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Universitatea de Medicină și Farmacie „Victor Babeș” din Timișoara

Ultrasound Atlas of Clinical Cases

Department of Gastroenterology and Hepatology, “Victor Babeș” University of Medicine and Pharmacy Timișoara

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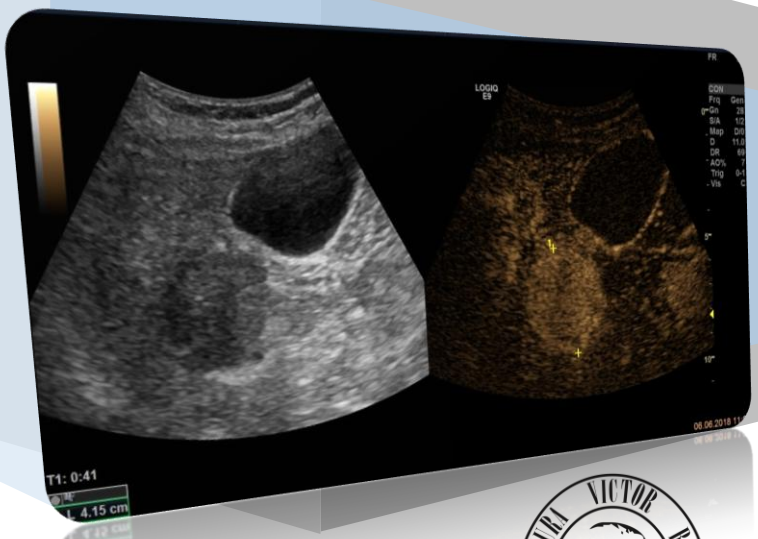

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Level of difficulty

A- Advanced Ultrasound Cases; B- Basic Ultrasound Cases

Contents

Introduction

Ultrasound is the most used imaging method in clinical practice. It has developed a lot in the last two decades, and the introduction of contrast-enhanced ultrasound (CEUS) made it very competitive with the other cross-sectional imaging methods. Being very cheap and available quite everywhere, this method is used a lot in clinical practice, for inpatients, but also for outpatients. Ultrasound is a useful tool for quite all specialties, thus training should begin early, even by students and, for sure, should continue during fellowship.

In daily practice, ultrasound machines have different sizes and performance. Pocket ultrasound is useful for bedside examination, while large and expensive systems are used for advanced ultrasound, such as CEUS evaluation, elastography, Doppler, etc.

Clinical ultrasound means that the examiner is aware of clinical information regarding the patient, sometimes of biological tests, and ultrasound is used to make decisions regarding diagnosis and treatment. In many cases, standard ultrasound examination can lead to the final diagnosis, but sometimes, a CEUS examination or other imaging techniques are needed. In some cases, echo-guided interventional procedures need to be performed.

In this collection of abdominal ultrasound cases, the authors try to show how and when to use abdominal ultrasound in a clinical scenario, when to use a CEUS examination, and when other modality of diagnosis are needed. In this cases collection, the presentation of the patients' clinical signs is followed by images from the ultrasound exam, which are subsequently explained, followed by discussions that explain the clinical judgment.

This collection of cases includes only abdominal ultrasound, focused on the gastroenterological field. The level of presented cases is basic or advanced and can be used for all who like ultrasound.

The authors

Case 1 Biliary tract (B)

- **History:** a 34-year-old male patient, asymptomatic, with no significant pathology (no prior hospitalization and surgery), presented for a routine clinical and ultrasound evaluation.
- **The clinical examination** did not reveal any abnormalities.
- **Laboratory tests** – normal complete blood cound, normal levels of AST and ALT, normal urine test.
- **Abdominal ultrasound examination** was performed (Fig. 1.1 – 1.5).

Fig. 1.1

Fig. 1.2

Fig. 1.3

Fig. 1.4

Fig. 1.5

- **Abdominal ultrasound findings** were (Fig. 1.6 A, B, C):

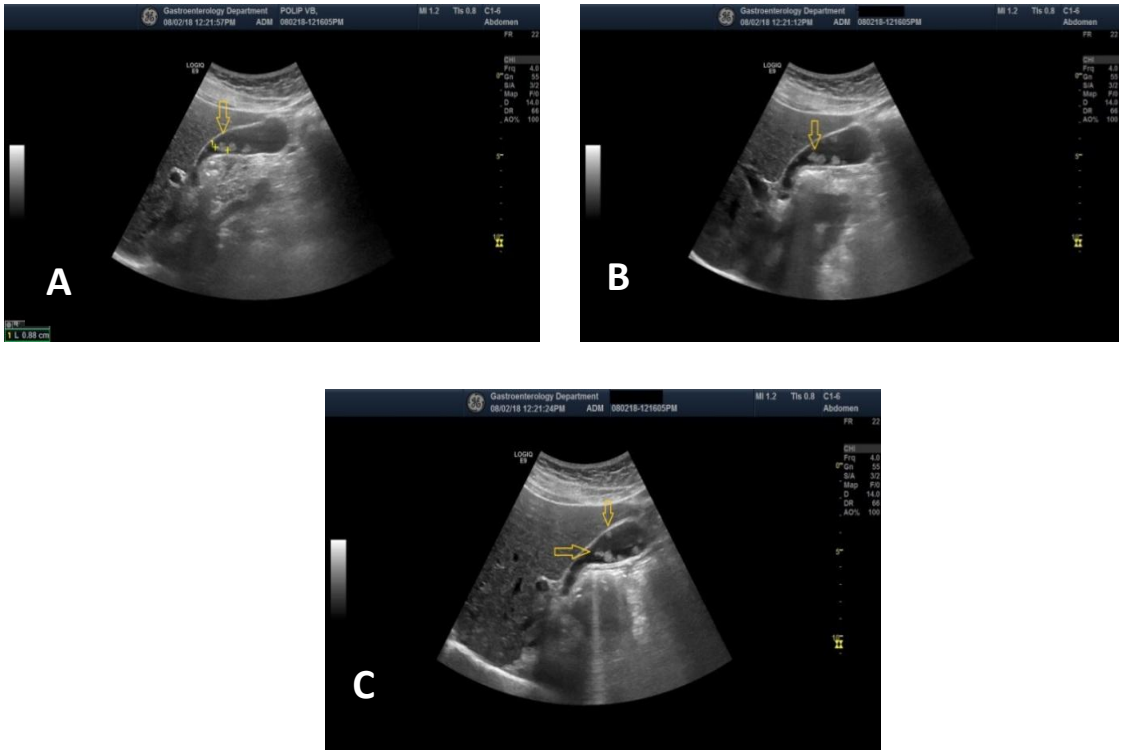


Fig. 1.6. A,B,C – Multiple gallbladder polyps: multiple hyperechoic structures with variable sizes (smaller than 1 cm), attached to the gallbladder wall, with no posterior acoustic shadowing; the structures do not move with a change in patient's position; intact gallbladder wall.

Discussion

- Gallbladder polyps are outgrowths of the gallbladder mucosal wall, usually found incidentally on abdominal ultrasound or after cholecystectomy.
- Polypoid lesions in the gallbladder can be divided in benign or malignant lesions. Benign galllbladder polyps are subdivided into benign neoplastic lesions (such as adenoma) and benign non-neoplastic lesions (such as cholesterol polyps, adenomyomas, inflammatory polyps). Correct diagnosis would help reduce unnecessary cholecystectomies [1].

- The majority of gallbadder polyps are benign, but malignant transformation is an important concern as gallbladder cancer has poor prognosis. Resection at an early stage is the only hope for cure.
- Growing gallblader polyps or polyps larger than 10 mm should be removed surgically (cholecistectomy) to prevent malingnant transformation.
- A study of Hui-Ping Zhang et. al showed that CEUS helped in the differential diagnosis among different kinds of gallbladder lesions, improving diagnostic efficiency. According to this study, CEUS examination could be used as a further diagnostic method if a definite diagnosis could not be made using conventional ultrasound [2].
- Follow-up: ultrasound every six months for a year and then yearly if the polip size is stable.

Final diagnostic: Multiple gallbladder polyps.

References:

1. Liu XS, Chen T, Gu LH, et al.Ultrasound-based scoring system for differential diagnosis of polypoid lesions of the gallbladder. J Gastroenterol Hepatol. 2018 Jun;33(6):1295-1299.

2. Zhang HP, Bai M, Gu JY, et al. Value of contrast-enhanced ultrasound in the differential diagnosis of gallbladder lesion. World J Gastroenterol. Feb 14, 2018; 24(6): 744-751.

Case 2 Biliary tract (B)

- **History:** a 68-year-old male patient, with atrial fibrillation, on anticoagulant treatment, presented himself for the evaluation of mild epigastric pain.
- **Clinical exam –** mild pain at epigastric palpation, BP 120/70 mmHg, AV 74 beats/min arrhythmic.
- **Biology:**
    - mild sideropenic anemia (Hb 11 g%, iron 33 µg/ml)
    - no cytolysis, no cholestasis.

- **Abdominal ultrasound: -** Fig. 2.1 and 2.2

Fig. 2.1

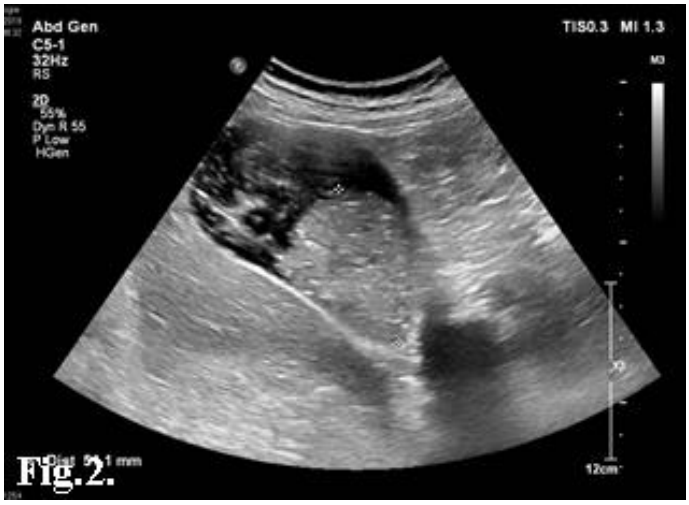


Fig. 2.2

- **Abdominal Ultrasound**

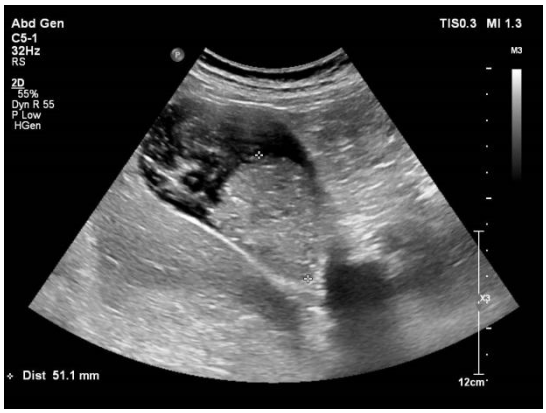


Fig. 2.1 **Fig. 2.2**

Fig. 2.1 and Fig. 2.2. Gallbladder with thin walls. Inside the gallbladder a round hyperechoic lesion, of approximately 5 cm in diameter is seen. It does not change the size, shape, or position when the patient turns from dorsal to lateral decubitus. There is also some loose hyperechoic material, with no posterior shadowing, floating in the fundus of the gallbladder.

- **Possible diagnoses:**
    - Gallbladder polyp or cancer (round hyperechoic lesion that does not change size, shape and position).
    - Biliary sludge.

- **Contrast enhanced ultrasound** was performed for the differential diagnosis (Fig. 2.3).

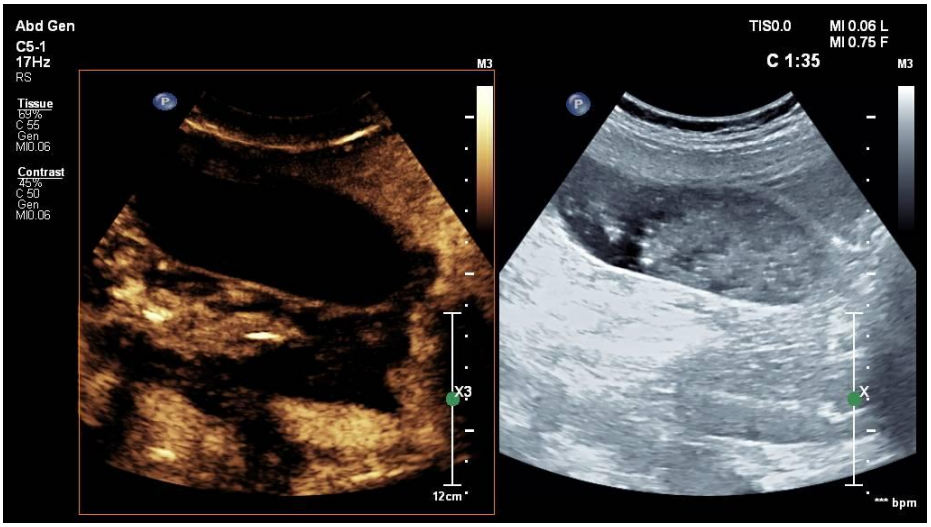


Fig. 2.3

Fig. 2.3 - The lesion inside the gallbladder was unenhancing in all vascular phases. So that the final diagnosis was biliary sludge.

Discussion

- The presence of a round hyperechoic lesion inside the gallbladder that does not change size, shape and position is highly suspicious for a gallbladder polyp. A polyp this size should be most probably malignant, but no changes of the gallbladder wall could be observed.
- CEUS excluded the diagnosis of gallbladder polyp or cancer since the lesion was avascular.
- Further work-up of the patient included a gastroscopy, which revealed a benign gastric ulcer (that can explain the epigastric pain and anemia in a patient on anticoagulants). Colonoscopy is scheduled.

Final diagnosis: Biliary sludge.

References:

1. Claudon M, Dietrich CF, Choi BI, et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) in the liver: update 2012—a WFUMB-EFSUMB initiative in cooperation with representatives of AFSUMB, AIUM, ASUM, FLAUS and ICUS. Ultraschall Med 2013; 34:11–29.

Case 3 Biliary tract (B)

- **Clinical presentation:** a 52 years-old-female was admitted in our department with recurrent *epigastric pain*.
- **Laboratory findings** revealed increased liver function test (AST: 88 U/L [5-45], ALT: 72 U/L [5-55], T.bilirubin: 1.2 mg/dL [0-1.2], D.bilirubin: 0.9 mg/dL [0-0.3], ALP: 79 U/L [35-104], GGT: 48 U/L [7-50], leucocytes: 10.200/uL [4.500-9500]).
- **Abdominal Ultrasound:** Fig. 3.1-3.3.

Fig. 3.1.

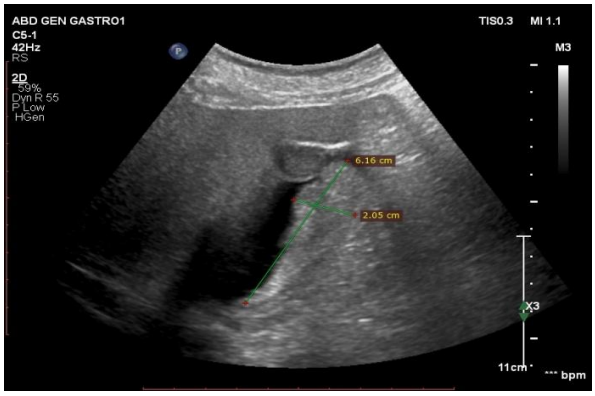


Fig. 3.2.

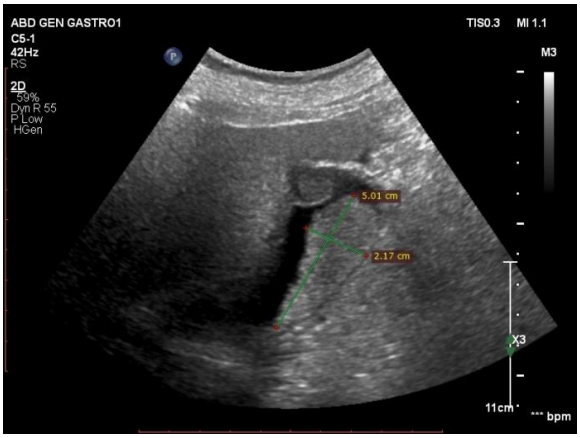


Fig. 3.3

- **Abdominal Ultrasound:** Fig. 3.1-3.3

Fig. 3.1.

Fig. 3.2.

Fig. 3.3

Abdominal Ultrasound: Fig. 3.1-3.3 revealed *a homogenous gallblader lesion* 6/2 cm in diameter, which did not move after changing patients' position and did not present posterior shadowing.

- **Differential diagnosis include:**
  - Gallbladder sludge
  - Gallbladder tumor

- **Contrast enhanced ultrasound** was performed for the differential diagnosis (Fig. 3.4-3.5)

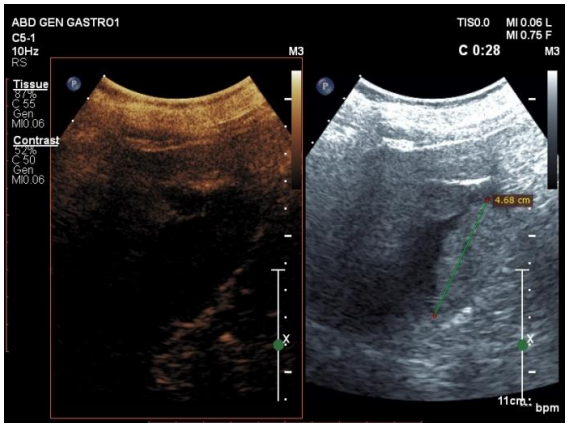


Fig. 3.4

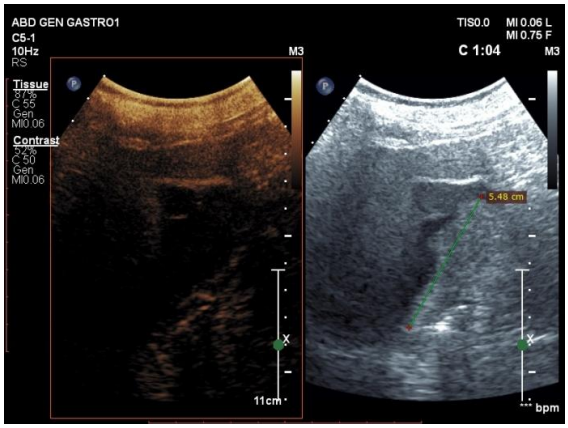


Fig. 3.5

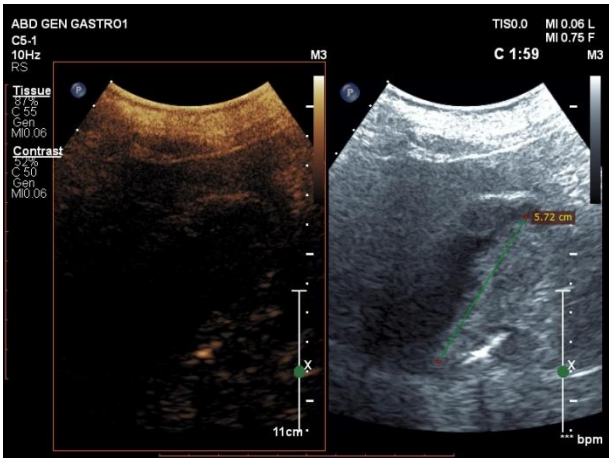


Fig. 3.6

Fig. 3.4-3.6. CEUS – The lesion is unenhancing in the arterial (Fig. 3.4), portal (Fig. 3.5) and late (Fig.3.6) phases.

Discussion

- Billiary sludge is a mixture of mucus, calcium bilirubinate and cholesterol crystals and is the consequence of imbalance between bile components alongside poor bile evacuation. By some authors, it is precursor of biliary lithiasis, and by others it is a reversible state [1].
- A particular form of billiary sludge is called ball-like or pseudotumoral sludge, in which the ultrasound appearance is of a globulous ecodense material inside the gallblader, which can retain its shape after patient mobilization or can desintegrate [2].

- Billiary sludge must be differentiated from gallblader tumours and polyps (easily done by contrast enhanced ultrasound – CEUS: billiary sludge does not enhance following contrast, being avascular, as opposed to tumours and polyps) [3].

Final diagnostic: “Ball-like” biliary sludge.

References:

1. Pazzi P, Gamberini S, Buldrini P, Gullini S. Biliary sludge: the sluggish gallbladder. Digestive and Liver Disease. 2003;35:39-45. doi:10.1016/s1590-8658(03)00093-8.

2. Lee CC, Huang JC, Shin JS, Wu MJ. Tumefactive Sludge Mimicking Gallbladder Neoplasm: A Case Report and Review of the Literature. J Med Ultrasound. 2018;26(2):103-106. doi:10.4103/JMU.JMU_19_18.

3. Serra C, Felicani C, Mazzotta E, et al. CEUS in the differential diagnosis between biliary sludge, benign lesions and malignant lesions. J Ultrasound. 2018;21(2):119-126. doi:10.1007/s40477-018-0286-5.

Case 4 Biliary tract (A)

- **History:** a 74 years-old-male presented with inappetence, jaundice, fever and mild tenderness in the right upper quadrant pain for three days. The patient`s past medical history showed type 2 diabetes.
- **Laboratory findings** revealed Leucocytosis = 17000/mm^3, CRP =167 mg/l, ALT 2.5xUVN, ASAT 1.7xUVN and total bilirubin, 4.5 mg %. The patient`s past medical history showed type 2 diabetes, treated with oral antidiabetics.
- **Ultrasound examination:** Fig.4.A-D

Fig. 4 (A-D)

Fig. 4. A-D: Ultrasound section for the gallbladder- from left to right there are sections of the gallbladder where a poorly delineated, inhomogeneous area of approximately 10 cm, with hyperechoic inclusions, can be seen.

