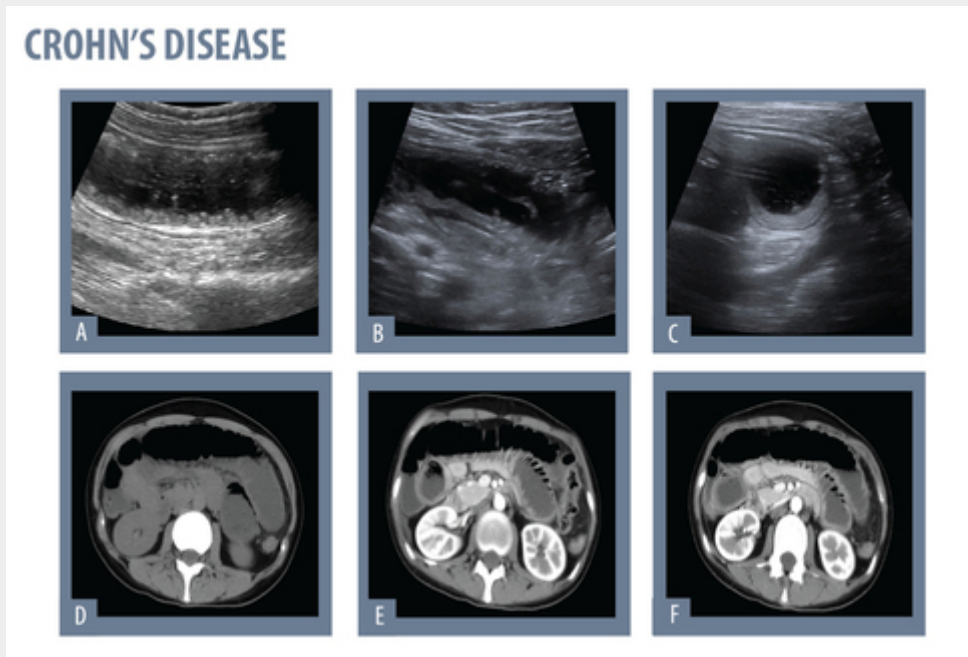


Fig.10 - 26 year-old patient presenting with RLQ pain, with a recent history of weight loss and diarrhea. On US (A,B, C) there were dilated bowel loops, with wall thickening and fluid-filled. On CT (D,E,F) there was apparent jejunum, ileum and ascending colon distention, and densification of the pericolic fat. She was admitted and diagnosed with Crohn's disease.