Contrast enhanced ultrasound: fig 4.2 (C-D)

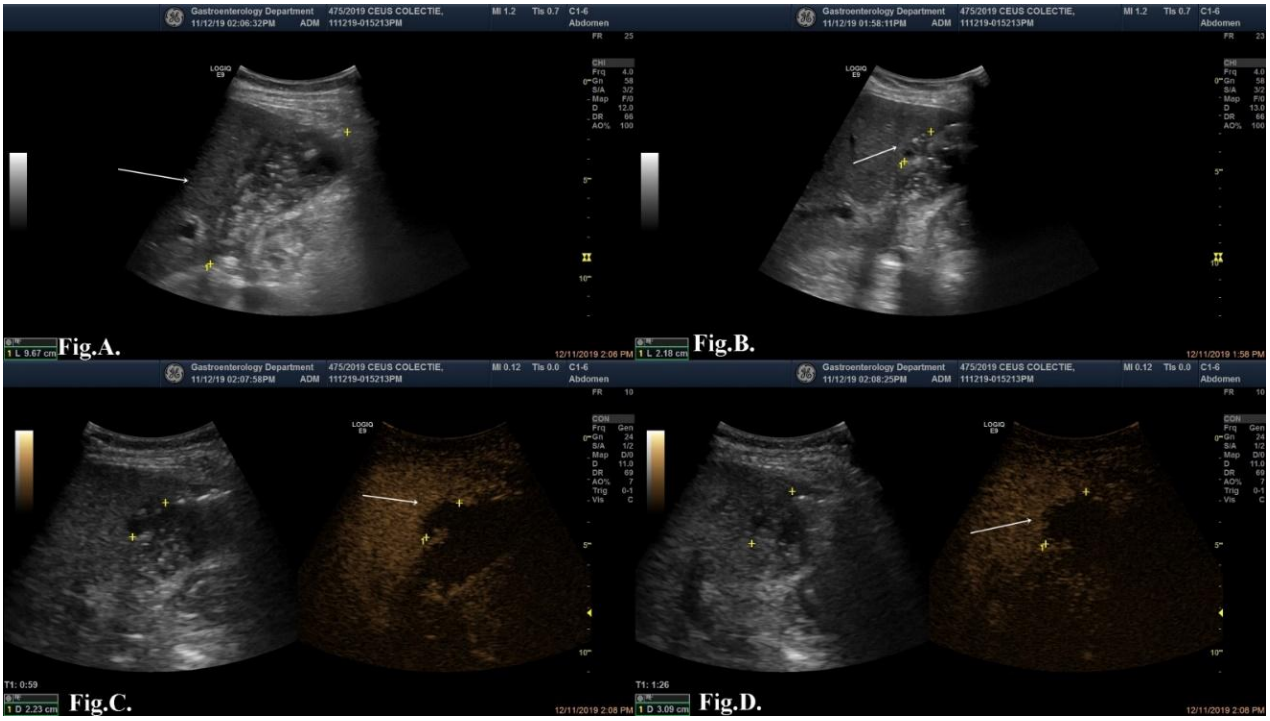
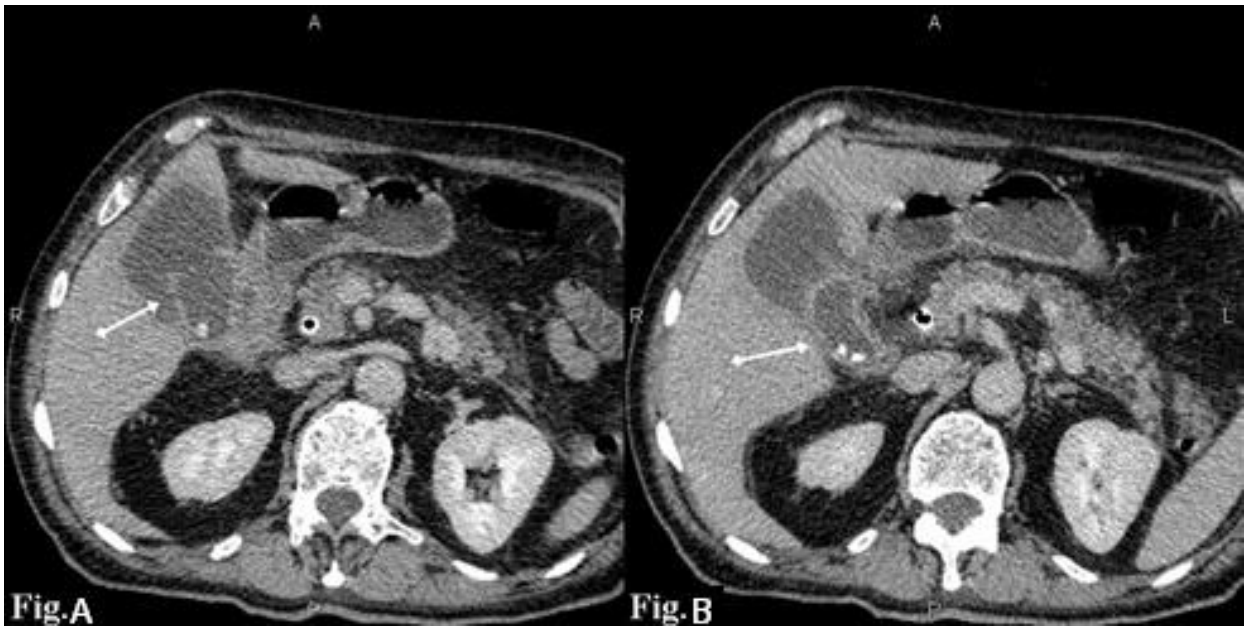


Fig 4.2 A a poorly delineated, inhomogeneous area of approximately 10 cm, with hyperechoic inclusions, can be seen (arrow).

Fig. 4.2 B. highlights a protrusion from the gallbladder into the liver which can be a discontinuation of the gallbladder wall.

Fig. 4.2 C and D, CEUS (portal and late phases), the gallbladder content is unenhancing, with an obvious unenhancing area (arrow) near the gallbladder wall.

- **Additional imaging (Fig. 4.3 A, B)**



Figures 4.3 A, B - CT venous phase, axial section: A - distended gallbladder, with thickened walls, suggestive for inflamation and also a gap in the wall of the gallbladder, suggestive for perforation. Fig. B - Gall stones are visible.

Discussion

- Cholecystitis is an inflammation of the gallbladder that occurs most commonly because of an obstruction of the cystic duct by gallstones (cholelithiasis).
- Typical signs of Cholecystitis are intense pain and tenderness in the right hipochondrium, fever, chils
- Cholecystitis may present differently, especially in elderly patients and diabetics. In these cases, the symptoms are vague without key physical findings, with localized tenderness the only presenting sign. These cases may progress to complicated cholecystitis rapidly and without warning.
- Ultrasound examination is the preferred initial imaging test for the diagnosis of acute cholecystitis and cholelithiasis.
- CT is a secondary imaging test that can identify extrabiliary disorders and complications of acute cholecystitis, such as gangrene, gas formation, and perforation.
- In acute cholecystitis, the initial treatment includes fasting, intravenous hydration, correction of electrolyte abnormalities, analgesia, and intravenous antibiotics.

- Definitive therapy involves cholecystectomy or placement of a drainage device; therefore, consultation with a surgeon is warranted.
- Consultation with a gastroenterologist for consideration of endoscopic retrograde cholangiopancreatography (ERCP) may also be appropriate, if there is proof of choledocholithiasis.

Final diagnosis: Acute cholecistitis.

References:

1. Jang T, Aubin C, Naunheim R. Minimum training for right upper quadrant ultrasonography. *Am J Emerg Med*. 2004 Oct. 22(6):439-43.
2. Lee SW, Yang SS, Chang CS,et al. Impact of the Tokyo guidelines on the management of patients with acute calculous cholecystitis. *J Gastroenterol Hepatol*. 2009 Dec. 24(12):1857-61.
3. Yarmish GM, Smith MP, Rosen MP, et al. ACR appropriateness criteria right upper quadrant pain. *J Am Coll Radiol*. 2014;11(3):316-322.

Case 5 Biliary tract (A)

- **History**: 76 years-old-male, no relevant medical history, presented with right upper abdominal pain, heart burn and bloating.
- **Laboratory findings** revealed normal blood tests with the exception of a mild thrombocytopenia.
- **Ultrasound examination (Fig 5.1-5.3):**

Fig 5.1

Fig.5.2

Fig. 5.3

Fig . 5.1

Fig. 5.2

Fig. 5.3

Fig. 5.1, 5.2 and 5.3 -Ultrasound evaluation unveiled an atypical B-mode aspect of the liver, with a heterogenous liver structure, that orientated the diagnosis towards a diffuse hepatic disease. Fig. 5.1-5.2 – Normal galbladder is seen.

- **Contrast enhanced ultrasound** was performed, however the hepatic structure was iso-enhancing in all vascular phases, not showing any abnormality.

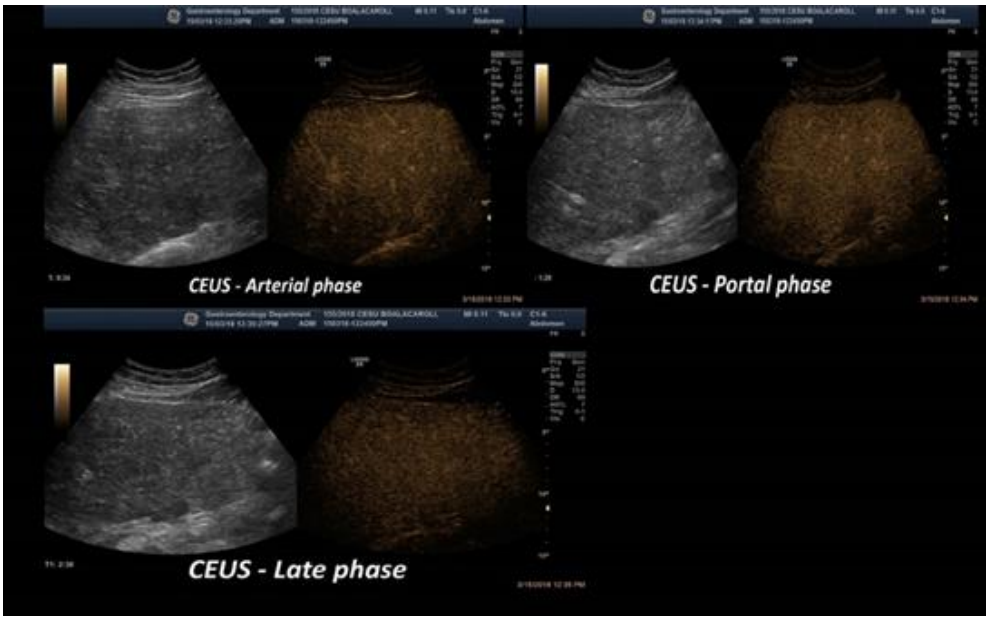


Fig 5.4 Iso-enhancement of the liver parenchima in all vascular phases.

- **Additional Imaging (Fig. 5.5 A-D)**

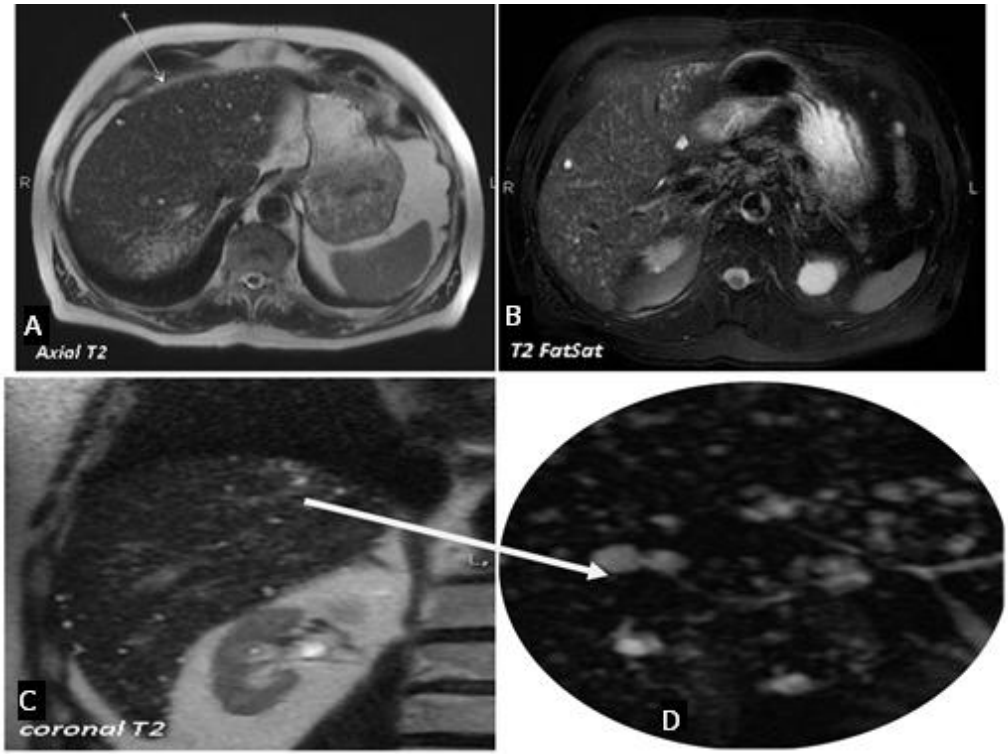


Fig.5.5 (A-D): different MRI sections showing the typical aspect of scattered cystic dilatations communicating with the biliary tree (MRCP), as in Caroli disease.

Discussion

- Caroli's disease is a rare, inherited, congenital disorder associated with an incomplete and faulty remodeling of the ductal structure.
- There are two types of Caroli's disease: type I - which usually has a benign course and type II or Caroli's syndrome - which is marked by complications that will appear before the age of 40 years.
- Due to the segmental dilatation of the intrahepatic bile ducts, patients presenting CD are more prone to develop intraductal calculi and all the complications related to this.
- No specific symptom or clinical sign in our case.
- Some patients may be asymptomatic - (CD I), whereas patients presenting type II CD may present complications (*secondary to cholestasis*).
- The final diagnosis is made mainly by imaging methods (CT and MRCP) or bay biposy.
- According to published data, ultrasound accuracy for the diagnosis of CD is approximatelly 30%.
- Even though US can visualize hepatic cystic lesions, intrahepatic lithiasis and provide informations about the bile ducts, it cannot differentiate cystic lesions emerging from other conditions.
- In this case report, we want to underline a miscellaneous US aspect of a CD type I.

Final diagnostic: Caroli disease type I.

References:

1. Zhong-Xia Wang, Yong-Gang Li, Rui-Lin Wang et al. Clinical classification of Caroli's disease: an analysis of 30 patients. International Hepato-Pancreato-Biliary Association. HPB 2015; 17: 278–283.
2. Bettini G, Mandrioli L, Morini M. Bile duct dysplasia and congenital hepatic fibrosis associated with polycystic kidney (Caroli syndrome) in a rat. Vet Pathol 2003;40:693–694.

Case 6 Biliary tract (A)

- **History:** a 32-year-old female patient was admitted in our department with *a 24-hour history of right upper quadrant and epigastric pain, jaundice, nausea, and vomiting.* She had similar pain in the past, particularly after eating fatty foods and sweets.
- **Clinical examination** revealed moderate tenderness in the upper quadrant on deep palpation, jaundice, and the patient noted dark-colored urine.
- **Laboratory tests** – cytolysis syndrome: AST-374 U/L (N 5-34U/L), ALT- 1072 U/L (N 0-55U/L); cholestasis: Alkaline phosphatase - 153 U/L (N 46-116U/L), γ-glutamyl transpeptidase 121 U/L (N 5-55 U/L), BT -5.5 mg/dl (N: 0.2-1.2 mg/dl); BD- 3.8 mg/dl (N: 0-0.2 mg/dl); normal complete blood cound and lipase. The urine test was positive for bilirubin.

- **Ultrasound examination:**

Fig 6.1

Fig 6.2

Fig 6.3

Fig 6.4

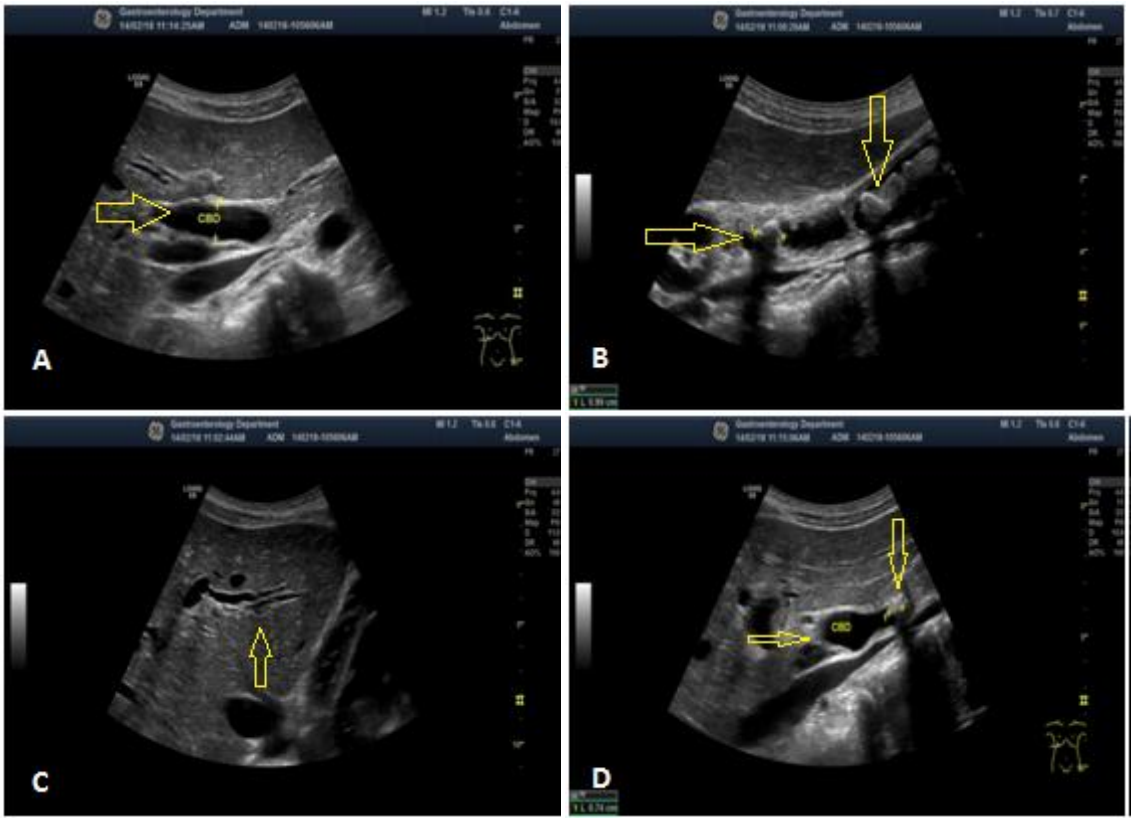


Fig. 6.5 A-D

- **Fig 6.5.A** - distended main bile duct with a diameter of 13-14 mm;
- **Fig 6.5.B** - cholecystolithiasys – multiple gallstones (hyperechoic images with acoustic shadowing) and biliary sludge;
- **Fig 6.5.C** - dilated intrahepatic biliary ducts;
- **Fig 6.5.D** - distended common bile duct and choledocholithiasis (small stone in the common biliary duct – CBD).

The patient has undergone **ERCP** that showed an enlarged main biliary duct with a filling defect at this level. Sphincterotomy and gallstone extraction was performed.

After ERCP, the general condition improved with the remission of jaundice and normalization of laboratory tests.

On discharge, the patient was refferred to surgerry for cholecystectomy.

Discussion

- Patients with jaundice should be examined by abdominal ultrasound on presentation.
- Ultrasound can differentiate among obstructive jaundice and hepatocellular jaundice in almost all patients.
- Ultrasound is highly sensitive for the diagnosis of gallbladder stones (sensitivity-98%), whereas choledocholithiasis is more difficult to detect (sensitivity-65-75%) [1,2].

- ERCP (endoscopic retrograde cholangiopancreatography) with endoscopic sphincterotomy, including stone extraction using baloon or Dormia basket, is the therapeutic method of choice in patients with obstructive jaundice due to choledocholithiasis.

Final diagnostic: Obstructive jaundice due to choledocholithiasis.

References:

1. Cooperberg PL, Burhenne HJ. Real-time ultrasonography. Diagnostic technique of choice in calculous gallbladder disease. N Engl J Med. 1980; 302:1277-1279.

2. Dietrich CF, Gouder S, Hocke M, et al. Endoscopic Ultrasound in the Differential Diagnosis of Choledocholithiasis. Endo heute 2004; 17(3): 160-166.

Case 7 Liver (B)

- **History:** a 70 years-old-male was admitted in our department with *fever, shiver, nausea, jaundice and abdominal pain*.
- **Laboratory findings** revealed:
    - leucocytosis 17.400 /microL [4000-900/microL],
    - elevated liver function tests AST: 109 U/L [5-45], ALT: 123 U/L [5-55], T.bil: 5.86 mg/dL [0-1.2], D.bil: 5.189 mg/dL [0-0.3], ALP: 550 U/L [35-104], GGT: 880 U/L [7-50],
    - inflammatory markers CPR: 92 mg/l, ESR 77mm/1h, Fibrinogen 621 mg/dl.

- **Abdominal Ultrasound:**

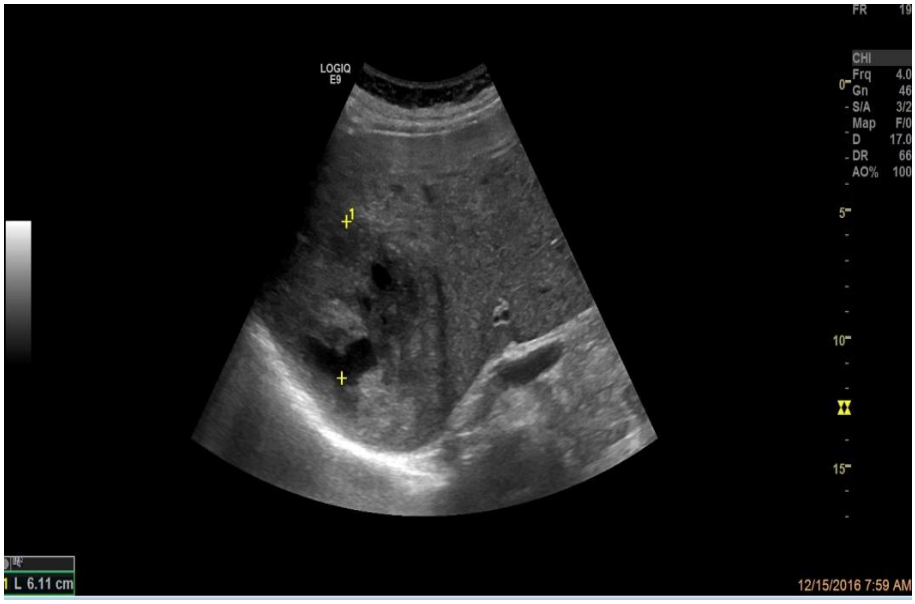


Fig.7.1

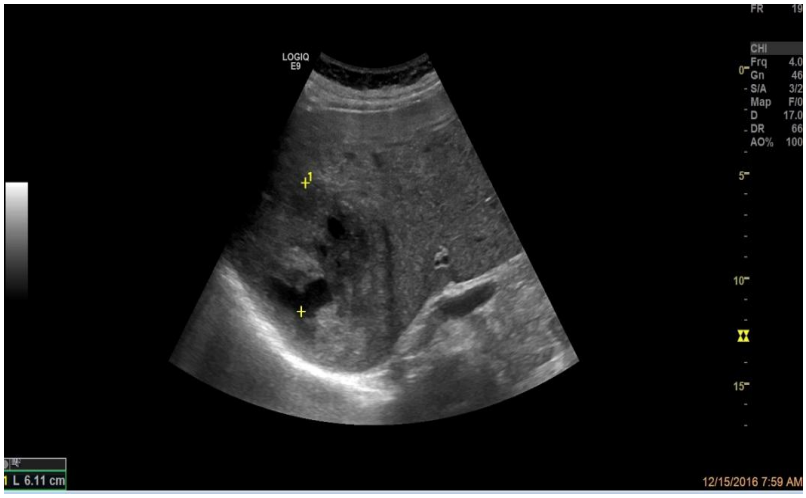


Fig.7.1 Ultrasound reveals an *inhomogenous hepatic lesion of approximatelly 7 cm* in diameter in the right hepatic lobe, segment VIII, with mixed, liquid-solid appereance.

- **Possible diagnoses**:
  - liver abscess – considering the clinical data;
  - liver hematoma - less likely (no history of trauma)
  - cystic tumor.

- **Contrast enhanced ultrasound (CEUS) was performed (Fig. 7.2 A-D),** which revealed

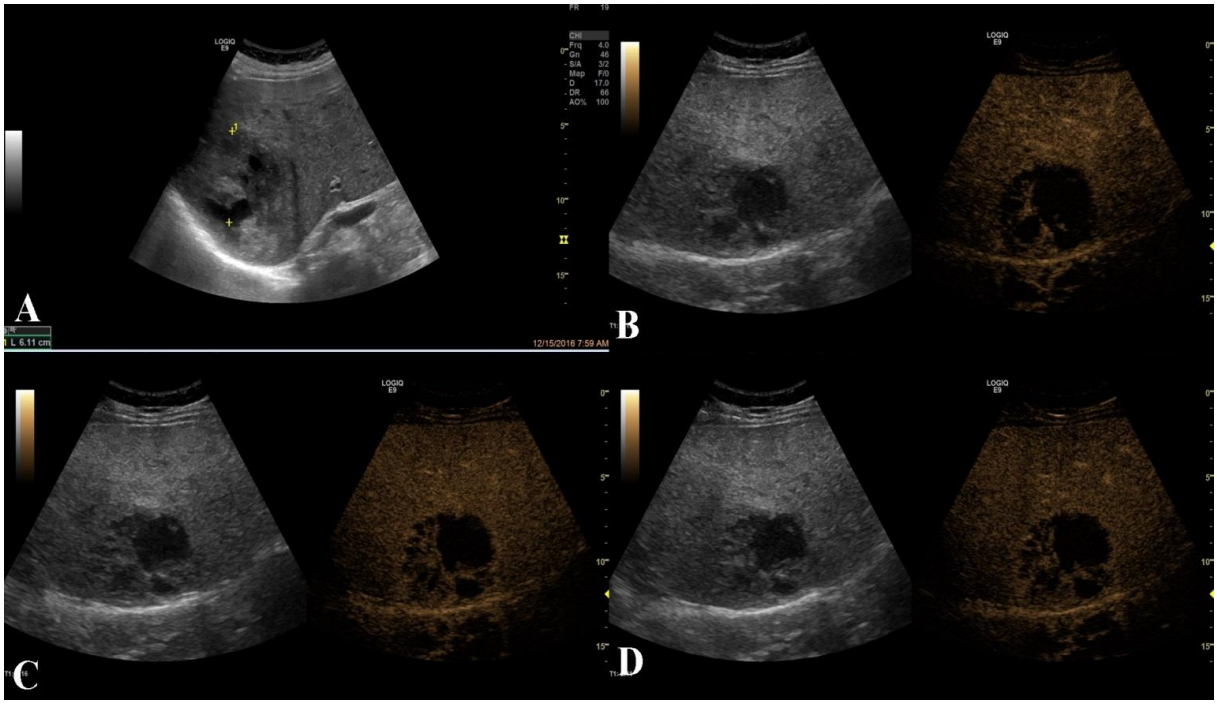


Fig.7.2. CEUS (A-D)

- **Fig. 7.2.A**: **Standard US** *inhomogenous hepatic lesion of approximatelly 7 cm* in diameter in the right hepatic lobe, segment VIII, with mixed, liquid-solid appereance, suggestive for liver abcess;
- **Fig.7.2.B: CEUS - arterial phase:** isoenhancement of the lesion as compared with the surrounding liver with unenhancing areas - honeycomb appereance;
- **Fig. 7.2.C: CEUS - portal phase** - septa enhancement with honeycomb appereance;
- **Fig. 7.2.D: CEUS - late phase** - honeycomb appereance with discrete washout.

Considering the clinical setting, the B-mode ultrasound aspect and the CEUS aspect, the final diagnosis was **liver abscess.**

A drainage system was installed unde US guidance, antibiotherapy was started, and the evolution was favourable.

Discussion

- In this situation, in a clinical context, Contrast enhanced ultrasound (CEUS) established the diagnosis of liver abscess with the typical honeycomb appereance in the arterial phase with isoenhancement in portal phase and discrete wash-out in the late phase.
- Usually, the positive diagnosis is established based on cross sectional imaging techniques: contrast enhanced CT or MRI, but lately with the introduction of contrast medium in ultrasonography, CEUS has become the modality of choice for diagnosis of liver abscess and also for interventional procedures (abscess aspiration, drainage) [1].
- The differential diagnosis with a necrotic tumor, with a hemorrhagic cyst or with a hematoma might be sometimes challenging.
- CEUS is an important tool in the management of liver abscesses, improves the detection of even small lesions, thus being very useful for the correct evaluation of disease extension.
- Also, the direct intracavitary injection of contrast agent allows confirmation of a correct positioning of a drainage system and the comunication of the cavities inside the abscess [2].

Final diagnostic: Liver Abscess

References:

1. Ignee A, Schuessler G, Cui XW, Dietrich CF. Intracavitary contrast medium ultrasound – different applications, a review of the literature ad future prospects. Ultraschall Med 2013; 34: 504-525.
2. Ignee A, Jenssen C, Cui XW, Schuessler G, Dietrich CF. Intracavitar contrast-enhanced ultrasound in abscess drainage– feasibility and clinical value. Scand J Gastroenterol 2016; 51: 41-47.

Case 8 Liver (B)

- **History:** a 35-year-old male patient, asymptomatic, with no relevant history, was reffered to the Department of Gastroenterology for reasseement of a focal liver lesion of unknown etiology detected at a previous ultrasound examination.
- **The clinical examination** did not reveal any abnormalities.
- **Laboratory tests** were normal, except Anti-Echinococcus antibodies that were positive.
- **An abdominal ultrasound** examination was performed (Fig. 8.1).

Fig. 8.1

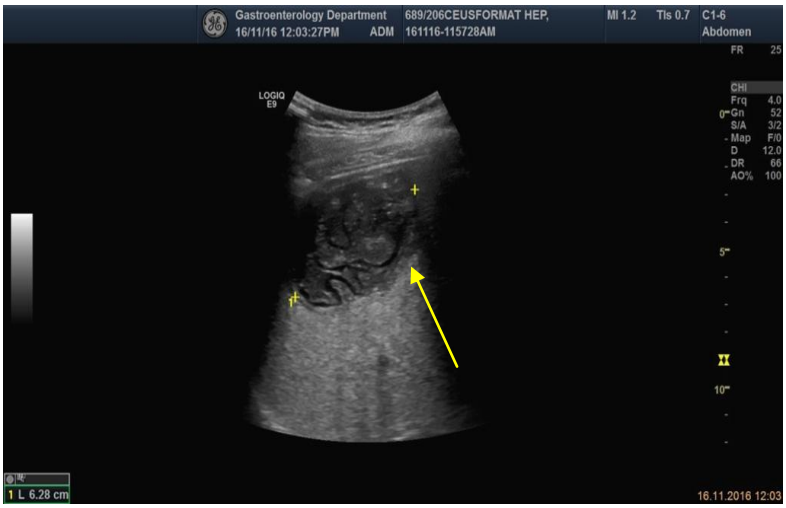


Fig. 8.1. Abdominal ultrasound revealed a hypoechoic, inhomogeneous lesion in the right liver lobe, 6/5 cm in diameter, with a well-defined wall. The ultrasound aspect raised the suspicion of hydatid cyst.

We performed contrast enhanced ultrasound (CEUS) to characterize the liver lesion, knowing that the hydatid cyst is an avascular lesion.

- **CEUS examination:**

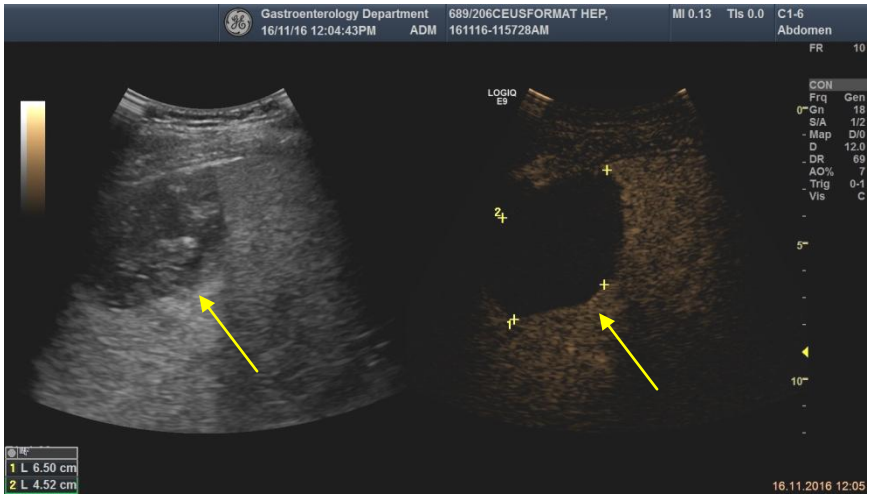


Fig. 8.2

Fig. 8.2 - CEUS examination showed the absence of contrast enhancement during the arterial phase. The lesion remained unenhanced during portal and late phases and confirmed the diagnostic of a hydatid cyst.

Discussion

- Ultrasound and CEUS are useful in diagnosing liver echinococcosis in all stages, providing valuable information for further management.
- Gharbi et al. first introduced the classification of hydatid liver disease based on the ultrasound appearance:
  - Type I: pure cystic fluid collection (spherical-ova, thick-walled);
  - Type II: fluid collection with detached membranes;
  - Type III: fluid collection with septa, multiple septa, ,,rosette-like"; ,,honeycomb" cyst; cyst with daughter cysts in a solid matrix;
  - Type IV: heterogeneous (hypoechoic-hyperechoic-intermediate) pattern;
  - Type V: calcified walls.

Final Diagnostic: Hydatic cyst type IV (Gharbi)

Reference:

1. Gharbi HA, Hassine W, Brauner MW, Dupuch K. Ultrasound examination of the hydatic liver. Radiology 1981;139(2):459-63.

Case 9 Liver (B)

- **History:** a 65-year-old male patient admitted in the Department of Gastroenterology for severe pain in the left lower quadrant;
    - for 2 months abdominal tenderness, weigth loss, constipation, fatigue, and
    - minor rectal bleeding 1 months ago;
    - personal medical history – arterial hypertension managed with telmisartan;
- **Laboratory findings:** anemia (Hb=9.8 g/dl); AST=86 UI/L; ALT= 105 UI/L; BT= 4.5 mg/dl
- **Colonoscopy:** revealed a rectal tumor, biopsies were taken that revealed an adenocarcinoma
- **Ultrasound examination (Fig. 9.1)**

Fig. 9.1

Fig. 9.1. Abdominal ultrasound findings were - multiple hyperechoic focal liver lesions with hypoechoic halo sign (target lesions) with various sizes.

- Based on the clinical data, history, biology, the suspected diagnosis was of liver metastases secondary to colonic cancer.

- **Contrast enhanced ultrasound (**CEUS) was performed for further characterization of the lesions (Fig. 9.2 A, B, C).

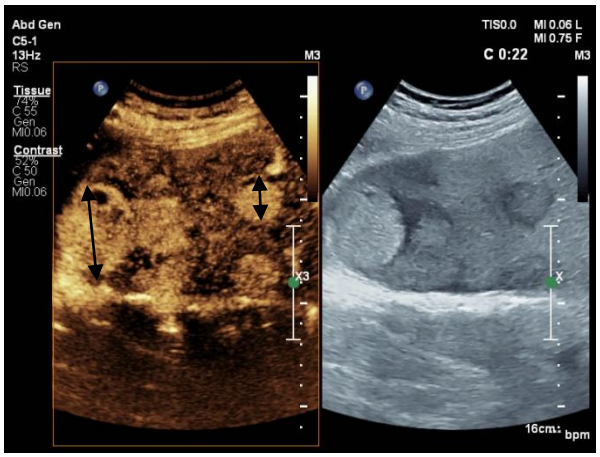


Fig. 9.2.A

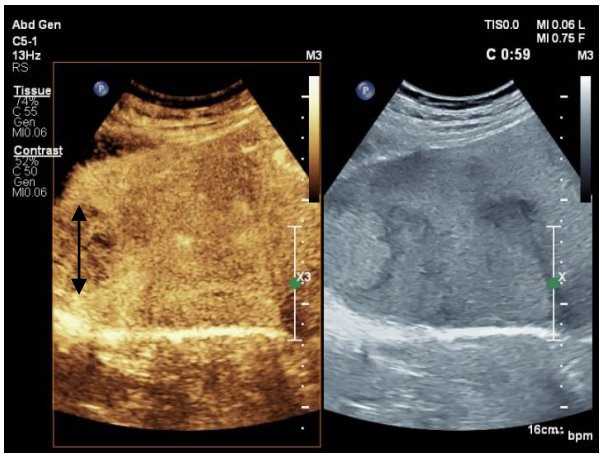


Fig. 9.2.B

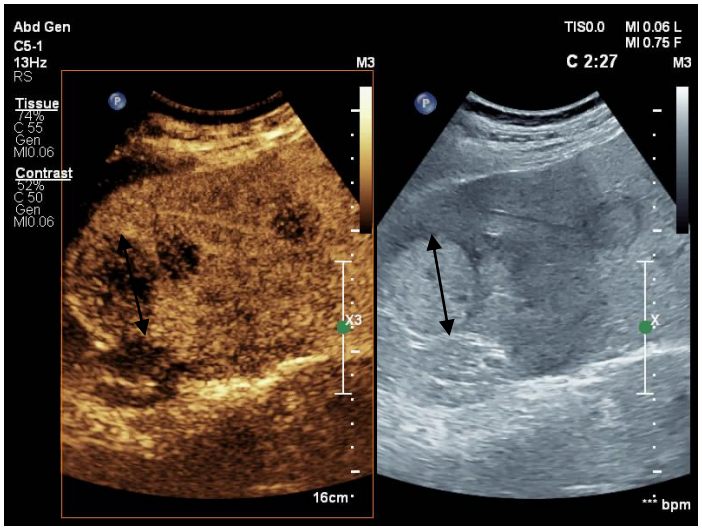


Fig. 9.2.C

Fig. 9.2.A arterial phase - the lesions are hyperenhancing as compared with the surrounding liver parenchyma.
Fig. 9.2.B portal phase - early washout starting 45 sec after contrast bolus.
Fig. 9.2.C late phase – the lesion show obvious washout.

- **CEUS conclusion: hypervascular liver metastases**.

Discussion

- CEUS has improved the diagnosis of liver metastasis and is an excellent imaging method for the vascular pattern characterization [1].
- CEUS has similar performance to CT and MRI for diagnosing liver metastases. The dual blood supply of the liver permits detection and characterization of focal liver lesions based on vascular enhancement patterns.
- CEUS improves the diagnosis of metastases in patients with a history of colorectal cancer who are undergoing surveillance.
- CEUS can differentiate venous thrombosis from tumor infiltration of hepatic vessels [2].

Final diagnostic: Hypervascular liver metastases.

References:

1. Claudon M, Dietrich CF, Choi BI, et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) in the liver--update 2012: a WFUMB-EFSUMB initiative in cooperation with representatives of AFSUMB, AIUM, ASUM, FLAUS and ICUS. Ultraschall Med 2013;34:11-29.

2. https://www.uptodate.com/Contrast-enhanced ultrasound for the evaluation of liver lesions.

Case 10 Liver (B)

- **History:** a 45-year-old male patient, admitted in emergency for upper digestive hemorrhage.
- **Clinical exam:** Pale, hypotensive patient, BP 90/50 mmHg, AV 110 beats/min
- **Laboratory findings:**
  - severe anemia (Hb 6 g%)
  - cytolysis – AST 3xUVN, ALT 3xUVN, GGTP – 6xUVN, alkaline phosphatase normal, Total bilirubin 1.5 mg%, INR -1.
- **Upper digestive endoscopy:** bleeding grade 3 esophageal varices – hemostasis by band ligation was performed in emergency
- **Transient elastography by FibroScan** – 55 kPa
- **Abdominal ultrasound evaluation: - Fig. 10.1, 10.2**

Fig. 10.1

Fig. 10.2

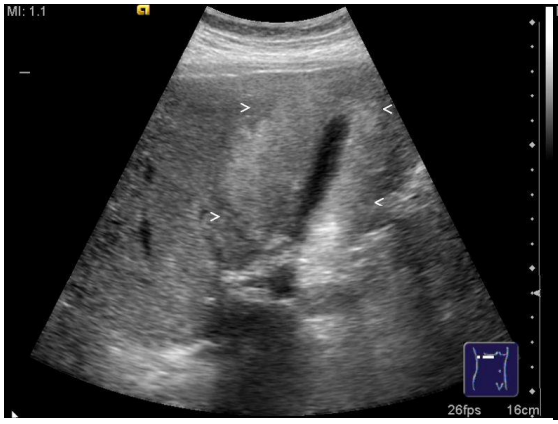


Fig. 10.1

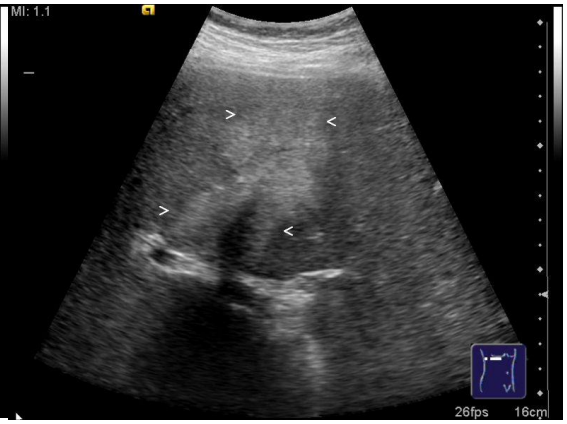


Fig. 10.2

Fig. 10.1. and Fig. 10.2. A large hyperechoic, homogenous, "clover-like" lesion surrounding the gallbladder, well delineated, with no mass-effect on the gallbladder.

- **Possible diagnoses:**
    - Hemangioma (hyperechoic homogenous lesion).
    - Hepatocellular carcinoma (newly discovered lesion in a cirrhotic patient).
    - Focal fatty infiltration (hyperechoic, homogenous lesion surrounding the gallbladder, well delineated, with no mass-effect).

- **Contrast enhanced ultrasound** was performed for the differential diagnosis.

Fig. 10.3.

Fig. 10.4.

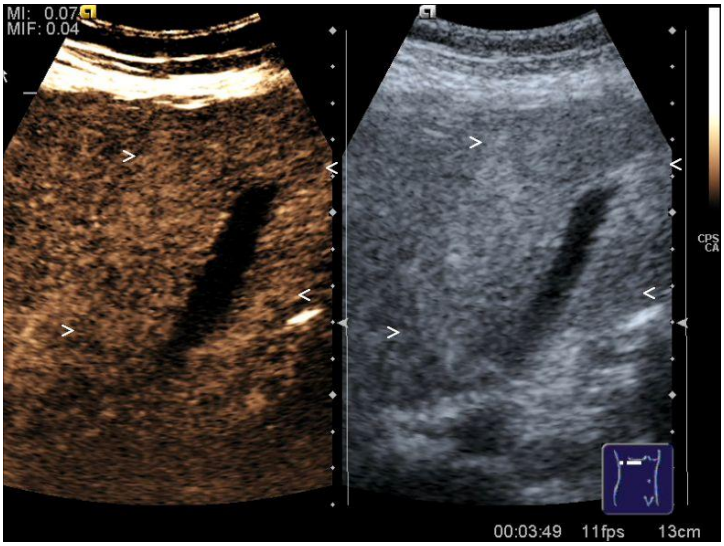


Fig. 10.5

Fig. 10.3 CEUS - arterial phase: the lesion is iso-enhancing.
Fig. 10.4 CEUS – portal phase: the lesion is iso-enhancing.
Fig. 10.5 CEUS – late phase: the lesion is iso-enhancing.

- **CEUS final diagnosis - focal fatty infiltration**.

Discussion

- When a new focal lesion is found in a cirrhotic liver, the first suspicion should be hepatocellular carcinoma. In CEUS, HCCs are hyperenhancing in the arterial phase and show washout, usually in the late phase [1]. The more well differentiated the HCC, the latter the washout [2].
- Due to the hyperechoic, well-delineated homogenous aspect, another suspicion is of a hemangioma, which has a typical enhancement pattern on CEUS, with nodular centripetal enhancement that starts in the arterial phase and progresses in the portal and late phases [1].
- However, the lesion found in our patient showed no invasion and no mass-effect on the gallbladder it surrounded, thus being less likely to be a liver tumor (benign or malignant).
- The diagnosis of **Focal Fatty Infiltration** was made by CEUS, and confirmed by MRI (Fig. 10.6).

- **Additional Imaging**

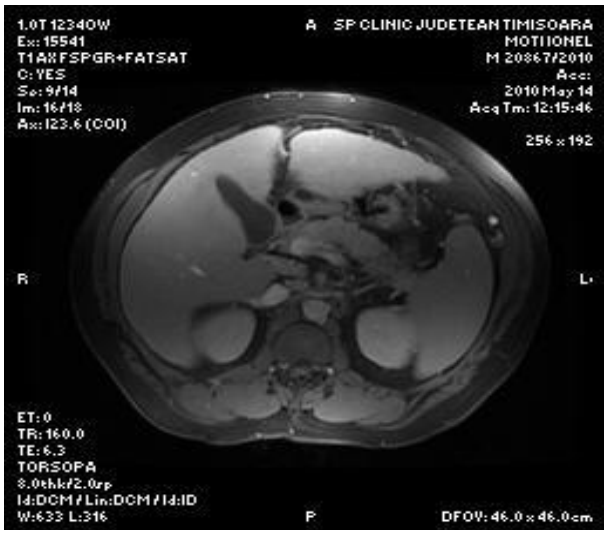


Fig. 10.6

Fig. 10.6. MRI – homogenous structure of the liver, no FLL surrounding the gallbladder

Follow-up at one year (the patient stopped drinking) showed no lesion in the liver by abdominal ultrasound.

Final diagnosis: Focal Fatty Infiltration.

References:

1. Claudon M, Dietrich CF, Choi BI et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) in the liver: update 2012—a WFUMB-EFSUMB initiative in cooperation with representatives of AFSUMB, AIUM, ASUM, FLAUS and ICUS. Ultraschall Med 2013; 34:11–29.

2. Boozari B, Soudah B, Rifai K, et al. Grading of hypervascular hepatocellular carcinoma using late phase of contrast enhanced sonography - a prospective study. Dig Liver Dis 2011;43:484-490.

Case 11 Liver (B)

- **History:** a 66 years old man, without any important medical history was referred to our Department with the suspicion of alcohol induced hepatic cirrhosis, complicated with hepatocellular carcinoma (HCC).
- **Biology:** mild anemia (Hb: 11.2 g/dl); elevated liver enzymes (AST: 2XUVN, ALT: 1.5XUVN, GGT: 5XUVN); AFP: normal value.
- **Transient elastography by Fibroscan:** 50.5 kPa.
- **Upper digestive endoscopy:** no pathological findings.
- **Abdominal ultrasound:** Fig. 11.1, Fig. 11.2.

Fig.11.1

Fig. 11.2

- **Abdominal Ultrasound: Fig. 11.1- 11.2**

Fig. 11.1

Fig. 11.2

Fig. 11.1 and 11.2 - the liver has an heterogeneous structure with irregular margins, typical findings in a cirrhotic patient. A hyperechoic lesion with a hypoechoic rim was described in the right liver lobe, in segment IV, measuring 3 cm.

- **Possible diagnosis:**
  - hemangioma (hyperechoic, homogenous lesion);
  - hepatocellular carcinoma (newly discovered lesion in a cirrhotic patient);
  - liver metastasis (hypoechoic rim).

- **Contrast enhanced ultrasound (CEUS)** was performed, for the differential diagnosis (Fig 11.3-11.4).

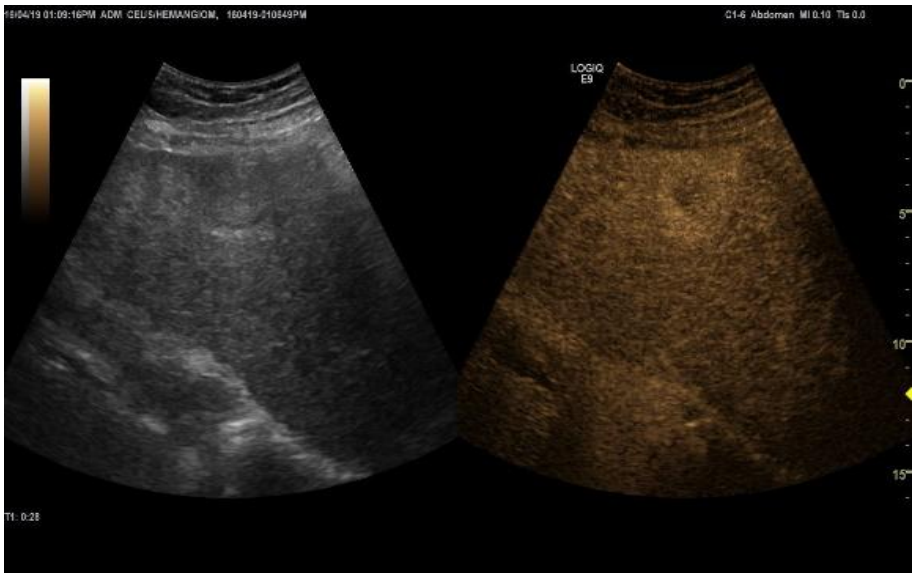


Fig. 11.3

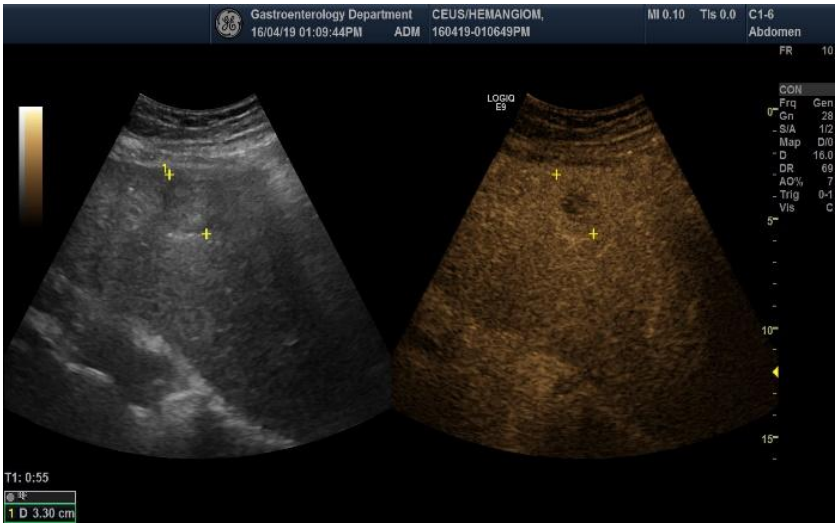


Fig. 11.4

Fig. 11.3 - in the arterial phase - peripheral nodular enhancement with centripetal filling;

Fig.. 11.4 - isoechoic aspect in the portal venous phase and delayed phase; no „wash out" was observed during the examination.