Emphysematous Cholecystitis

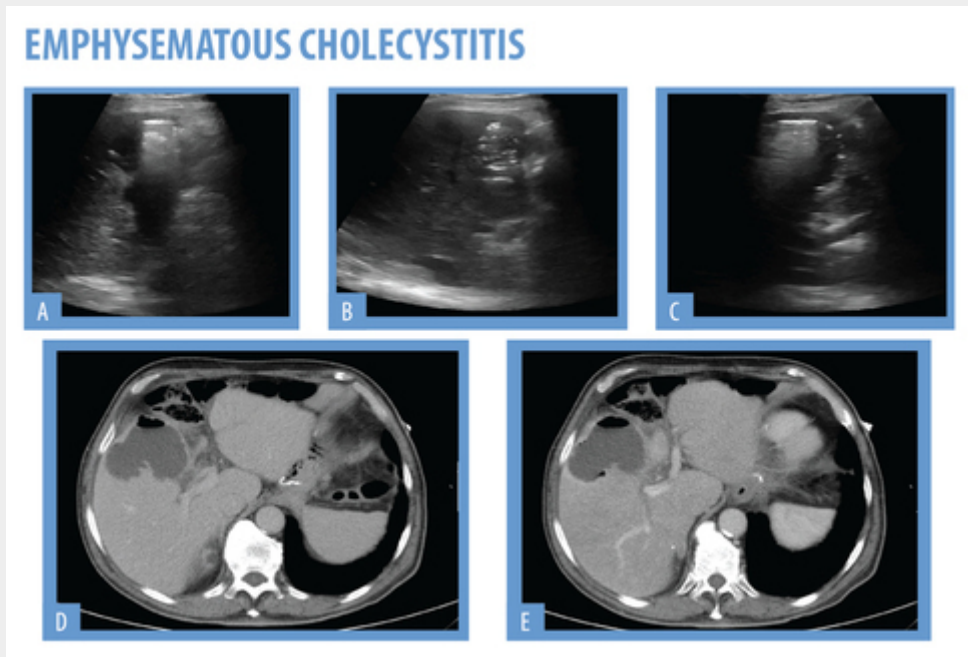


Fig5. 74 year-old diabetic patient. Presented with intense RUQ pain, fever and hypotension. On US (A,B,C) the gallbladder is filled with heterogeneous content, containing multiple foci that cast a "dirty shadow". There appears to be air in the gallbladder wall. The patient underwent CT (D, E) which corroborates the US findings.

Epiplonic Appendagitis

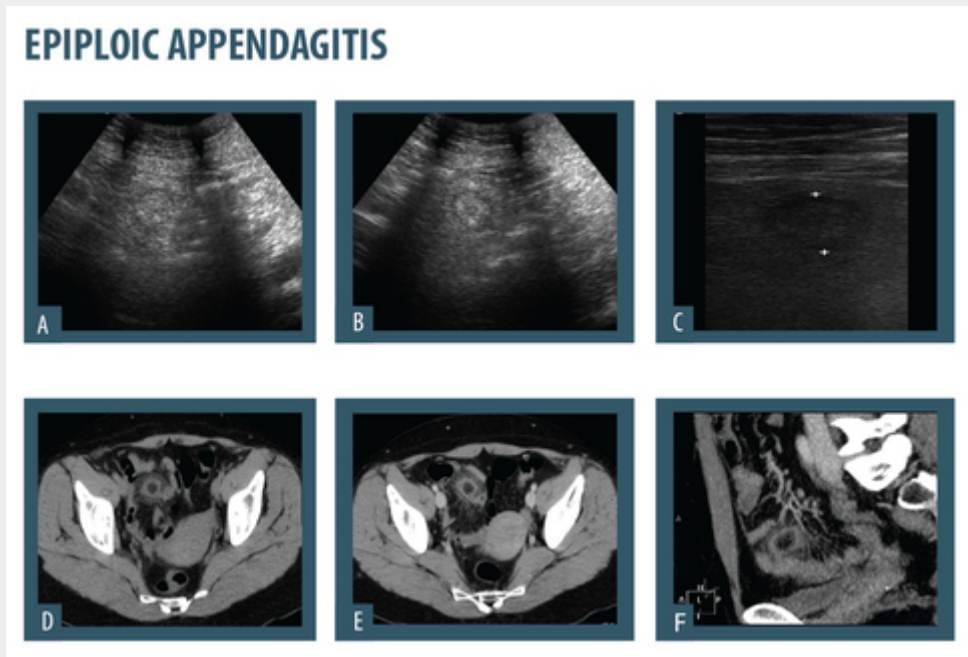


Fig. 14- 49 year-old patient presenting with lower quadrant pain, irradiating to the LLQ. On US (A,B,C) there is a rounded image, with thickened walls, non-compressible and painful with applied pressure of the transducer. On CT, this rounded lesion was localized in the antimesenteric surface of the colon and had central fat attenuation and showed peripheral enhancement. This was diagnosed as an epiplonic appendagitis.