- **The conclusion of the examination was: atypical hemangioma.**

Discussion

- Haemangioma is the most common benign tumor in the liver. Haemangiomas typically appear as hyperechoic, well defined lesions. However, when the features are atypical at conventional ultrasound, further investigation is required, especially when the lesion appears in a cirrhotic patient [1].
- In a cirrhotic liver, any new focal liver lesion should be highly suspicious for HCC, thus a contrast imaging method is needed for a final diagnosis.
- Later the diagnosis was confirmed by MRI exam.

Final diagnosis: Liver hemangioma.

Reference:

1. Huang M, Zhao Q, Chen F, You Q, Jiang T. Atypical appearance of hepatic hemangiomas with contrast-enhanced ultrasound. Oncotarget. 2018;9(16):12662-12670. doi:10.18632/oncotarget.24185

Case 12 Liver (A)

- **History**: a 64 year old man, known with chronic hepatitis B from 2010, at present being under treatment with Entecavir, presented to the emergency room complaining of pain in the right upper quadrant, malaise, weight loss and rectal bleeding.
- **Clinical exam**:
  - BP was 140/80 mmHg, HR=70 beats/minute
  - abdominal pain in the right upper quadrant, spontaneously and on palpation;
  - rectal bleeding
- **Laboratory findings** revealed:
  - Hypochrome, microcytic anemia - Hb=10.5 g/dl
- **A flexible sigmoidoscopy** was performed revealing a stenosing sigmoid tumor and biopsies were taken.
- **Abdominal ultrasound** revealed the following aspect (Fig.12.1-12.3)

Fig. 12.1.

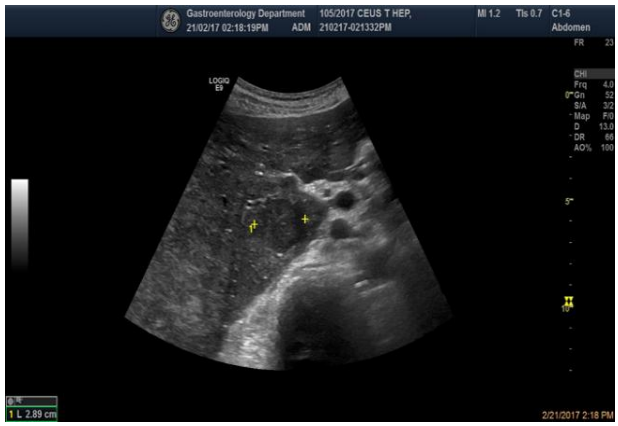


Fig. 12. 2

Fig. 12.3

\

- **Abdominal ultrasound** (Fig. 12.1-12.3)

Fig. 12.1

Fig. 12.2

Fig. 12.3

Fig.12.1 - a large hyperechoic mass (10 cm) occupying the segments V, VI, VIII of the liver, with no evidence of vascular involvement;
Fig.12.2 - another isoechoic tumor of 3 cm near the portal bifurcation;
Fig.12.3 - two similar tumors in the left liver lobe of 6 and 2 cm respectively.

The caudate lobe was les than 35 mm and the spleen was 10 cm in length.

- **Possible diagnoses** at this moment
  - Considering the chronic hepatitis B history – possible hepatocellular carcinoma;
  - Considering the stenosing sigmoid tumor – possible metastases.

- **Contrast enhanced ultrasound** was performed (Fig. 12.4-12.6), which revealed the following aspect:

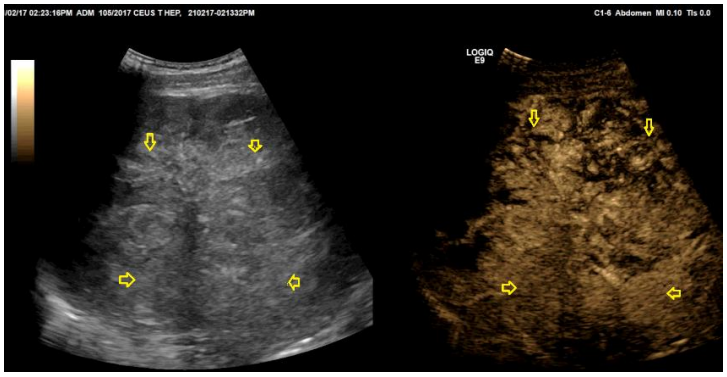


Fig. 12.4

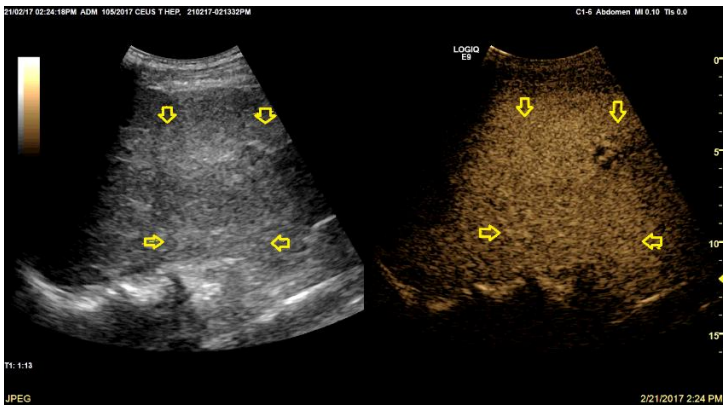


Fig. 12.5

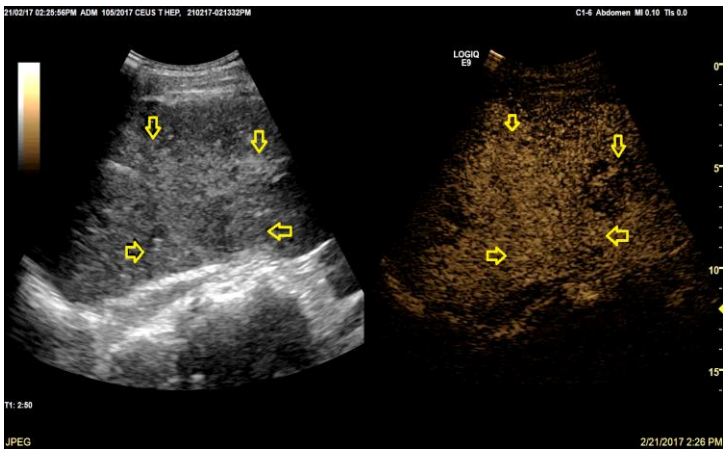


Fig. 12.6

Fig. 12.4 CEUS - arterial phase, the large hyperechoic lesion occupying the segments V, VI, VIII of the liver is hyperenhancing.

Fig. 12.5 CEUS - portal phase, the large hyperechoic lesion occupying the segments V, VI, VIII of the liver is isoenhancing.

Fig. 12.6 CEUS - late phase, the large hyperechoic lesion occupying the segments V, VI, VIII of the liver shows a slight wash-out.

Based on CEUS we could exclude liver metastasis (much earlier and intense „wash-out”). Possible diagnoses in this stage - hepatocellular carcinoma and less likely hepatocellular adenomas (newly developed lesions).

- **Additional Imaging**
- An MRI with liver specific contrast was performed (Fig. 12.7-12.10), showing a central scar composed of fibrous tissue (compatible with a cholangiocarcinoma)

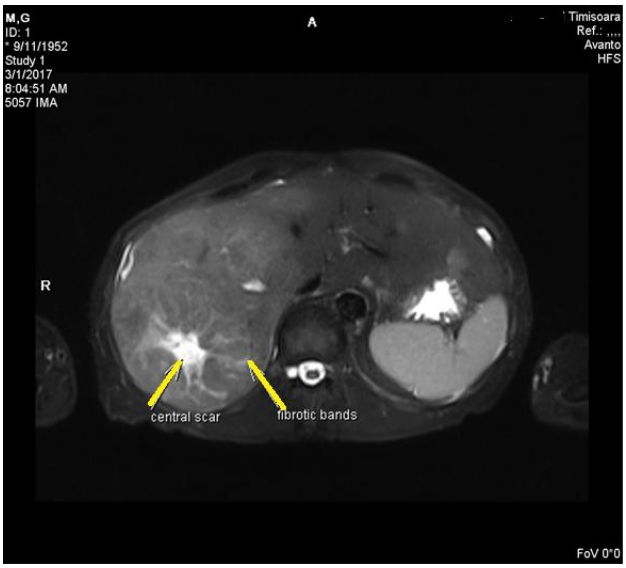


Fig. 12.7

Fig. 12.8

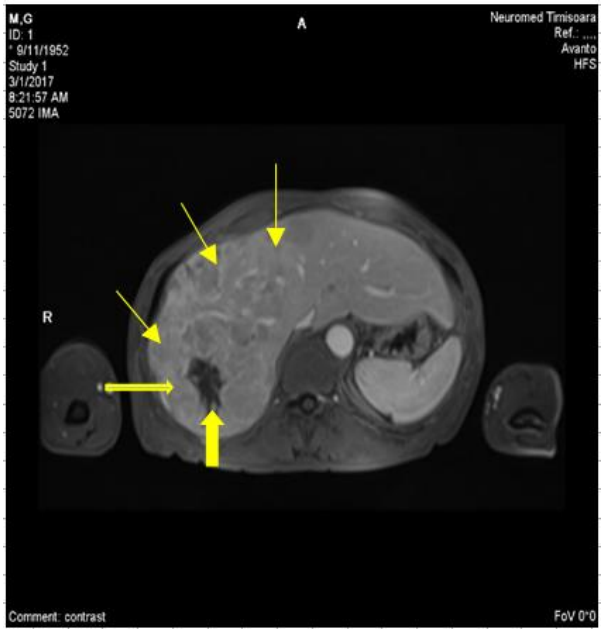


Fig. 12.9

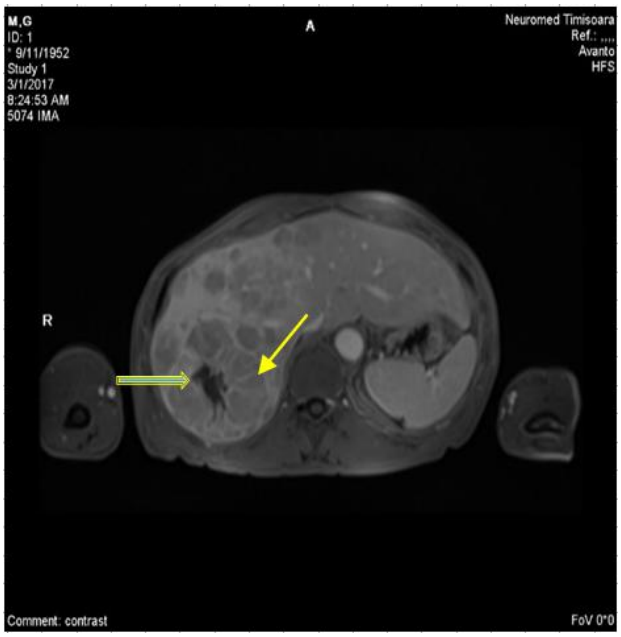


Fig. 12.10

Fig. 12.7-12.10 – Hepatic tumour with central scar and fibrotic bands in T2FatSat (Fig.12.7),axial contrast-enhanced MRI T1 FS(VIBE) image in arterial phase shows that tumours (yellow arrows) are hyperattenuating compared with liver parenchyma (Fig.12.8), portal phase shows that tumours are isoattenuating (yellow arrows) compared with adjacent liver parenchyma. Central scar does not show any enhancement (bold yellow arrow) (Fig.12.9) Axial contrast-enhanced MRI T1 is now hypoattenuating with enhancement of the capsule (yellow arrow). Central scar does not show any enhancement (bold yellow) (Fig.12.10)

- Finally, **a core biopsy** was performed, which confirmed the diagnosis of fibrolamellar HCC, while the tumour in the sigmoid was a tubulo papillary adenocarcinoma (pT3N1bLV1R0).

Discussion

- The diagnosis of fibro-lamellar carcinoma may not be suspected until radiological imaging or histopathological examination is done.
- Hepatocellular carcinomas are malignant liver lesions that appear in cirrhotic patients.
- Fibro-lamellar hepatocellular carcinoma is a rare type of malignant liver tumor which occurs most often in young adults without an underlying liver disease, usually with normal serum levels of alpha-fetoprotein [1].
- Frequently it appears as a single mass and the diagnosis is suggested by imaging findings (CT scans or MRI), and confirmed by histology.
- The particularity of this case was the presence of multiple fibro-lamellar lesions in an elderly patient with underlying chronic HBV hepatitis and underlying non-liver neoplastic disease (adenocarcinoma of the sigmoid colon).

Final diagnosis: Fibrolamellar hepatocellular carcinoma.

Reference:

1. Titelbaum DS, Burke DR, Meranze SG, et al. Fibrolamellar hepatocellular carcinoma: pitfalls in nonoperative diagnosis. Radiology. 1988 Apr;167(1):25-30.

Case 13 Liver (A)

- **History**: a 49 year old woman, asymptomatic, without no other known pathology and with no use of contraceptives, presented to the emergency room complaining of a sudden-onset right upper quadrant pain, as well as right lower quadrant pain.
- **Clinical exam**:
  - BP was 130/80 mmHg, HR=70 beats/minute
  - abdominal pain in the right hypochondrium, spontaneously and on palpation;
- **Laboratory findings** revealed:
  - Leucocytosis - 13300/mm^3
  - Normochrome anemia - Hb=10.5 g/dl
  - AST 476 IU/l, ALT 280 IU/l
- **Abdominal ultrasound**: revealed the follwing aspect (Fig.13.1 and Fig.13.2)

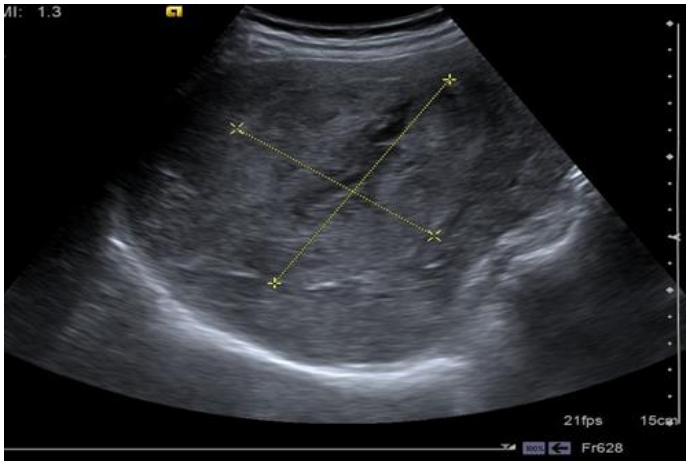


Fig.13.1

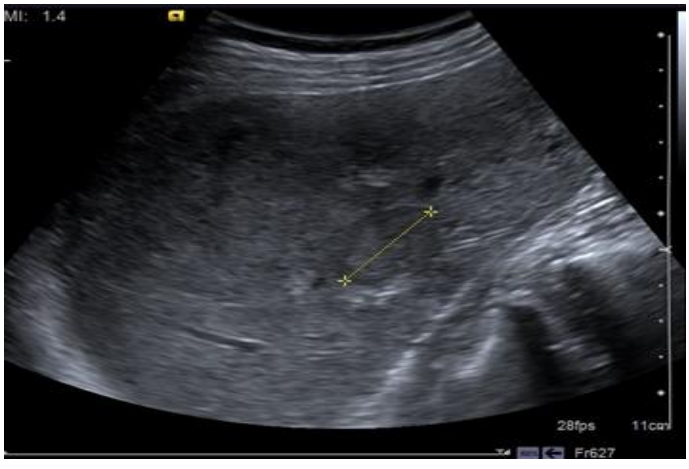


Fig.13.2

Abdominal ultrasound (Fig.13.1-13.2)

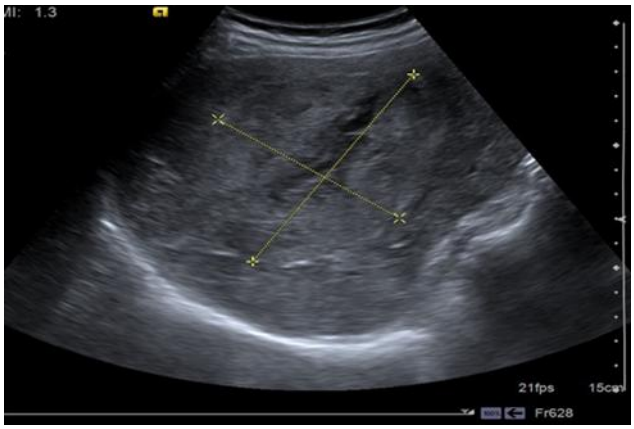


Fig.13.1

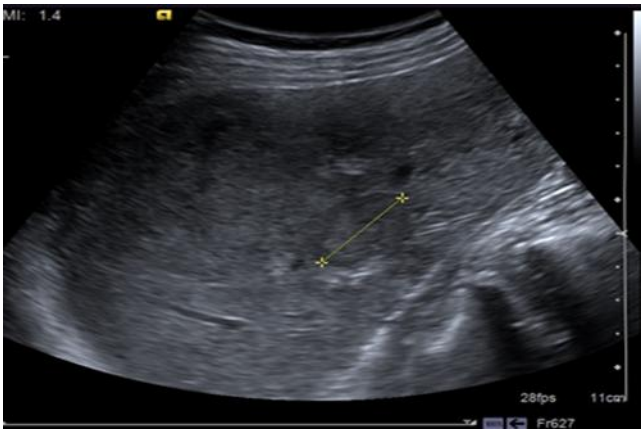


Fig.13.2

Fig.13.1-13.2 Ultrasound B-mode image of the right liver lobe (intercostal section) reveals a large isoechoic inhomogeneous mass (12/8 cm) occupying the segments VIII, VII, VI, and V of the liver (Fig.13.1), and a hypoechoic lesion, 2.7 cm in diameter in segment VI (Fig.13.2)

- **Possible diagnosis:**
  - Liver tumor (benign or malignant)
  - Liver hematoma

- **Contrast enhanced ultrasound** was performed, which revealed the following aspect of the larger lesion (Fig.13.3-13.4):

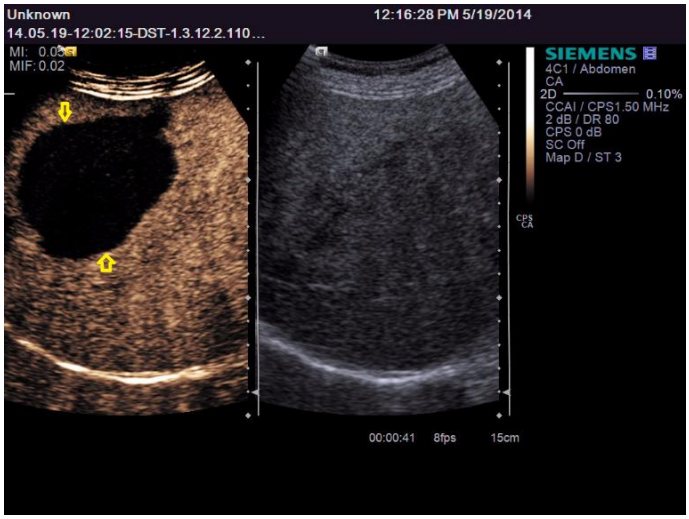


Fig.13.3

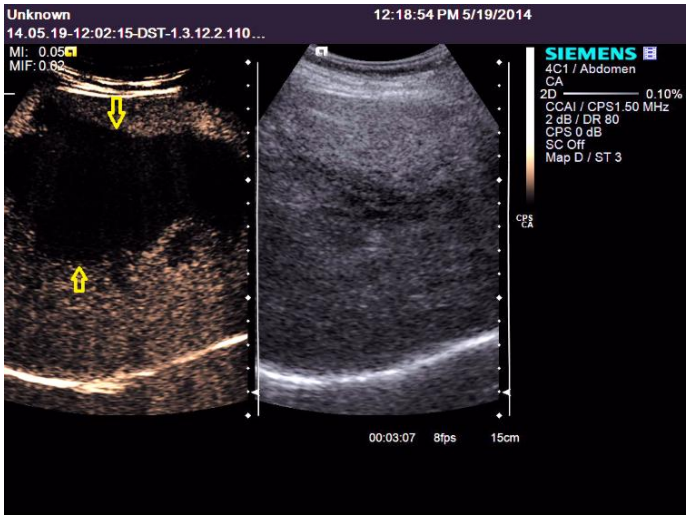


Fig.13.4

Fig.13.3-13.4 CEUS - arterial phase the large lesion in segments VIII, VII, VI, and V was non-enhancing as compared with the surrounding tissue (Fig.13.3); late phase the large lesion was still unenhancing, but a slight wash-out was visible at the margins of the lesion (Fig.13.4).

- Considering the clinical setting, the B-mode ultrasound aspect and the CEUS aspect a ruptured tumor of the liver was suspected (possible malignant, due to the late „wash-out").

- **Additional Imaging**
  - **MRI** was performed for a definitive diagnosis (Fig.13.5-13.8)

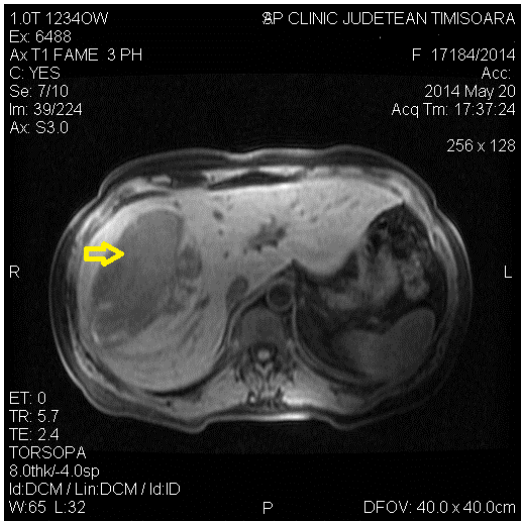


Fig.13.5

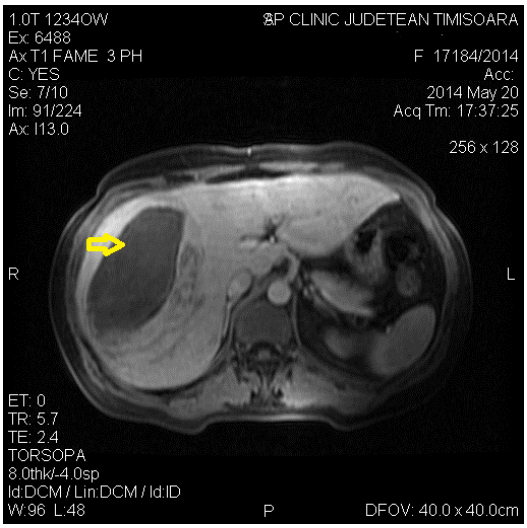


Fig.13.6

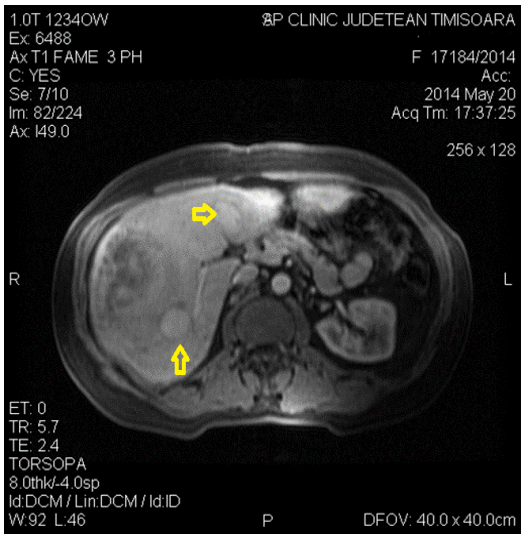


Fig.13.7

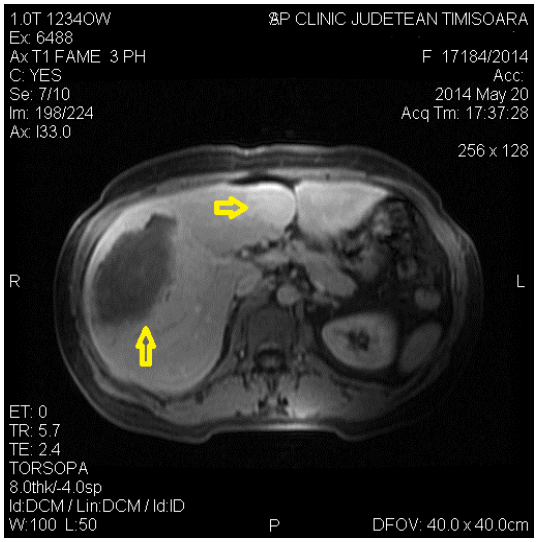


Fig.13.8

Fig.13.5-13.8- MRI of the abdomen was performed that showed a large hematoma (11/5cm) in the middle of hepatocelullar adenoma (arrows) (Fig.13.5-13.6) and multiple nodular lesions sugestive for hepatocelullar adenomas (arrows) (Fig.13.7-13.8)

- Due to the fact that the patient was hemodinamically stable, without haemoperitoneum, we opted for a conservative management. At 3 months the hematoma regressed from 12 to 7 cm, than, at 1 year, to 5 cm (Fig.13.9).

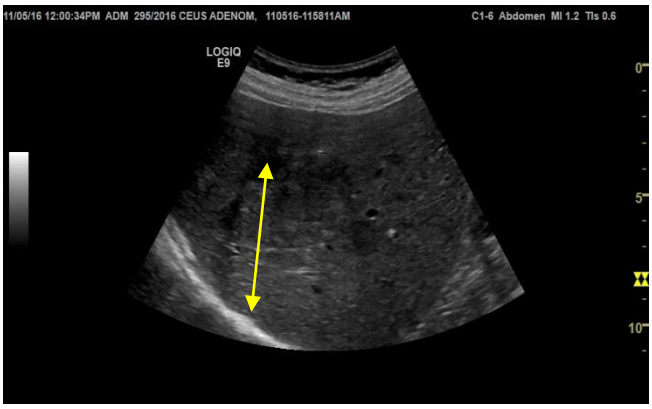


Fig.13.9

Fig.13.9 US B mode image after 1 year reveals an hyperechoic lesion of 5 cm.

- **Contrast enhanced ultrasound** 1 year after presentation showed the following aspect (Fig.13.10-13.12)

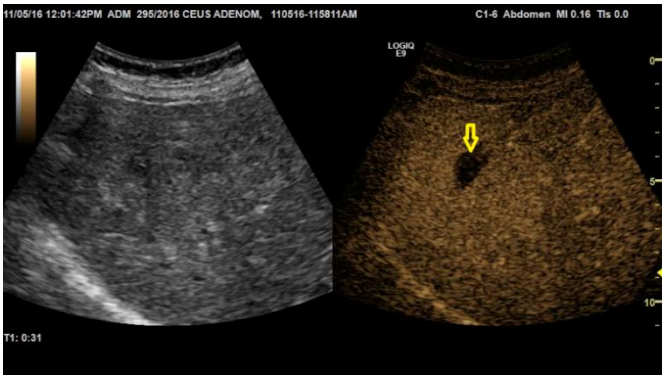


Fig.13.10

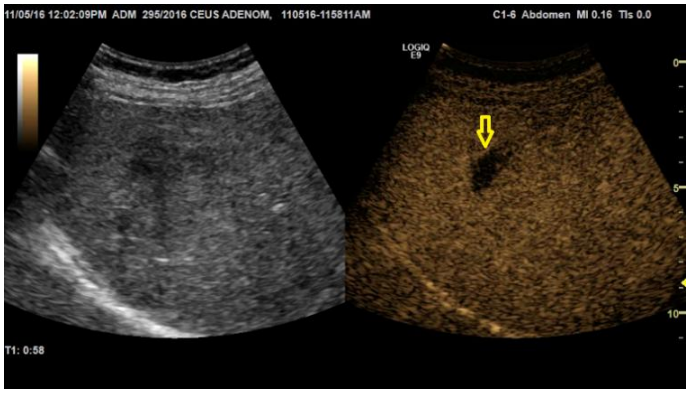


Fig.13.11

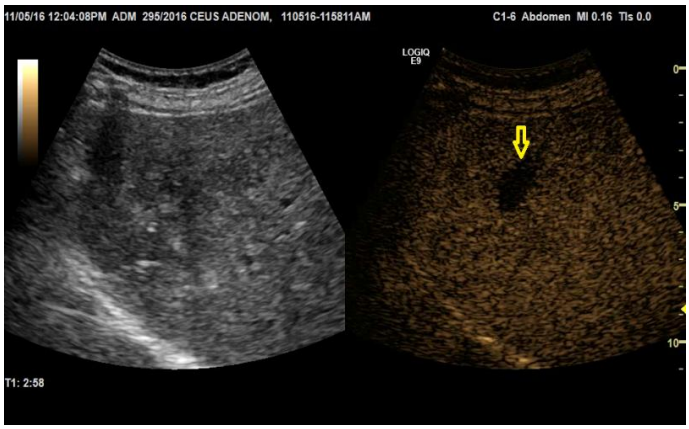


Fig.13.12

Fig.13.10-13.12 - CEUS after 1 year – arterial phase the lesion is slightly hyperenhancing with the exception of central area that is unenhancing (Fig.13.10), portal phase the lesions mantains the contrast with the exception of the central area which is unenhancing (Fig.13.11), late phase the lesion is isoenhancing, with the exception of the central area, still unenhancing (Fig.13.12).

Discussion

- Hepatocellular adenoma (HA) is a rare benign tumour of the liver. The lesions most often are seen in young women using oral contraceptives. HA are usually solitary (70-80% of cases) [1] and large at the time of diagnosis (5-15 cm) [2]. Most patients are clinically asymptomatic but in some cases HAs may rupture and bleed, causing right upper abdominal quadrant pain. Spontaneous rupture of hepatocellular adenoma is usually a non-life threatening condition, but rarely, rupture may lead to hemorrhagic shock needing emergency treatment. HA can undergo malignant transformation to hepatocellular carcinoma (HCC) [3,4] for this reason surgical resection is advocated in most patients with presumed HAs.
- The particularity of this case is the clinical and biological silent evolution until a brutal complication which, fortunately, had a spontaneous uneventful evolution.

Final diagnostic: Spontaneous intrahepatic rupture of a hepatocellular adenoma.

References:

1. Faria SC, Iyer RB, Rashid A et-al. Hepatic adenoma. AJR Am J Roentgenol. 2004;182 (6): 1520.

2. McGahan JP, Goldberg BB. Diagnostic ultrasound. Informa Health Care. (2008)

3. Gyorffy EJ, Bredfeldt JE, Black WC et al. Transformation of hepatic cell adenoma to hepatocellular carcinoma due to oral contraceptive use. Ann Intern Med. 1989;110:489–490.

4. Neuberger J, Portmann B, Nunnerly HB et al. Oral contraceptive-associated liver tumors: occurrence of malignancy and difficulties in diagnosis. Lancet. 1980;1:273–276.

Case 14 Liver (A)

- **History:** a 75 years old female patient presents in the emergency room complaining of pain in the base of the right hemithorax, fever 38-39 C at home, chills, fatigue. Medical history reveals essential arterial hypertension and previous hospitalization for bacterial pneumonia three weeks ago.
- **Chest X-ray** was normal.
- **Lab tests** show leukocytosis, inflammatory syndrome, and cytolytic syndrome.
- **An abdominal ultrasound** examination was performed.

Fig 14.1

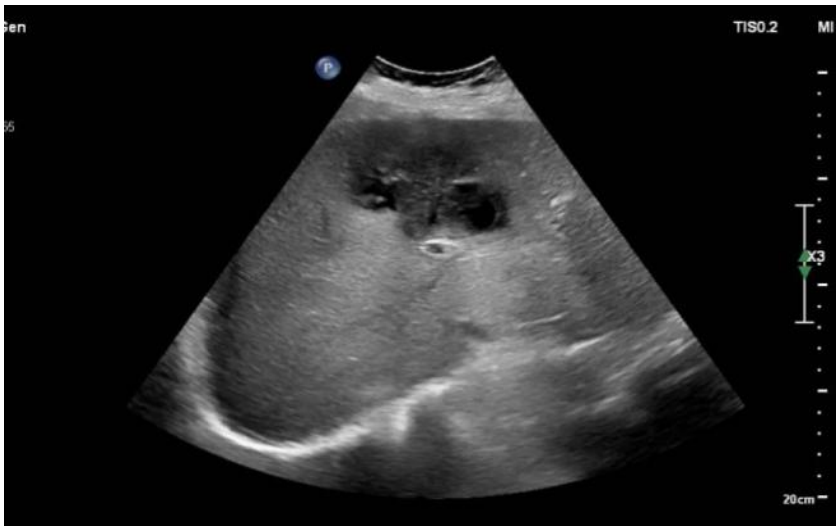


Fig 14.2

Fig. 14.1

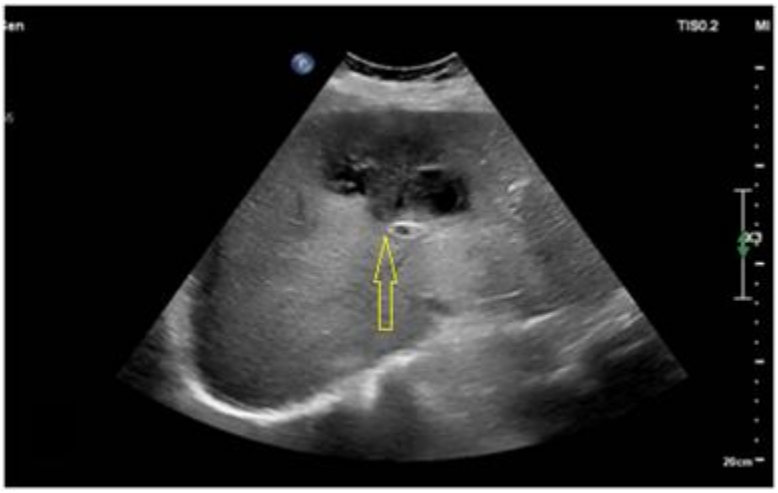


Fig. 14.2

Fig. 14.1. and Fig 14.2. The Ultrasound examination shows in the right liver lobe, segment IV, a hypoechoic focal liver lesion of 7/8 cm, with an anechoic component, in the context of a liver with moderate steatosis.

- **Contrast enhanced ultrasound (CEUS) was performed (Fig. 14.3 A, B, C),** which revealed:

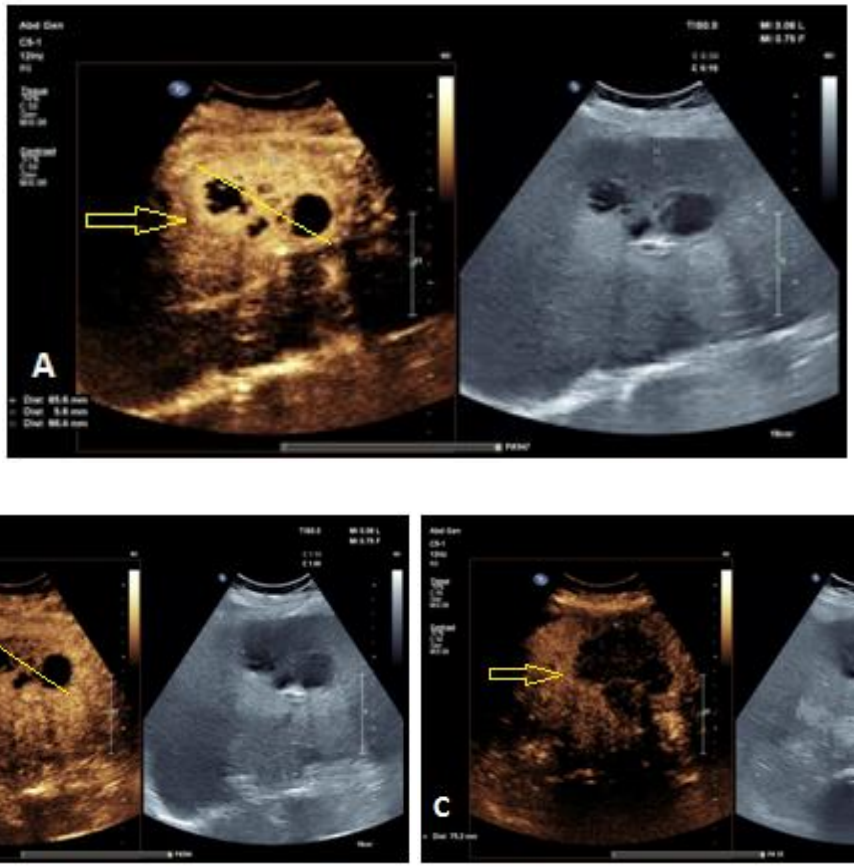


Fig 14.3(A-C) CEUS

- **Fig. 14.3. A** - shows in the arterial phase a hyperenhancing pattern in the periphery of the hepatic lesion but also at the level of the septa, suggesting a "honeycomb" pattern.
- **Fig. 14.3. B, C** - In the venous (B) and late (C) phases a mild washout can be observed in the hyperenhancing areas.

In the clinical and paraclinical context, the suspicion of liver abscess was raised. To confirm the diagnosis, we performed an ultrasound guided puncture of the lesion with extraction of 2 ml of pus.

The culture of the aspirated liquid showed a purulent collection with Escherichia coli.

Initially, we started treatment with a wide spectrum antibiotic, afterward adjusted according to the antibiogram with a favorable clinical evolution. The patient became afebrile, and the inflammatory biological syndrome improved. During hospitalization, the abscess did not evolve to a collection suitable for percutaneous drainage. The patient was discharged with the recommendation to continue antibiotic treatment for up to 4 weeks, with uneventful evolution during follow-up.

Discussion

- Biliary tract obstruction is the most common source of pyogenic liver abscess. Abdominal infection, such as appendicitis, diverticulitis, or a perforated bowel can also be cause for liver abscess. Many liver abscesses are cryptogenic and frequently associated with chronic medical conditions such as diabetes mellitus.
- Conventional ultrasound has 85 to 96% sensitivity for detecting pyogenic liver abscesses. In CEUS examination, the presence of rim enhancement in the arterial phase, septa enhancement (honeycomb appearance), no enhancement in the liquid-necrotic areas, and venous hypoenhancement are the most common features of liver abscesses.
- US-guided aspiration is required for a definite diagnosis and also obtains a sample for microbiology. The proper treatment of liver abscesses includes wide-spectrum antibiotics, percutaneous aspiration, percutaneous drainage, or surgical drainage.

Final diagnostic: Liver abscess

References:

1. Mavilia MG, Molina M, Wu GY. The Evolving Nature of Hepatic Abscess: A Review. J Clin Transl Hepatol. 2016;4(2):158-68.
2. Cai YL, Xiong XZ, Lu J, et al. Percutaneous needle aspiration versus catheter drainage in the management of liver abscess: a systematic review and meta-analysis. HPB (Oxford). 2015;17(3):195-201
3. Claudon M, Cosgrove D, Albrecht T, et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) – update 2008. Ultraschall Med 2008; 29: 28-44.
4. Gyorffy EJ, Frey CF, Silva J Jr, McGahan J. Pyogenic liver abscess. Diagnostic and therapeutic strategies. Ann Surg 1987; 206: 699-705.
5. Mohsen AH, Green ST, Read RC, McKendrick MW. Liver abscess in adults: ten years experience in a UK centre. QJM 2002; 95: 797-802.
6. Popescu A, Sporea I, Șirli R, et al. Does Contrast Enhanced Ultrasound improve the management of liver abscesses? A single centre experience. Med Ultrason 2015, Vol. 17, no. 4, 451-455.

Case 15 Liver (A)

- **History**: a 68-year-old female patient, known with HBV compensated liver cirrhosis under treatment with Entecavir for three years with PCR AND HBV undetectable. The patient came to our department for a surveillance ultrasound examination.
- **FibroScan** = 49 kPa.
- **Lab tests** showed pancytopenia, hypoalbuminemia, and AFP= 145 ng/ml.
- **Ultrasound examination:**

Fig 15.1

Fig 15.2

Fig. 15.1 - hyperechoic material inside the portal vein (arrow) – portal thrombosis?

Fig 15.2 - partial absence of flow inside the right portal branch – no Doppler signal in the thrombus area.

- **Contrast enhanced ultrasound (CEUS)** was performed for further characterization (Fig 15.3 A, B).

Fig 15.3.A, B - CEUS: thrombus enhancement is absent in arterial (A) and late (B) phase. This pattern confirms the benign nature of the thrombosis.

Discussion

- Portal vein thrombosis (PVT) is a frequent complication of liver cirrhosis, and its prevalence increases with the severity of liver disease and is most often associated with hepatocellular carcinoma (HCC). Patients with liver cirrhosis and hepatocellular carcinoma can have malignant or benign PVT.

- CEUS is a very sensitive method for the differential diagnosis between benign and malignant PVT. Blunt thrombi are avascular and will not enhance during CEUS examination, while a hyperenhancement pattern of portal thrombus in the arterial phase, with “wash out” in the portal or late phase, is typical for malignant PVT.

Final diagnostic: Partial benign portal vein thrombosis.

References:

1. Danila M, Sporea I, Popescu A, et al. Portal vein thrombosis in liver cirrhosis - the added value of contrast enhanced ultrasonography. Med Ultrason. 2016 Jun;18(2):218-33.

2. Chammas MC, Oliveira AC, D Ávilla MJ, et al. Characterization of Malignant Portal Vein Thrombosis with Contrast-Enhanced Ultrasonography. Ultrasound Med Biol. 2019;45(1):50-55.

Case 16 Liver (A)

- **History:** a 32-year-old female patient with no medical history was complaining about intermittent abdominal pain in the upper right abdominal quadrant presented in the department of Gastroenterology for abdominal ultrasound evaluation.
- **Lab tests** - normal liver enzymes, AFP; negative serum markers for hepatitis viruses.
- **Ultrasound examination:**

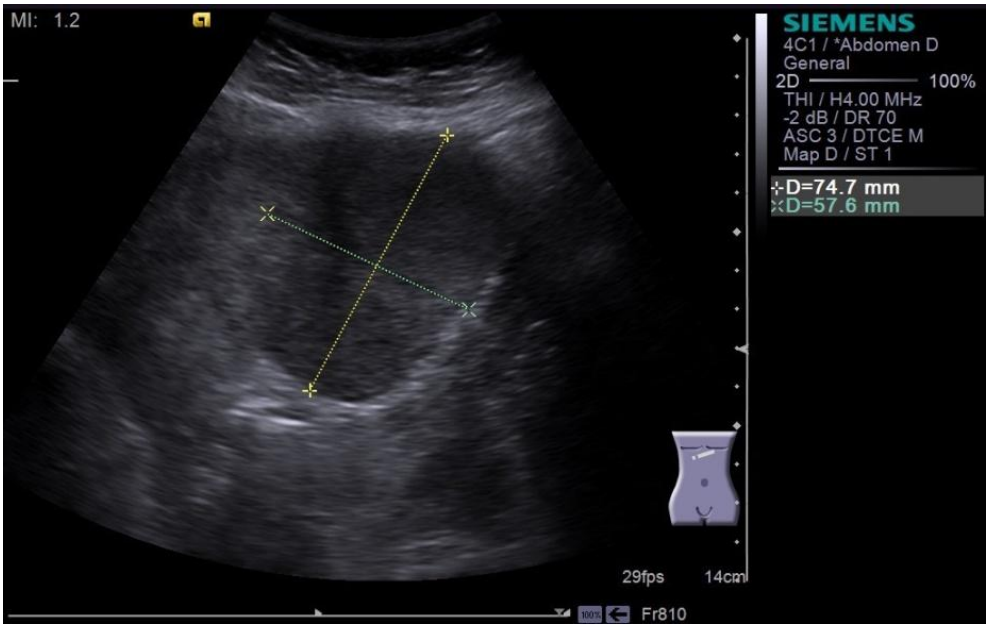


Fig 16.1

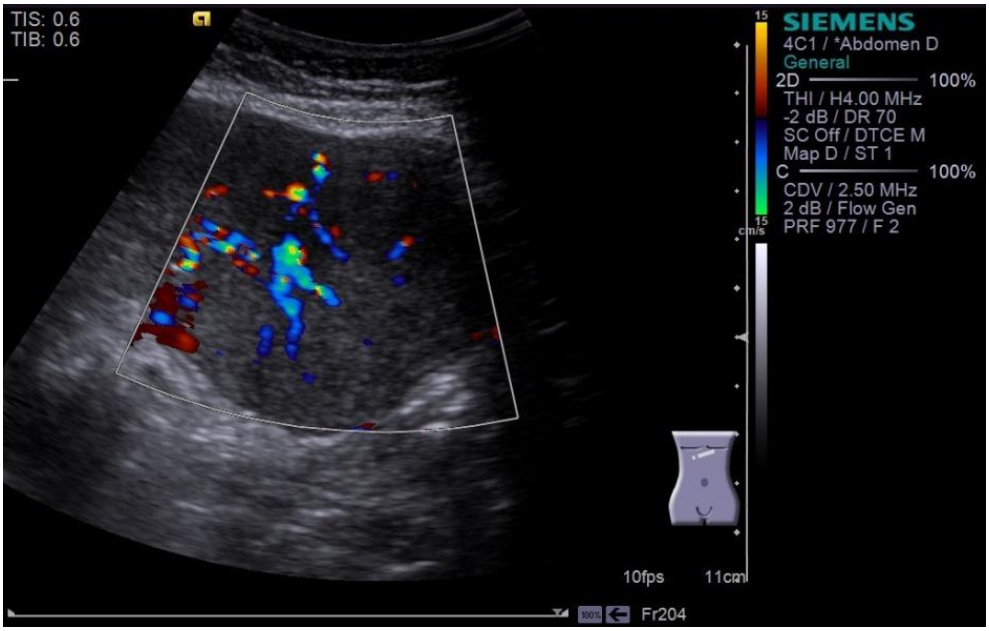


Fig 16.2

- **Ultrasound examination:**

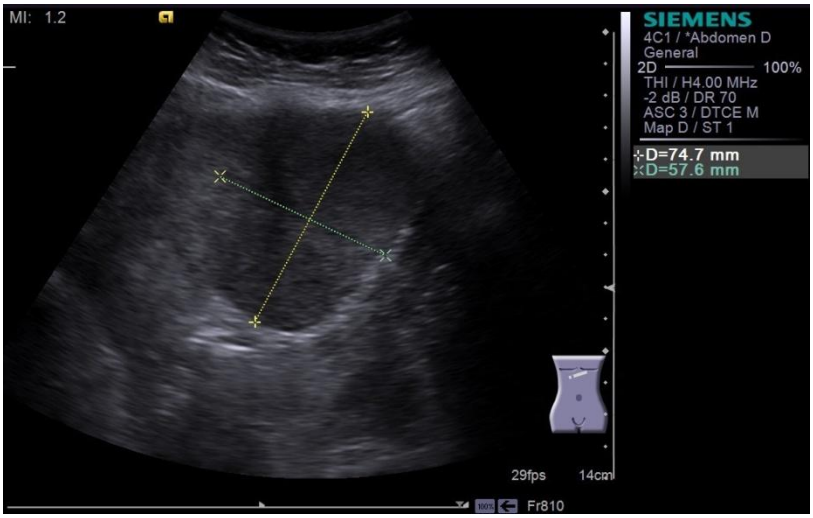


Fig 16.1 - hypoechoic focal liver lesion in the right liver lobe of 7.5/6 cm.