Liver Abscess

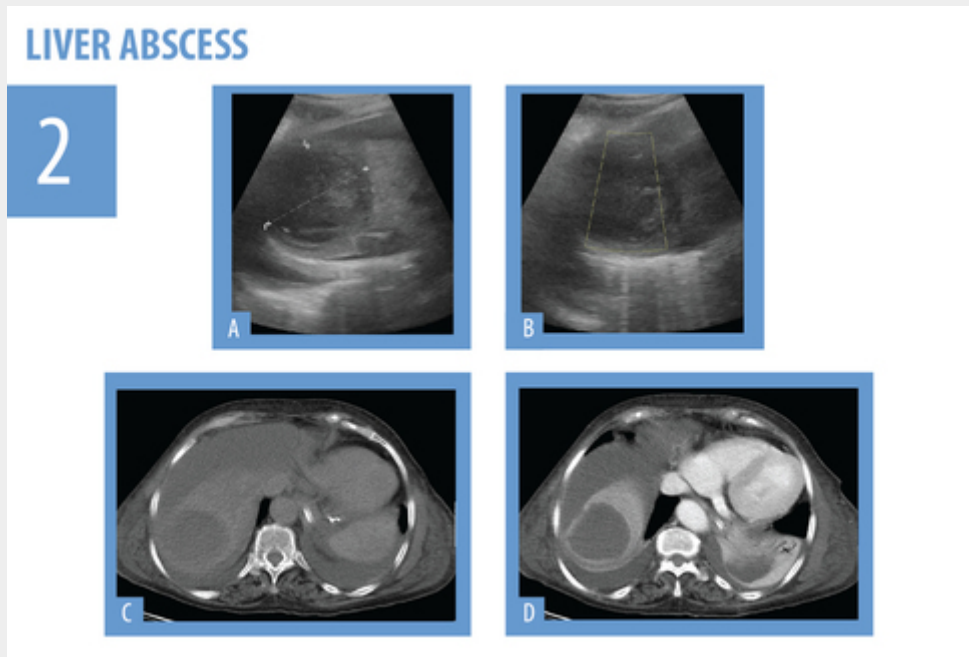


Fig.6.2. - 37 year-old intravenous drug user. He presented with fever, RUQ, loss of appetite. On US (A,B) there is a heterogeneous mass in the right liver lobe, in subcapsular location. This lesion also showed no internal Doppler sign. CT images (C,D) confirm the US findings, and also demonstrate perihepatic and perisplenic fluid.

Liver Abscess

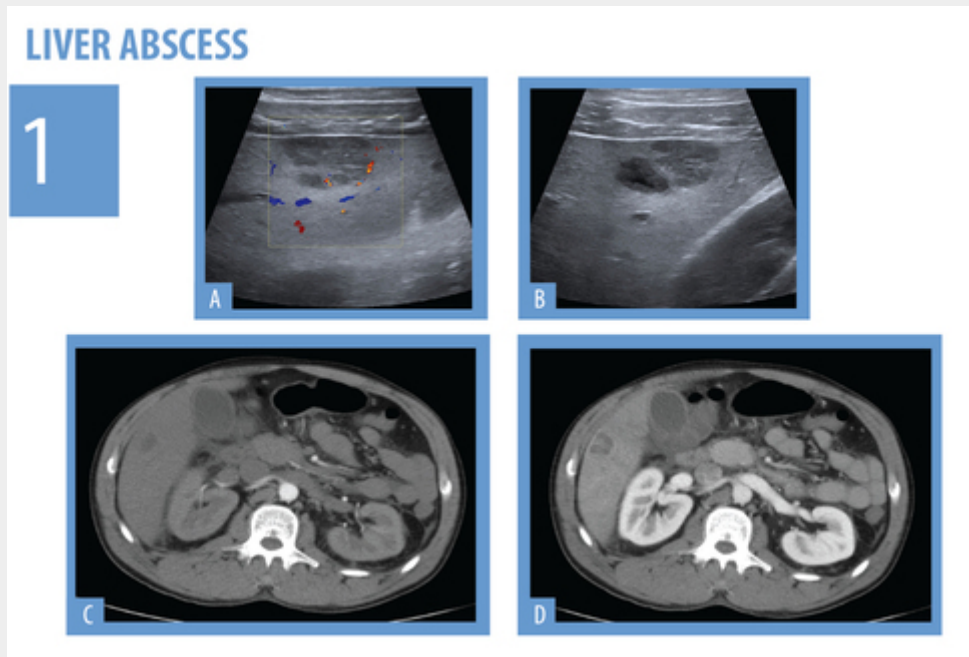


Fig.6.1 - 64 year-old patient presenting with high grade fever and RUQ pain. On US (A,B) there is an apparent heterogeneous image on the right liver lobe. It had no internal Doppler signal. Due to rapidly deterioration, CT (C,D) was performed before and after intravenous contrast which demonstrated a heterogeneous lesion, with irregular contours and peripheral enhancement. There seem to be some thin septa within the abscess.