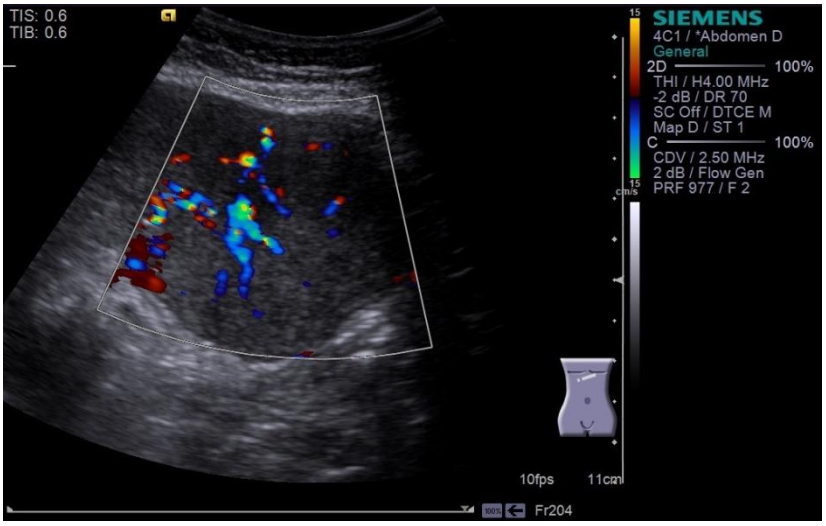


Fig. 16.2 – Spoke-wheel pattern blood flow detected in colour Doppler mode.

- **Contrast enhanced ultrasound (CEUS)** was performed for further characterization. (Fig. 16.3 A, B, C).

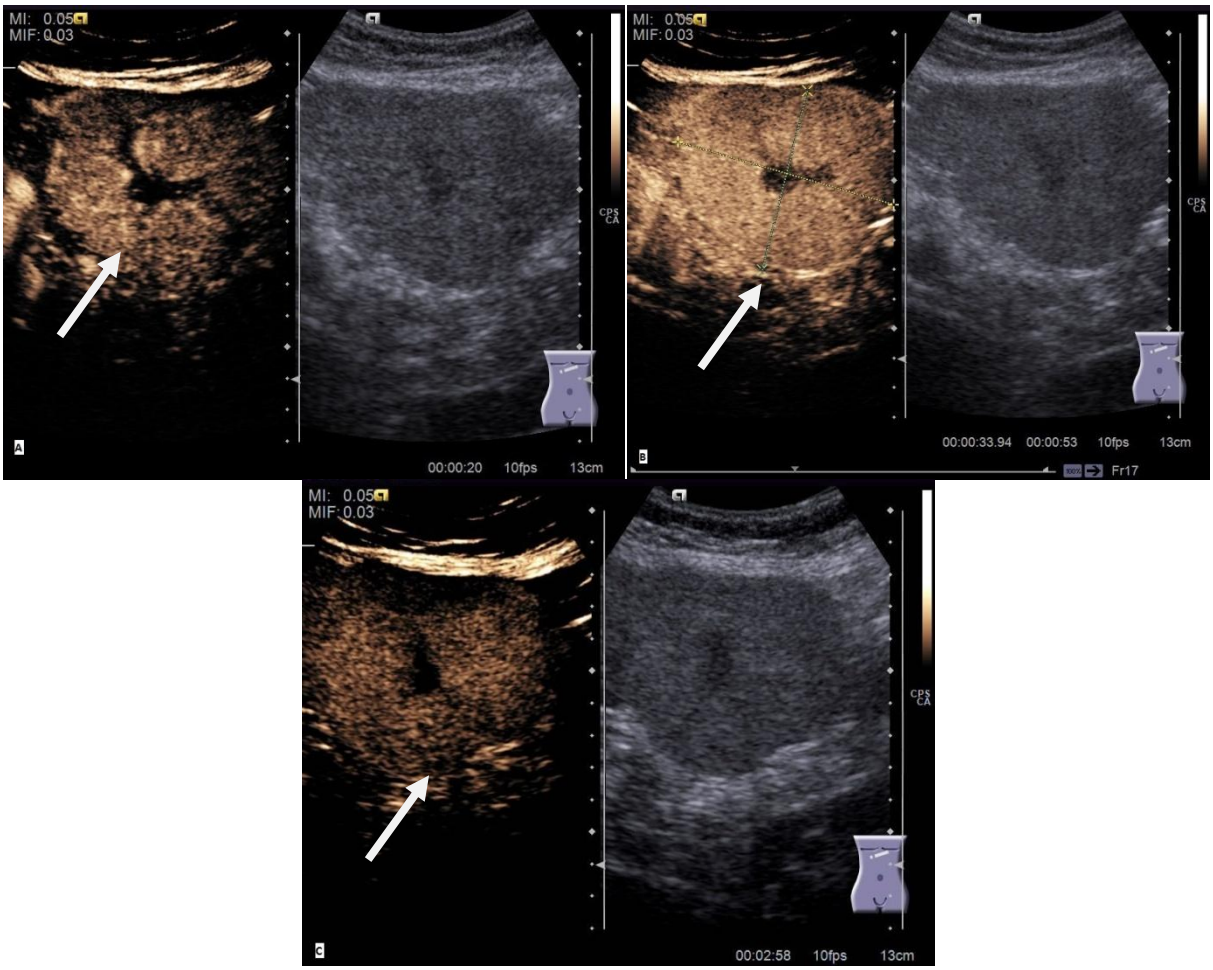


Fig. 16.3. A - arterial phase - the tumor has a rapid, complete, centrifugal arterial hyperenhancing; unenhanced central scar;
Fig. 16.3. B - portal phase - hyperenhancing tumor, unenhanced central scar;
Fig. 16.3. C - late phase - iso/hyperenhancing lesion; no washout; unenhanced central scar.

The CEUS enhancement pattern is typical for focal nodular hyperplasia [1, 2, 3].

Discussion

- Focal nodular hyperplasia (FNH) is the second most common benign liver lesion. Frequent, it is incidentally discovered during a routine ultrasound examination since the majority of cases with focal nodular hyperplasia are asymptomatic. CEUS can be used as a good alternative method for the rapid diagnosis of FNH.

- A recent study showed that CEUS is a feasible approach for the diagnosis of focal nodular hyperplasia with similar performance to MRI [1].

Final diagnostic: Focal nodular hyperplasia (FNH).

References:

1. Negrão de Figueiredo G, Mueller-Peltzer K, Schwarze V, et al. Long-term study analysis of contrast-enhanced ultrasound in the diagnosis of focal nodular hyperplasia. Clinical Hemorheology and Microcirculation. 2019 Nov. DOI: 10.3233/ch-190710.

2. Venturi A, Piscaglia F, Vidili G, et al. Diagnosis and management of hepatic focal nodular hyperplasia. J Ultrasound. 2007;10(3):116-127. doi:10.1016/j.jus.2007.06.001.

3. Claudon M, Dietrich CF, Choi BI, et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) in the liver--update 2012: a WFUMB-EFSUMB initiative in cooperation with representatives of AFSUMB, AIUM, ASUM, FLAUS and ICUS. Ultraschall Med 2013; 34:11-29.

Case 17 Liver (A)

- **History**: a 66 years-old-male was admitted in our department with malaise, fever up to 38.7 °C , abdomial pain, predominantly in the right hypochondrium. The onset was approximately two weeks before presentation, with progressive worsening.
- **Clinical exam**:
  - poor general state, uncooperative, drowsy patient
  - jaundiced sweaty skin, parched tongue
  - BP 80/60 mmHg, AV 100 b/min
  - abdominal pain in the right hypochondrium, spontaneously and on palpation; hepatomegaly with the inferior margin of the liver 4 cm below the ribs
- **Laboratory findings** revealed:
  - Increased liver function test - AST: 289 U/L [5-45], ALT: 236 U/L [5-55], T.bil: 3.9 mg/dL [0-1.2], ALP: 432 U/L [35-104], GGT: 195 U/L [7-50].
  - Leucocytosis with neutrophylia - 12700/mm^3, neutrophyles 95.2%
  - Normochrome anemia - Hb=11 g/dl
  - Hypoalbuminemia - Albumins=1.6 g/dl

- **Abdominal ultrasound**:

Fig. 17.1

Fig. 17.2

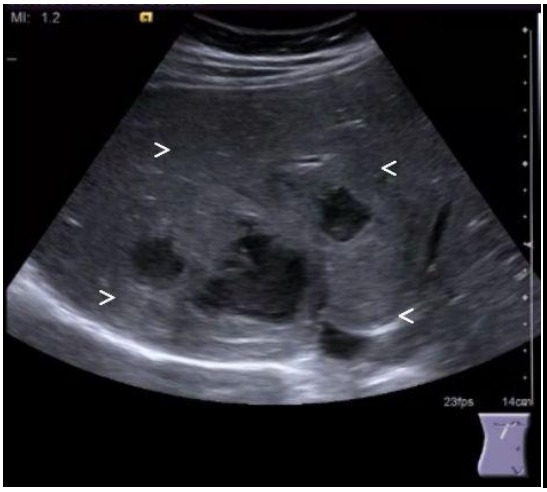



Fig. 17.1 **Fig. 17.2**

Fig. 17.1 and 17.2 : In the segments VII and VIII of the liver, a slightly hyperechoic poorly delineated large lesion, approximately 10/8 cm, with anechoic areas inside.

- **Possible diagnoses**:
  - liver abscess – considering the clinical data;
  - liver hematoma: less likely – no history of trauma
  - cystic tumor.

- **Contrast enhanced ultrasound** was performed, which revealed the following aspect:


Fig. 17.3 **Fig. 17.4**

Fig. 17.3 CEUS: Arterial Phase - Enhancing lesion, with unenhanced center.
Fig. 17.4 CEUS: Late phase - The rim of the lesion is slightly hypoenhancing and the central part is still unenhancing.

Considering the clinical setting, the B-mode ultrasound aspect and the CEUS aspect, the final diagnosis was **Liver Abscess.**

- **Ultrasound guided aspiration** was performed and puss was extracted, thus confirming the diagnosis. Culture from the aspirate was positive for Klebsiella pneumoniae sensitive to Cefepime, Ertapeneme, Meropeneme, Imipeneme. Treatment with Ertapenem 2x 250 mg/day was started and, after an initial acute renal failure (creatinine 9mg%) treated conservatively, the outcome was favorable with complete remission.

Discussion

- The incidence of liver abscess is slightly increasing (4.1: 100,000), with a mortality of 3-30% (higher in the elderly, in patients with organ deficiency) [1]. There are three major forms of liver abscesses, classified by etiology: pyogenic abscesses, more than 80% of the cases; amoebic abscesses (caused by Entamoeba histolytica, approximately 10% of cases); and fungal abscesses, most commonly due to Candida, less than 10% of cases.
- The treatment of liver abscesses is made by ultrasound or CT guided percutaneous drainage associated with antibiotic therapy [2, 3]. Surgical drainage or resection associated with antibiotic therapy is needed in patients with ruptured abscess and secondary peritonitis; in large multiloculated abscesses (5 cm); which do not respond to percutaneous drainage and antibiotic therapy [2, 4].

Final diagnosis: Liver Abscess.

References:

1. Meddings L, Myers RP, Hubbard J, et al. A population-based study of pyogenic liver abscesses in the United States: Incidence, mortality, and temporal trends. *Am J Gastroenterol* 2010 Jan; 105:117.

2. Hope WW, Vrochides DV, Newcomb WL et al: Optimal treatment of hepatic abscess. An Surg.2008;74:178-182.

3. Liu CH, Gervais DA,Hahn PF, et al. Percutaneous hepatic abscess drainage: do multiple abscesses or multiloculated abscesses preclude drainage or affect outcome? Vasc Interv Radiol.2009;20:1059-1065.

4. Chung YF, Tan YM, Lui HF, et al. Management of pyogenic liver abscesses - percutaneous or open drainage? Singapore Med J.2007;48:1158-1165.

Case 18 Liver (A)

- **History:** a 77-year-old patient with Gaucher disease undergoing enzyme replacement therapy with a history of left renal cancer (left nephrectomy and splenectomy 7 years ago) performs a routine check-up.
- **Biology:** Laboratory tests showed a normal hemoglobin level, normal transaminases, no cholestasis and no other changes except a slightly elevated serum AFP level (24 ng/ml) and a high level of ferritin (823 µg/l).
- **Abdominal ultrasound** (Fig.18.1-18.3)

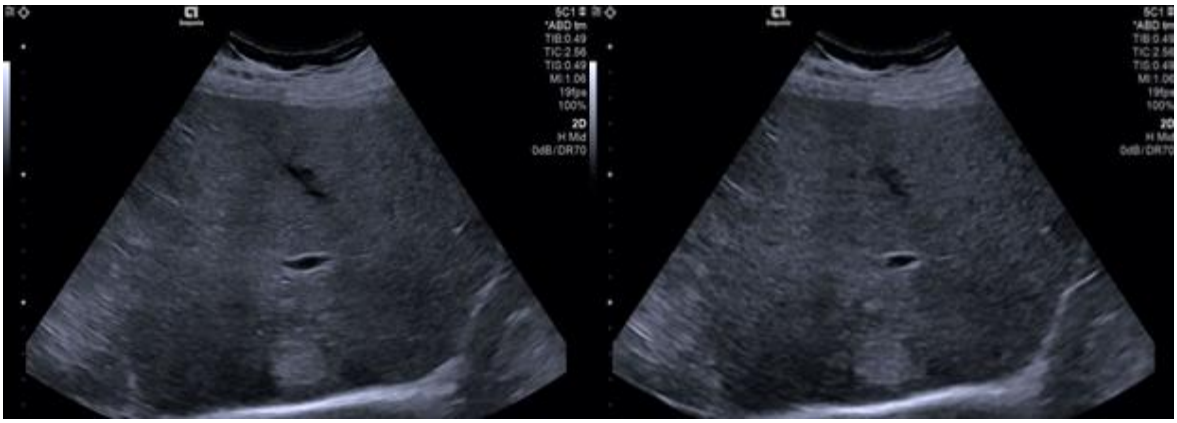


Fig.18.1 **Fig.18.2**

Fig.18.3

- **Abdominal ultrasound** (Fig.18.1-18.3)

Fig.18.1

Fig.18.2

Fig.18.3

Fig.18.1-18.3 - Homogenous liver, in segment 7 of the liver a focal hyperechoic lesion of approximately 4/3.7 cm in size, newly developed.

- **Possible diagnoses:**
  - Gaucheroma
  - Benign liver tumor (less likely due the fact that is a new lesion in an elderly man)
  - Liver metastasis (history of renal cancer)
  - Hepatocellular carcinoma (HCC).

- **Contrast enhanced ultrasound** was performed: (Fig. 18.4-18.5).

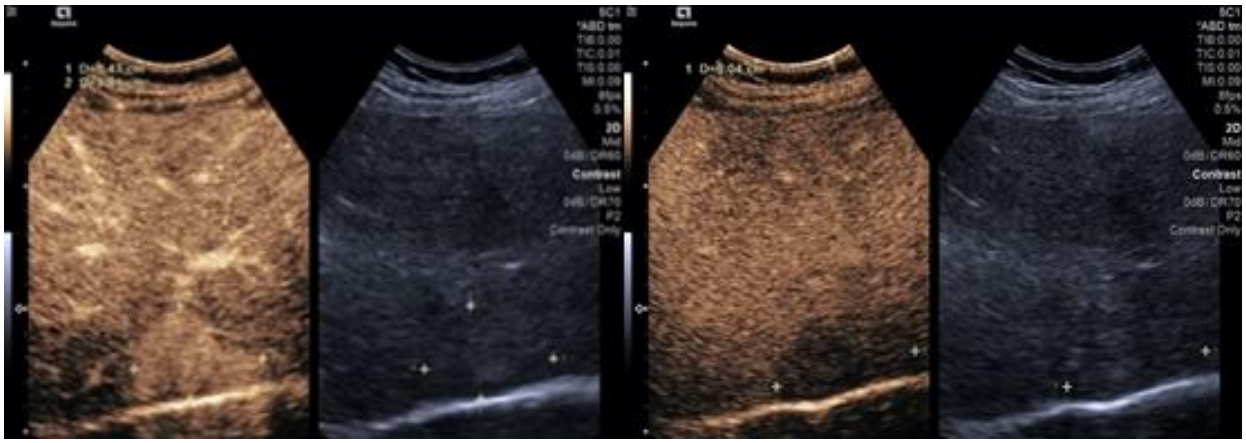


Fig.18.4 **Fig.18.5**

Fig.18.4-18.5 CEUS- the lesion was hyperenhancing in the arterial phase, completely enhanced at 20 sec (Fig. 18.4), followed by wash out in the portal phase which becomes evident in the late phase (Fig 18.5).

- **Diagnosis following CEUS – malignant lesion** (either metastasis, or hepatocellular carcinoma).

- **Additional Imaging**

- **Liver transient elastography** (FibroScan) was performed - liver stiffness median of 7.7 kPa, corresponding to significant fibrosis (F=2 Metavir).

- **Contrast enhanced CT** scan was performed, revealing in the hepatic segment VII, in contact with the posterior wall of the right hepatic vein, a hypervascularized lesion in the arterial phase with central necrosis, enhancing from the periphery towards the center but with peripheral wash-out in the late phase. The aspect is suspicious for malignancy, but it could not differentiate between metastasis or HCC (Fig. 18.6).

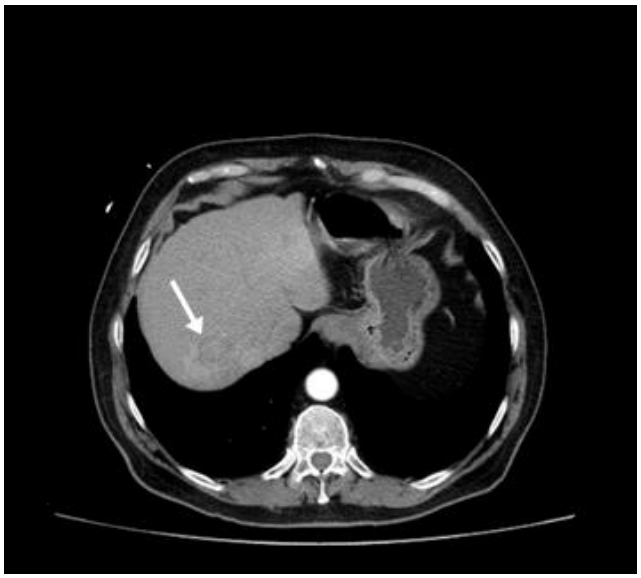


Fig.18.6

Fig.18.6 Contrast enhanced CT scan - a hypervascularized lesion in the arterial phase with central necrosis, enhancing from the periphery towards the center but with peripheral wash-out in the late phase

- Core-biopsy was performed and the pathology exam diagnosed a **poorly differentiated hepatocellular carcinoma (G3).**

Discussion

- A newly developed lesion in an elderly patient with Gaucher disease and a history of renal cancer rises difficult differential diagnosis problems.
- First of all – the possibility of a gaucheroma (accumulation of sphingolipids in liver macrophages), but with a low probability, due to the fact that the patient is undergoing enzyme replacement therapy for 6 years.
- Secondly, due to the history of left kidney cancer, a liver metastasis is also possible (but also with a low probability due to the fact that the kideny cancer was operated 7 years ago, with no signs of recurrence during follow-up).
- Thirdly – Gaucher disease patients are at higher risk for HCC and lymhoma [1]. HCC ussualy occurs in patients with severe fibrosis and cirrhosis, but in our case the FibroScan revealed only significant fibrosis. However, the biopsy revealed the presence of a poorly differentiated HCC.
- Considerring all these facts the immaging differential diagnosis was impossible in our patient's case.

Treatment: Following the results of the pathological exam and considering the good status of the patient, a decission to perform liver resection was taken, with good postoperative evolution (the patient was discharged 10 days after surgery).

Final diagnosis: Poorly differentiated hepatocellular carcinoma (G3)

References:

1. Arends M, van Dussen L, Biegstraaten M et al. Malignancies and monoclonal gammopathy in Gaucher disease; a systematic review of the literature. Br J Haematol, 2013;161: 832-842.

Case 19 Liver (A)

- **History:** A 61-year-old male patient, with type 2 diabetes, hypertensive, who presented in consultation for abdominal discomfort.
- **Clinical exam:** Overweight patient (BMI 28 kg/m^2), BP 140/80 mmHg, AV 80 beats/min, hepatomegaly (liver 5-7 cm below the costal rim, elastic consistency), no pain on palpation.
- **Biology:**
    - mild anemia (Hb=11.4g%, normal leucocytes, thrombocytes, normal iron) and
    - increased BSR (82 mm/1h);
    - normal aminotransferases but with slight cholestasis: ALP=196 IU/l (Upper value of Normal – UVN=126 IU/l), GGTP=142 IU/l (UVN=72 IU/l), with normal bilirubin;
    - no signs of hepatic insufficiency (normal albumins, INR);
    - negative viral markers for HBV and HCV hepatitis; normal Alpha-fetoprotein.

- **Abdominal ultrasound:**

Fig. 19.1

Fig. 19.2

- **Abdominal ultrasound:**

Fig. 19.1

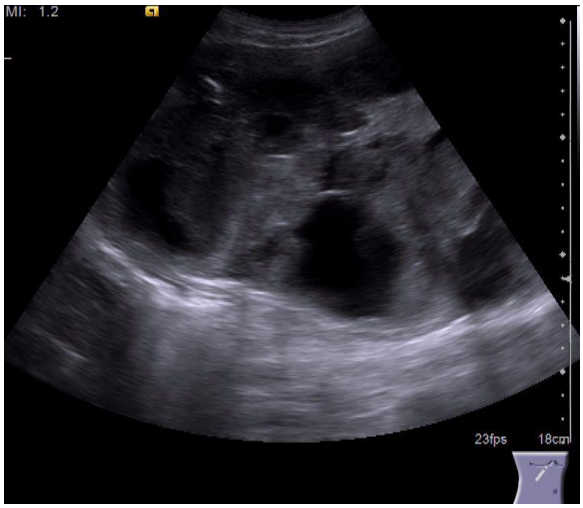
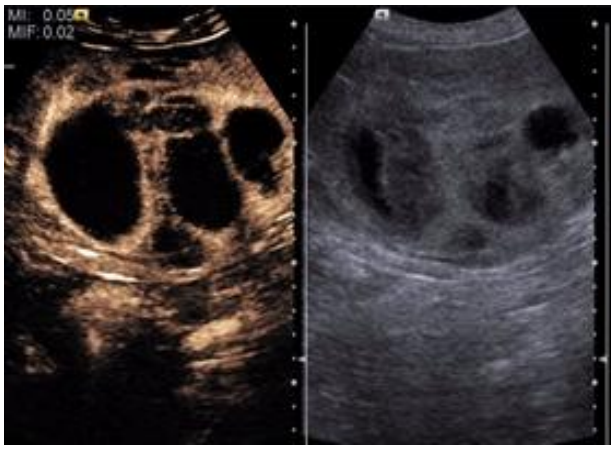


Fig. 19.2

Fig. 19.1 and Fig.19.2. - Multiple masses 7-10 cm in diameter, some anechoic with thick septa and others with mixed content, anechoic and echodense, that occupy almost the whole liver.

- **Possible diagnoses:**
    - Cystic tumor (cyst-adenoma, cyst-adenocarcinoma, cystic metastases).
    - Hemorrhagic biliary cysts (cystic lesions with echoic content).

- **Contrast enhanced ultrasound** was performed for the differential diagnosis.
    - revealed multiple cystic lesions with walls and septa enhancing in the arterial phase (Fig.19.3) and which did not show washout in the portal-venous and late phases (Fig.19.4). The echodense content present in some of the cysts did not enhance following contrast.
    - **The conclusion of CEUS – benign cystic tumor of the liver – probably cyst-adenoma, with intracystic hemorrhage**.