MULTI DETECTOR CT

Advantages

Shorter acquisition time
Less respiratory artifacts
Thinner collimation
Better contrast exploitation

Protocol

Adapt to the clinical-laboratory findings of each patient
Acquire non-enhanced images
(depict haemorrhage or calcified stones)
Contrast enhancement : Iodinated agents(portal phase)
Oral contrast agents(GI perforation)

Fig.2 - Schematic representation of key aspects in CT abdominal imaging: advantages of MDCT and simplified protocol.

Meckel's Diverticulum

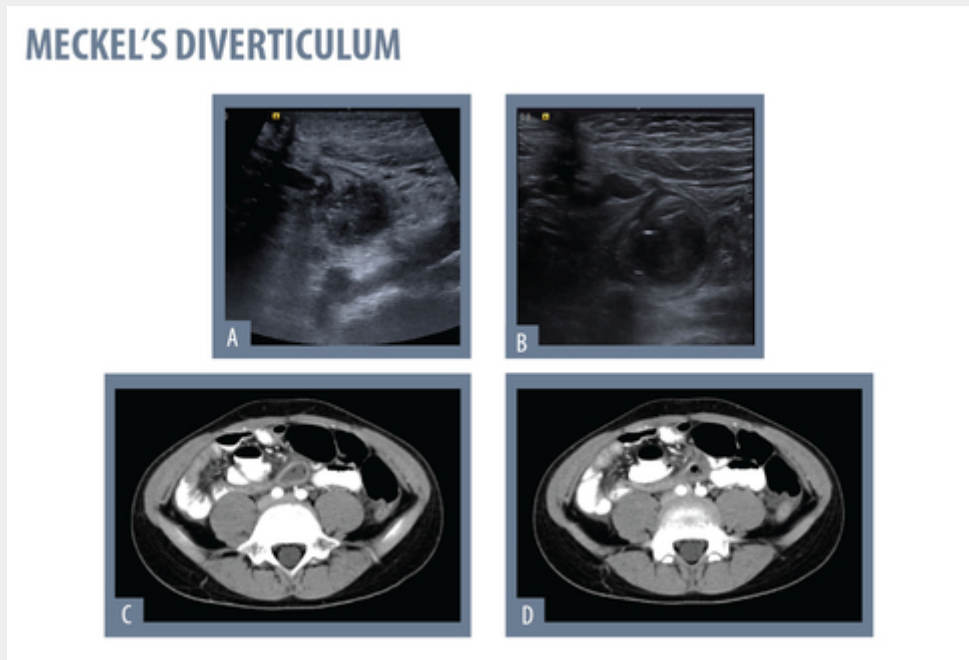
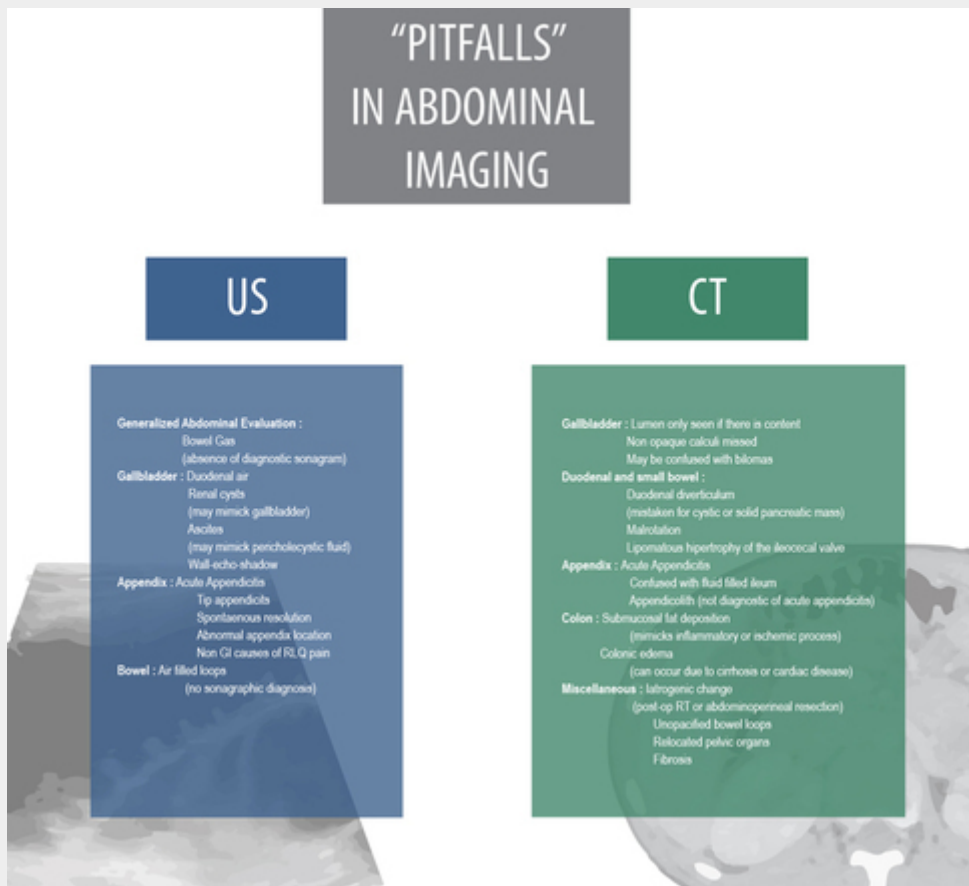