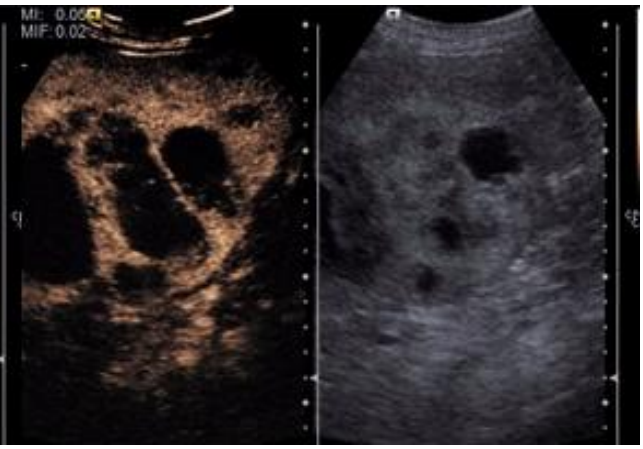


Fig. 19.3 **Fig. 19.4**

- **Fig. 19.3-19.4 CEUS – arterial phase** - multiple cystic lesions with walls and septa enhancing in the arterial phase (Fig.19.3), **late phase** - multiple cystic lesions with walls and septa, which did not show washout (Fig.19.4). The echo dense content present in some of the cysts did not enhance following contrast.

- ## Additional Imaging
- **Abdominal CT with contrast**
    - described a large cystic tumor, approximately 25.4/14/16.4 cm, in segments II, III, IV of the liver, with small calcium deposits in the septa, with thick walls, enhancing in the arterial phase, with mass effect on the gall bladder. Another 7 cm cystic lesion was described in segment VIII (Fig. 19.5)

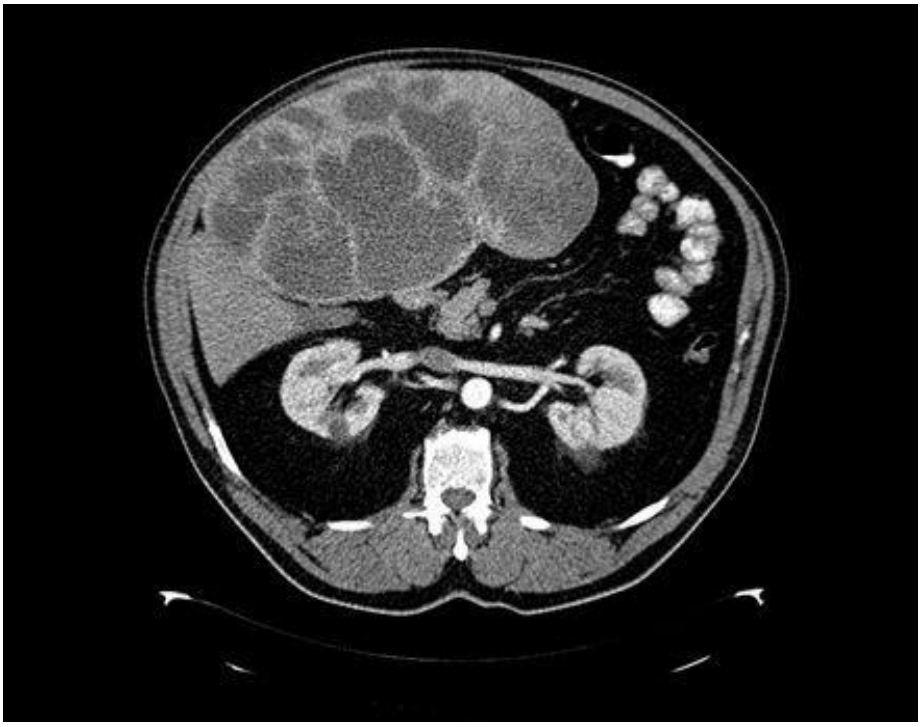


Fig. 19.5

Fig. 19.5. Abdominal Contrast Enhanced CT – arterial phase: a large cystic tumor, approximately 25.4/14/16.4 cm, in segments II, III, IV of the liver, with small calcium deposits in the septa, with thick walls, enhancing in the arterial phase.

- **Echoguided core biopsy** was performed.
    - The conclusion of the pathological exam was: Hyperplasic type alterations of the hepatocytes (regenerative/focal nodular, adenomatous) with no dysplasia, so that the **final diagnosis was Cyst-Adenoma.**

Discussion

- Cyst-adenomas are rare tumors of the liver; they represent less than 5% of the non-hydatid cysts of the liver [1], with less than 200 cases reported worldwide. They originate from the bile ducts in the liver, or less frequently in the extrahepatic bile duct or gallbladder [2, 3].
- Small cysts are asymptomatic, while, in larger cysts, the clinical symptoms are not specific, the most frequent ones being abdominal discomfort and abdominal mass, in 1/3 of cases obstructive jaundice being the first symptom to appear [4]. Rarely ascites

secondary to portal hypertension or acute abdominal pain due to intracystic hemorrhage, cyst rupture or torsion, can occur [1].

- Usually the biological parameters are almost normal, with slightly increased aminotransferases or cholestasis in some cases. Tumor markers have no value in differentiating benign cyst-adenoma from cyst-adenocarcinoma [4].
- Ultrasonography is a useful tool for the first assessment of cyst-adenoma. Usually a well-defined, smooth-walled cyst with septa is seen. On CT, the aspect is similar, the cyst being a low-density one. The internal septa and wall enhance following contrast both in CEUS and in contrast CT. It is difficult to distinguish cyst-adenoma from cyst-adenocarcinoma on imaging methods alone. Thick walls, calcification, enhancing papillary projections inside the cyst usually indicate a cyst-adenocarcinoma [5].
- Since there is a high risk of malignant transformation, and since patients treated by partial excision, marsupialization, internal drainage, aspiration or intratumoral sclerosing injection have experienced high recurrence rates, radical excision of the tumor is the first treatment choice [6]. Ultrasound follow-up every 6 months post-surgery should be performed due to the high risk of recurrence. In very large, multiple cysts, such is the case in our patient (in which almost no healthy tissue was available), liver transplantation should be considered.

Final Diagnosis: Cyst-Adenoma.

References:

1. Hernandez Bartolome MA, Fuerte Ruiz S, Manzanedo Romero I, et al. Biliary cystadenoma. World J Gastroenterol. 2009;15(28):3573-3575.

2. Rooney TB, Schofer JM, Stanley MD, et al. Biliary cystadenoma of the gallbladder. AJR Am J Roentgendol 2005; 185:1571-1572.

3. Florman SS, Slakey DP. Giant biliary cystadenoma: case report and literature review. Am Surg 2001; 67:727-732.

4. Zhou JP, Dong M, Zhang Y, Kong FM, et al. Giant mucinous biliary cystadenoma: a case report. Hepatobiliary Pancreat Dis Int 2007; 6: 101-103

5. Choi BI, Lim JH, Han MC, et al. Biliary cystadenoma and cystadenocarcinoma: CT and sonographic findings. Radiology 2004; 171:57-61.

6. Davies W, Chow M, Nagorney D. Extrahepatic biliary cystadenomas and cystadenocarcinoma. Report of seven cases and review of the literature. Ann Surg 1995; 222: 619-625.

Case 20 Liver (A)

- **History:** A 82 years-old-female was admitted in our department with obstructive jaundice and epigastric pain.
- **Biology:**
  - Lipase : 1163U/L
  - Elevated liver enzymes – AST 10xUVN, ALT 10xUVN, Total bilirubin: 4.2 mg/dL [0-1.2], Direct bilirubin: 4.067 mg/dL [0-0.3], ALP: 304 U/L [35-104], GGT: 268 U/L [7-50].

- **Abdominal ultrasound examination (Fig. 20.1-20.4):**

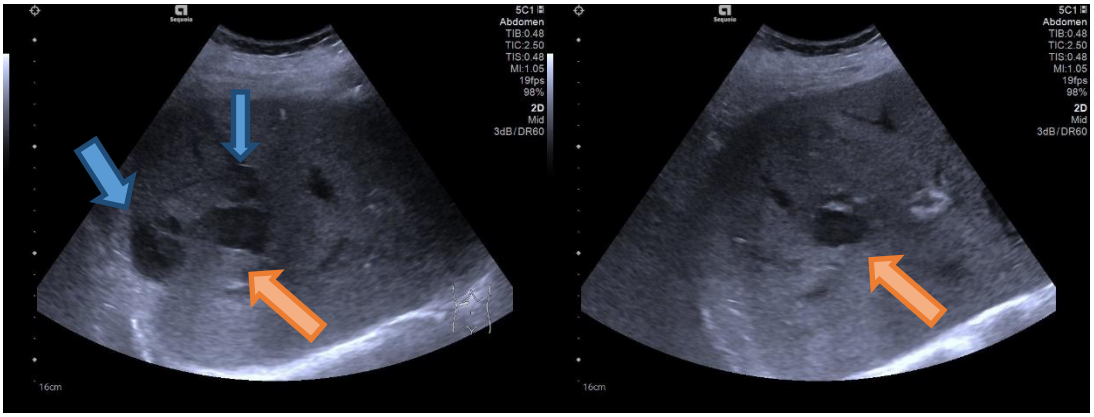


Fig 20.1 **Fig 20.2**

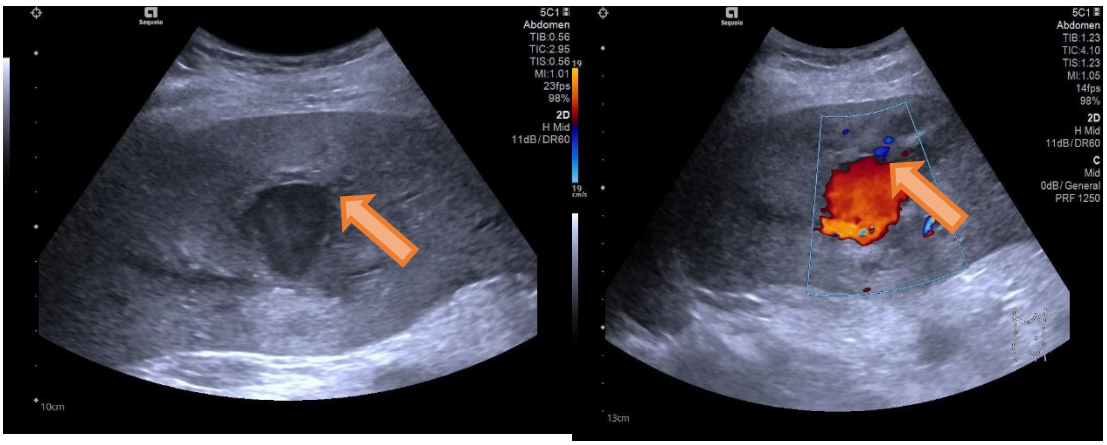


Fig 20.3 **Fig 20.4**

- **Abdominal ultrasound examination (Fig. 20.1-20.4):**

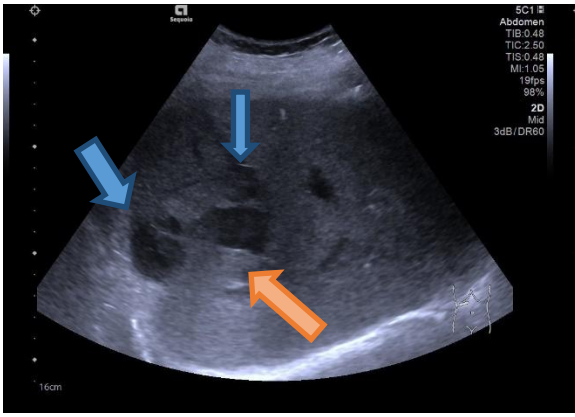


Fig 20.1

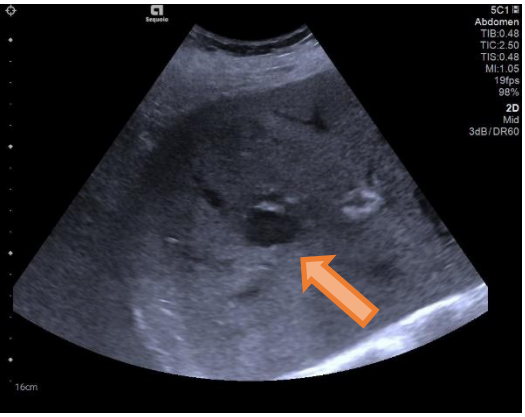


Fig 20.2

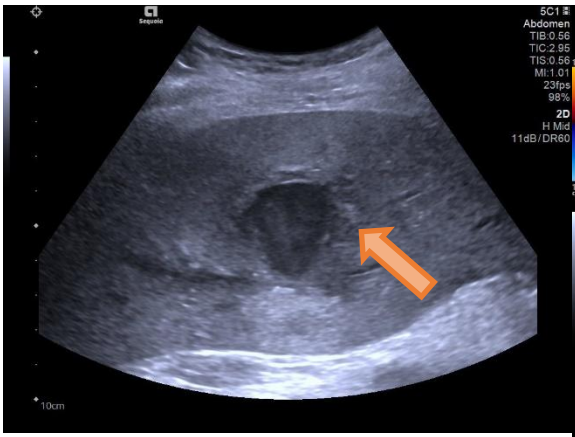


Fig 20.3

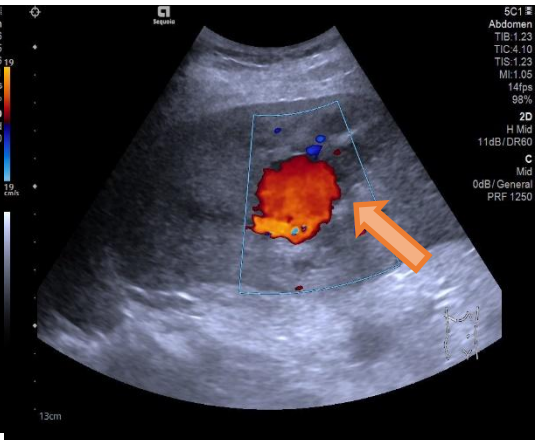


Fig 20.4

Fig 20.1, Fig 20.2, Fig.20.3, Fig 20.4 Blue arrow: hypoechoic, inhomogeneous lesion, with anechoic content; Red arrow: hypoechoic lesion, one of them with pulsatile Doppler flow (pseudoaneurysm?).

- **Possible diagnoses:**
  - Liver abscess
  - Hematoma with pseudoaneurysm
  - Liver Hemangioma;
  - Focal Nodular Hyperplasia;
  - Hepatocellular carcinoma.

- **Contrast enhanced ultrasound** was performed for the differential diagnosis.

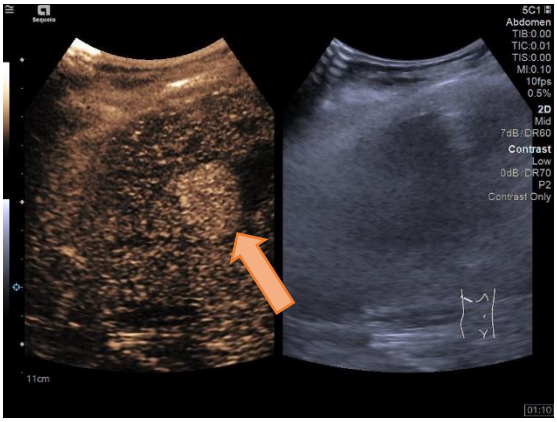
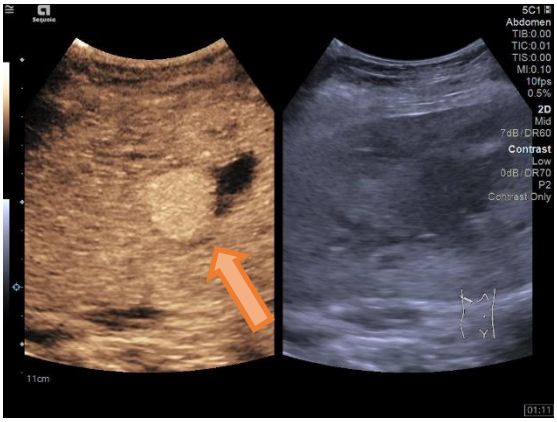


Fig 20.5



Fix 20.6

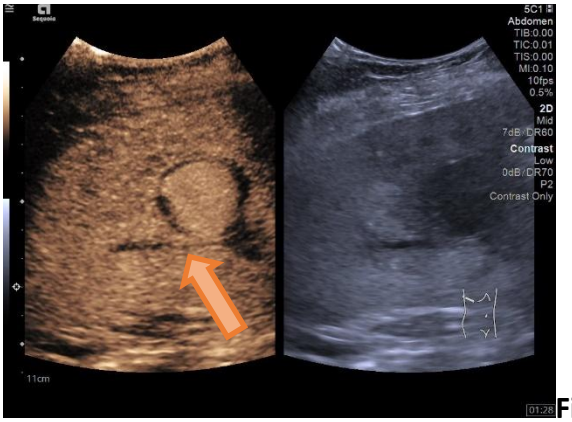


Fig. 20.7

Fig. 20.5, Fig 20.6, Fig 20.7 Red arrow: the hypoechoic lesion (pseudoaneurysm), enhancing in all the examined phases ;

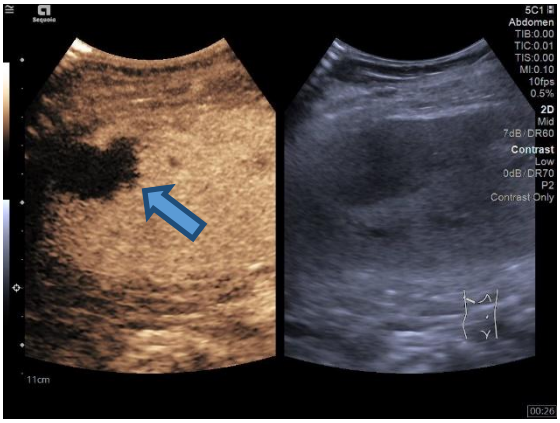


Fig. 20.8

Fig.20.8 Blue arrow: The hypoechoic lesion is unenhancing in all the examined phases

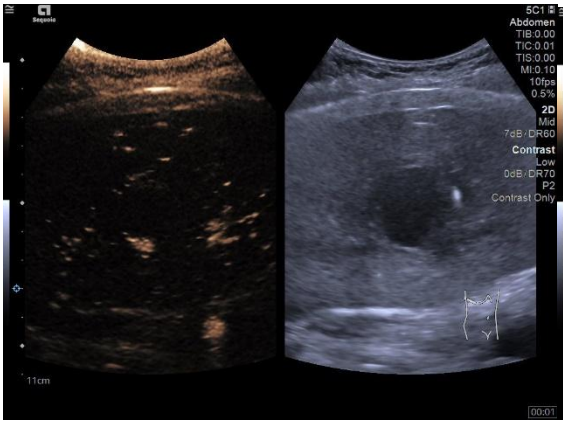


Fig. 20.9

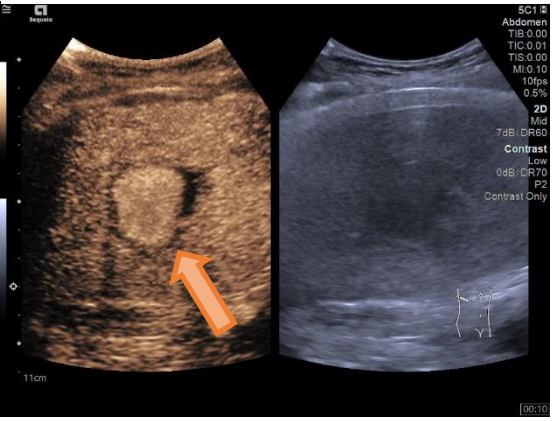


Fig. 20.10

Fig.20.9 microbublles beeing burst at low ultrasound frequencies and at high mechanical indices.

Fig.20.10 rapid fill of the pseudoaneurism after bursting indicating its vascular nature (red arrow).

- CEUS final diagnosis Hepatic abscess (blue arrow) with a vascular abnormality (red arrow)

Additional imaging

A Colangio-MRI was performed that showed moderately dilated intra- and extrahepatic bile ducts, multiple images compatible with choledocholithiasis as well as the presence of some inhomogeneous structures in the hepatic segment VI/VII

- **CT scan** was performed that showed two lesions in the VII segment non enhancing (liver abscesses) and one aneurysmal dilatation of the segmental VII hepatic artery.
- The diagnosis of **liver abscesses** made by CEUS, and confirmed by MRI and CT scan (Fig. 20.11, 20.12). The diagnosis of hepatic artery pseudoaneurysm was made by CT-scan (Fig 20.11, Fig 20.12)

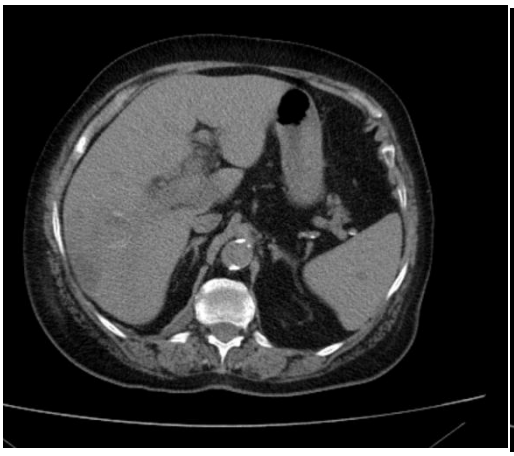


Fig. 20.11

Fig. 20.12

- Ultraselective embolisation was successfully performed (Fig 20.13, Fig 20.14).

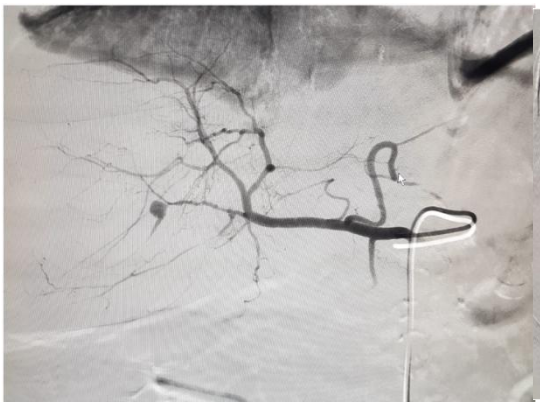


Fig 20.13

Fig 20.14

- After embolization, the lesion is completely non-enhancing (Fig 20.15, Fig 20.16)

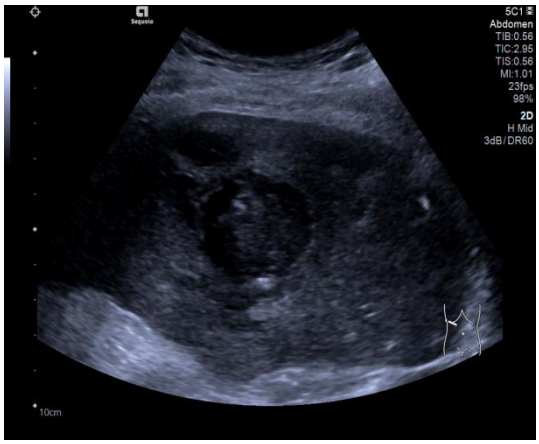


Fig 20.15

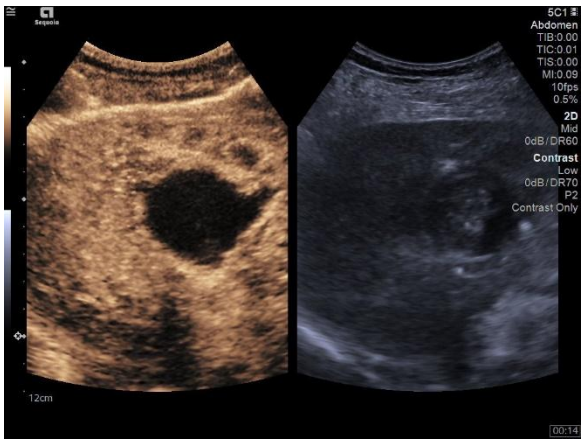


Fig 20.16

Final diagnosis: liver abscess and hepatic artery pseudoaneurysm.