Fig.12 - 20 year-old patient presenting with acute RLQ pain. On US (A,B) there a rounded image, which appeared fluid filled some echogenic foci casting a "dirty shadow", suggestive of air. It was adjacent to the bowel wall, and seemed continuous with it through a pedicle. CT (C,D) revealed that the rounded image seen on US was actually a finger-like projection that extended from the right iliac fossa, fluid and air filled. There was some adjacent fat stranding. An inflammation of a Meckel's diverticulum was diagnosed.

Pitfalls in Abdominal Imaging



Some "pitfalls" seen in ultrasound and CT imaging of the abdomen.

Pseudomembranous Colitis

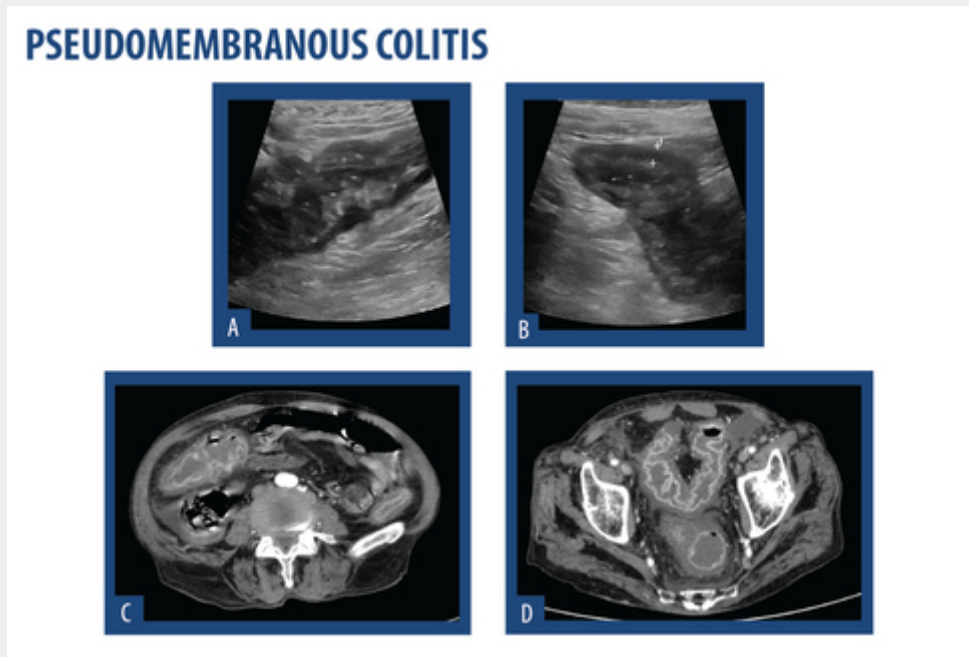


Fig.11 - 35 year old patient with recent diarrhea and presenting with acute RLQ pain. On US (A,B) there was marked thickening of bowel loops and some fluid within and surrounding the bowel. There was high suspicion for inflammatory bowel disease. The patient underwent CT (C,D) which demonstrated an irregular and "shaggy" wall thickening and enhancement of the luminal surface, indicating hyperemia.

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