References:

1. Barge, Jaideep U, Jorge E Lopera. “Vascular complications of pancreatitis: role of interventional therapy.” Korean journal of radiology vol. 13 Suppl 1,Suppl 1 (2012): S45-55.

2. Shiozawa, Kazue, et al. "Right Hepatic Artery Pseudoaneurysm Complicating Acute Pancreatitis: A Case Report." Medical Principles and Practice 22.4 (2013): 402-404.

3. Yu, Y.H., Sohn, J.H., Kim, T.Y.,et al. Hepatic artery pseudoaneurysm caused by acute idiopathic pancreatitis. World Journal of Gastroenterology 2012, 18(18),229.

Case 21 Liver (A)

- **History:** a 78 years-old-female was admitted in our department with *abdominal pain, fever, nausea and mild jaundice*.
- **Laboratory findings** revealed leucocytosis 16,400 /microL[4000-900/microL], elevated liver function tests (AST: 320 U/L [5-45], ALT: 430 U/L [5-55], T.bil: 3.8 mg/dL [0-1.2], D.bil: 3.2 mg/dL [0-0.3], ALP: 350 U/L [35-104], GGT: 580 U/L [7-50]), Creatinin level: 4.3 mg/dl and inflammatory markers (CPR: 155 mg/l, ESR 65mm/1h, Fibrinogen 521 mg/dl).
- **Ultrasound examination: Fig.21.1 (A-B).**

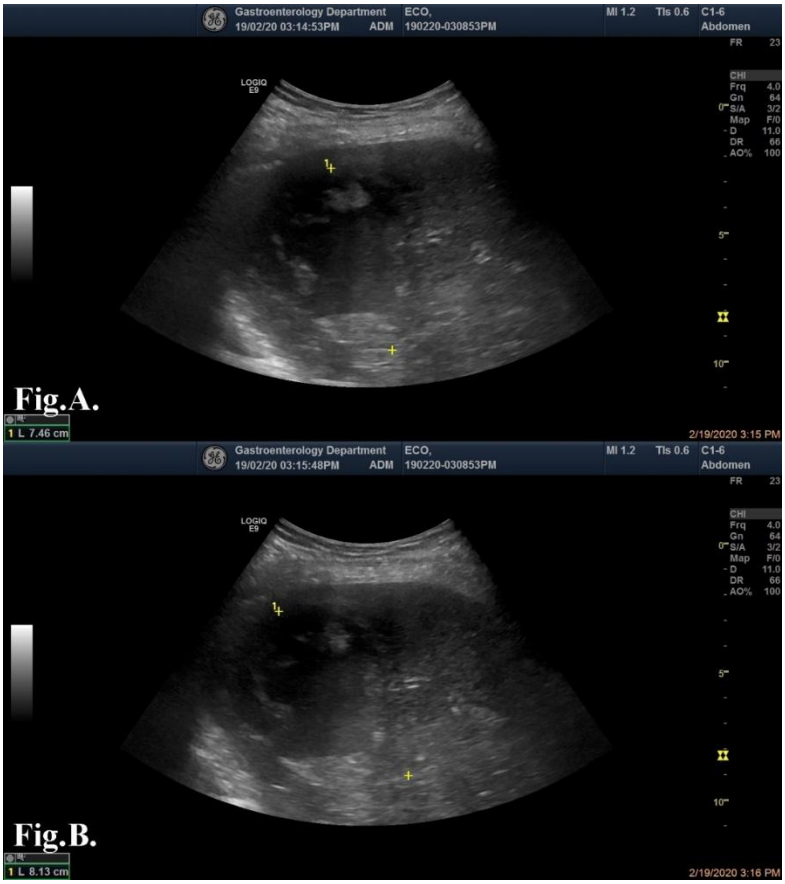
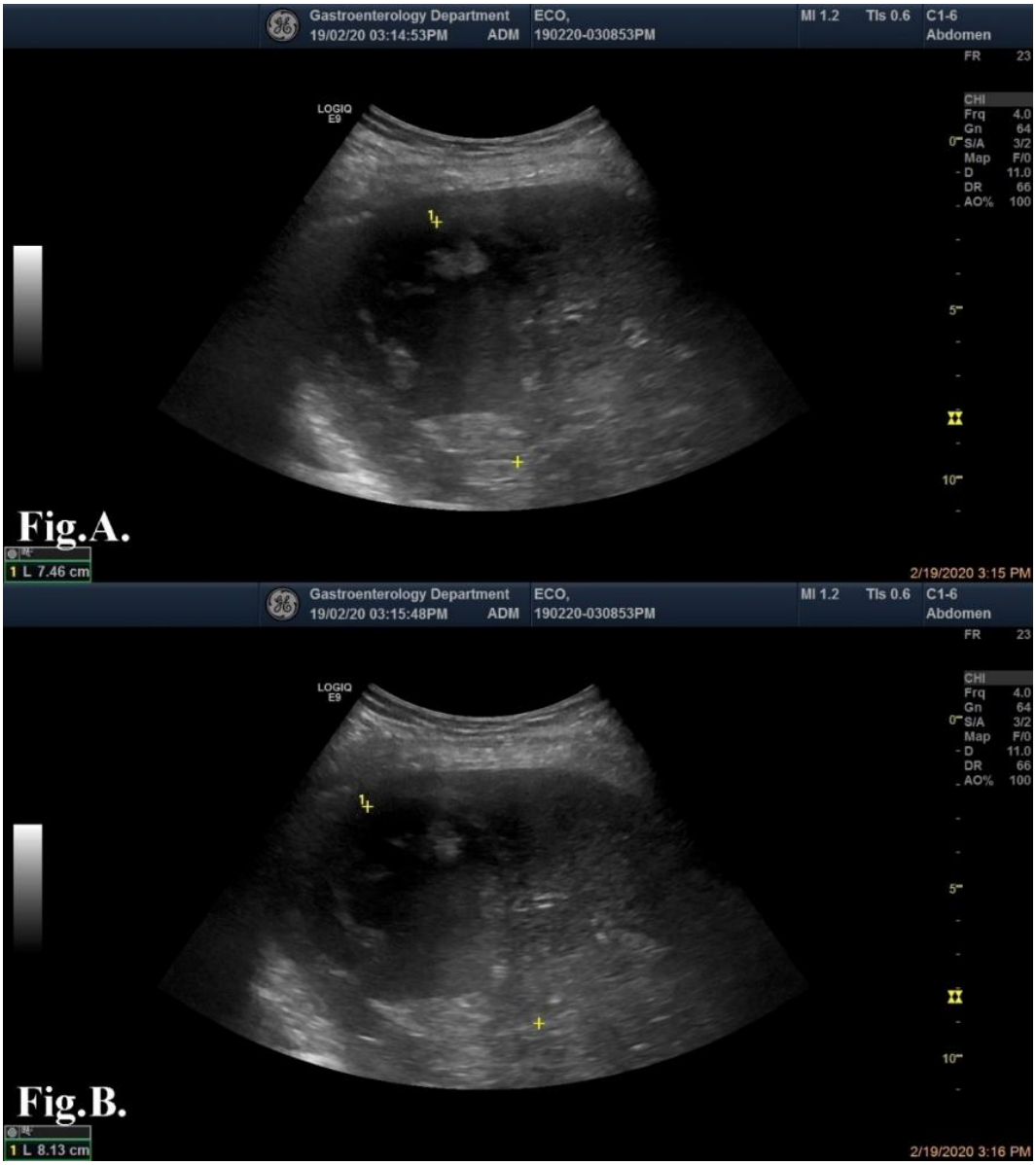
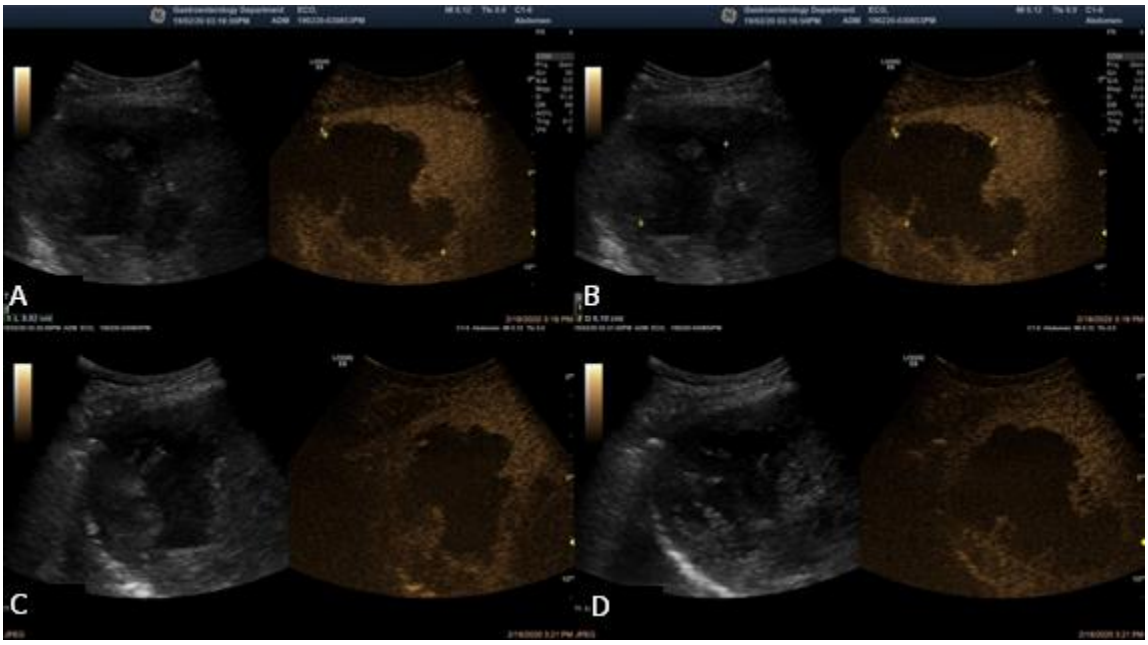


Fig. 21. A, B



- **Fig. 21.1 A, B. G**rey scale US - *inhomogenous lesion of approximately 8 cm* in the right liver lobe, segment VI, VII,VIII with a predominant liquid appereance and some debridements inside, suggestive for liver abcess.

- **Contrast enhanced ultrasound: Fig. 21.2 (C, D, E, F).**



- **Fig. 21.2 (A-D).** Contrast enhanced ultrasound reveals a typical aspect of rim enhancement in the arterial phase (A) with a central unenhanced area, suggestive for devitalized tissue (necrotic tissue). In portal and late phases (Fig. C,D,E) we can depict a slight wash-out in the periphey of the lesion, subsequent to the inflammation process.

Discussion

- In this case, from the US evaluation and the clinical data, the diagnosis was higly suspicious for a liver abscess.
- Contrast enhanced ultrasound (CEUS) helped us for the final diagnosis given the fact that the patient was uable to undergo computer tomography.
- The comorbidites contraindicated surgical treatment, thus interventional ultrasound was the only option. By CEUS, the examiner could deliniate the liquefied abscess (unenhancing areas).

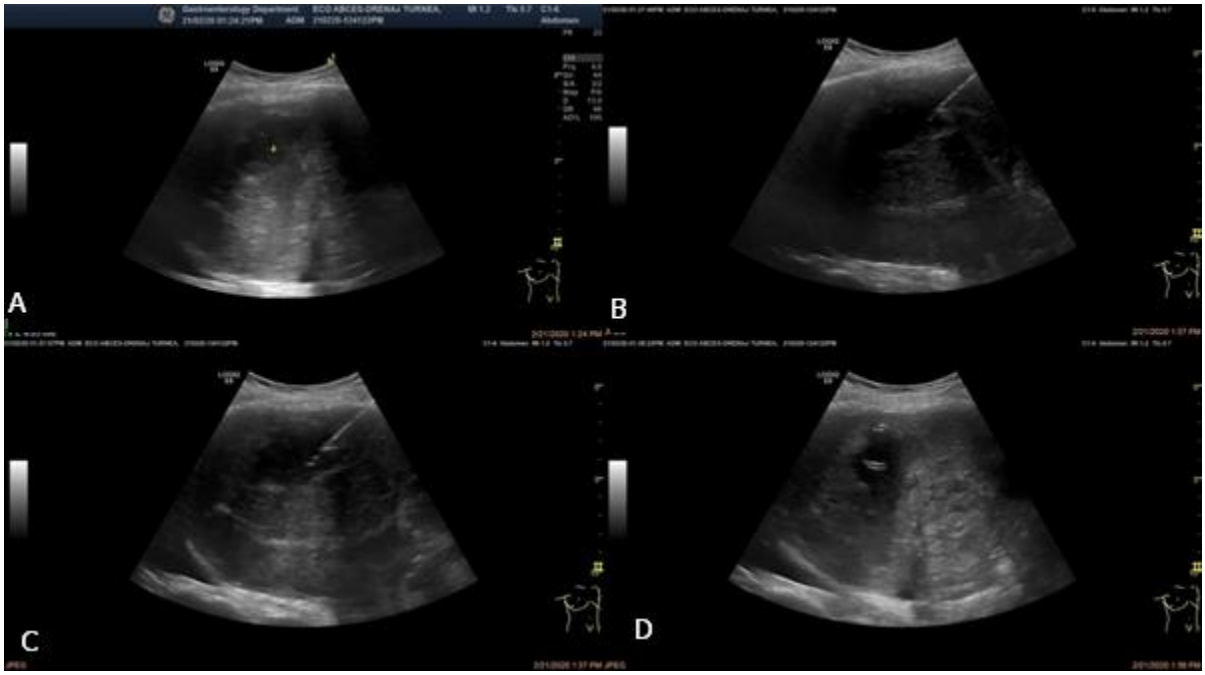


Fig. 21.3 (A-D). The interventional procedure of inserting (A,B), aspirating (Fig. C) and fixing (D) a draining tube (pig-tail) in order to evacuate the pus in a minimally invasive way.

Final Diagnostic: Liver Abscess.

Refrences:

1. Popescu A, Sporea I, Şirli R, et al. Does Contrast Enhanced Ultrasound improve the management of liver abscesses? A single centre experience. Med Ultrason. 2015 Dec; 17 (4): 451-5.

2. Liu CH, Gervais DA, Hahn PF et al. Percutaneous hepatic abscess drainage: do multiple abscesses or multiloculated abscesses preclude drainage or affect outcome? Vasc Interv Radiol.2009; 20: 1059-1065.

3. Chung YF, Y M Tan, H F Lui et al. Management of pyogenic liver abscesses - percutaneous or open drainage? Singapore Med J.2007; 48: 1158-1165.

Case 22 Liver (A)

- **History:** a 72 years-old-male was admitted in our Department with *jaundice, diffuse abdominal pain, weight loss and hyperchrome urine.*
- **Laboratory findings** revealed increased liver function test (AST: 98 U/L [5-34], ALT: 81 U/L [0-55], T.bil: 7.08mg/dL [0.2-1.2], D.bil: 5.66 mg/dL [0-0.2], ALP: 444 U/L [50-136], GGT: 761U/L [15-85]).
- **Ultrasound examination: Fig. 22.1, 22.2.**

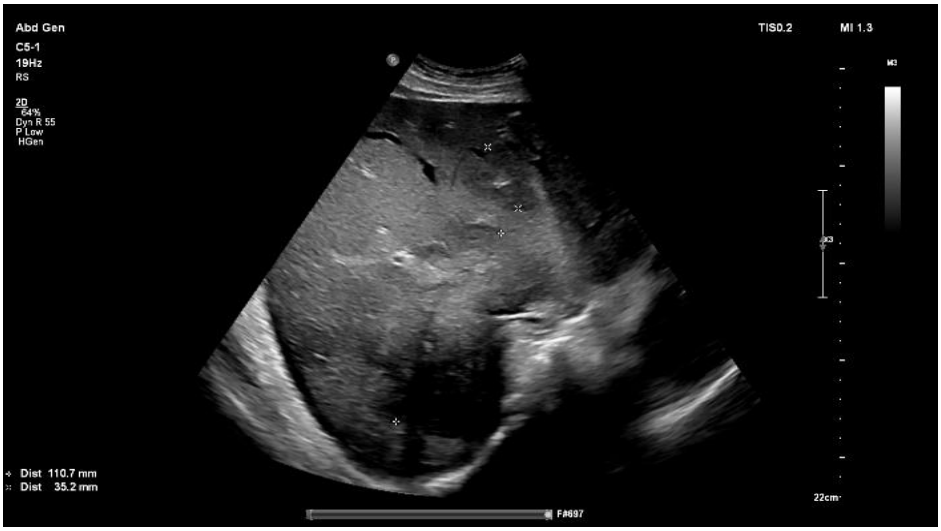


Fig. 22.1

Fig. 22.2

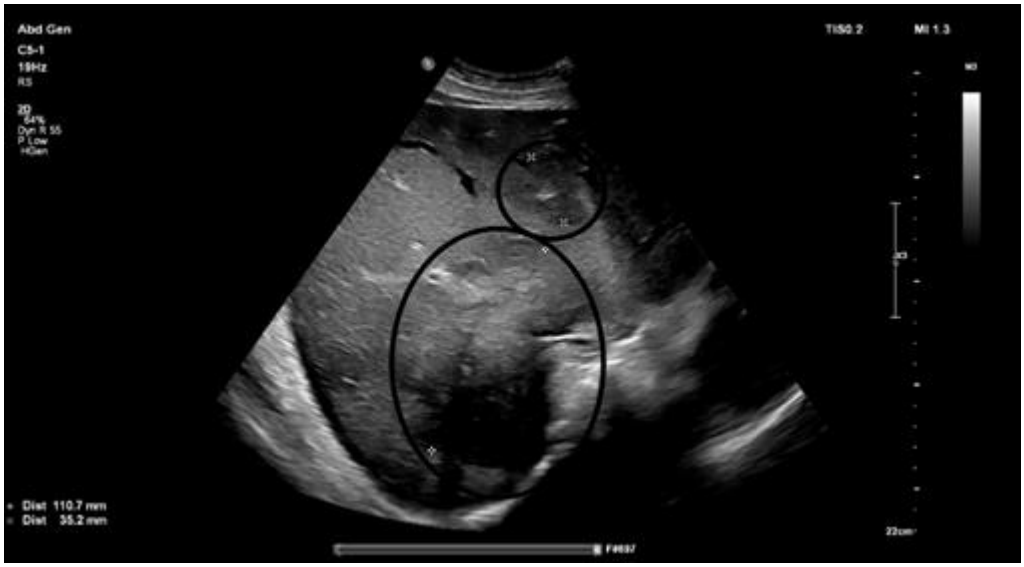


Fig. 22.1 The liver presents in the right hepatic lobe- segments VI-VII an inhomogeneous lesion of about 11 cm and in segment IV another lesion of about 3.5 cm, in contact with the right suprahepatic vein. Minimally dilated bile ducts and perihepatic ascites.

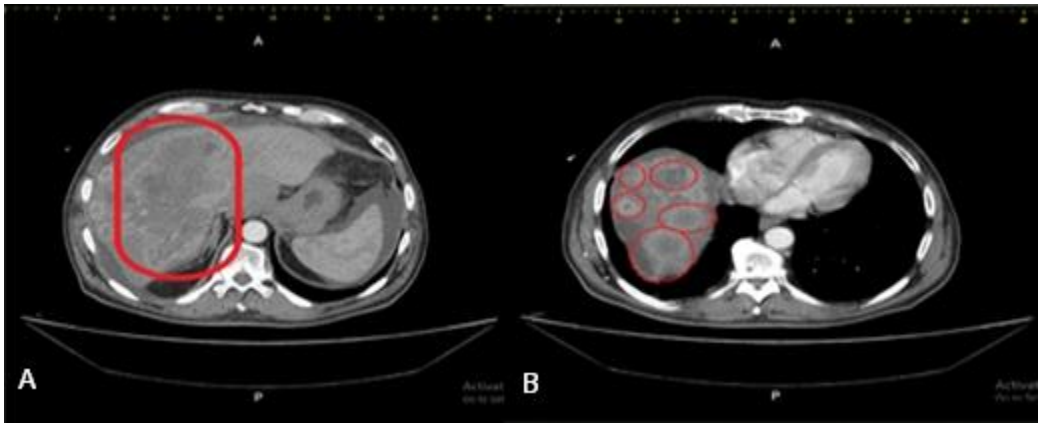
Fig. 22.2 In this section we can depict a gallbladder stone of about 1.5 cm with posterior shadowing.

- **Contrast enhanced ultrasound** is performed (Fig. 22.3 A,B):

- **Fig.22.3 (A, B)- CEUS:** The lesion in segments VI-VII shows rapid rim-like enhancement in the arterial phase (A) and wash-out in late arterial and portal phase (B) suggestive for cholangiocarcinoma (without being able to exclude hepatocellular carcinoma. Malignant portal thrombosis (wash-out in portal-late phase).

• Additional Imaging

- **Computed tomography** with contrast was performed and revealed a large heterogeneous mass that occupies the right hepatic lobe (segments IV, V, VII and VIII) suggestive for cholangicocarcinoma. Several nodular lesions disseminated in the hepatic parenchyma were also depicted, suggestive for metastatic lesions (Fig. 22.4. A-C).



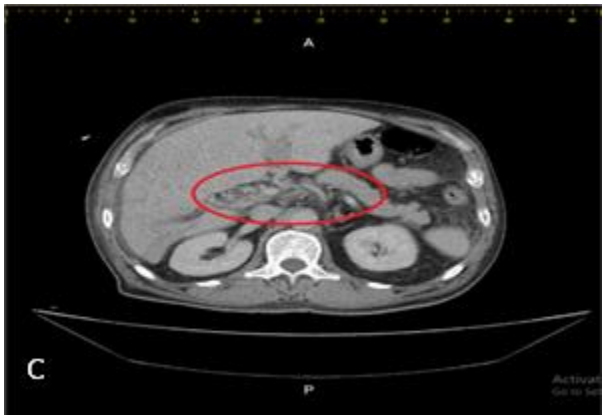


Fig.22.4 (A-C) - Contrast enhanced CT images: In the first image we observe the large mass that occupies almost entirely the right hepatic lobe (A), in the second image (B) we observe the secondary nodular lesions and in the third image (Fig. C) important collateral circulation and portal thrombosis.

Discussions

- Intrahepatic cholangiocarcinomas can originate from either small intrahepatic ductules (peripheral cholangiocarcinomas) or large intrahepatic ducts proximal to the bifurcation of the right and left hepatic ducts [2].
- Cholangiocarcinomas that involves the intrahepatic ducts (approx.20%) may present with right upper quadrant pain, weight loss and in some situation jaundice [3]. Some patients may be asymptomatic and the lessions are detected incidentally at a routine evaluation.
- The patient underwent imaging workout that confirmed the presence of malignant focal liver lesions; suggestive for cholangicarcinoma, rather than for hepatocellular carcinoma, given that alpha-fetal protein has a normal value (AFP=0.9 ng/ml).
- The patient was further on reffered to the Oncology department.

Final Diagnostic: Intrahepatic cholangiocarcinoma complicated with liver metastases. Malignant portal thrombosis. Biliary lithiasis.

References:

1. Xu HX, Chen LD, Liu LN, et al. Contrast-enhanced ultrasound of intrahepatic cholangiocarcinoma: correlation with pathological examination. Br J Radiol. 2012 Aug; 85(1016): 1029–1037.

2. Blechacz BR, Gores GJ. Cholangiocarcinoma. Clin Liver Dis. 2008; 12(1):131-150.

3. Saha SK, Zhu AX, Fuchs CS, Brooks GA. Forty-Year Trends in Cholangiocarcinoma Incidence in the U.S.: Intrahepatic Disease on the Rise. Oncologist. 2016 May; 21(5):594-9.

Case 23 Liver (A)

- **History:** a 25 years-old-male, was admitted in our department with *obstructive jaundice and epigastric pain*.
- **Laboratory findings** revealed increased liver function test (AST: 153 U/L [5-45], ALT: 180 U/L [5-55], T.bil: 10.2 mg/dL [0-1.2], D.bil: 8.9 mg/dL [0-0.3], ALP: 505 U/L [35-104], GGT: 291 U/L [7-50]).
- **Abdominal ultrasound** (Fig. 23.1. A-D):

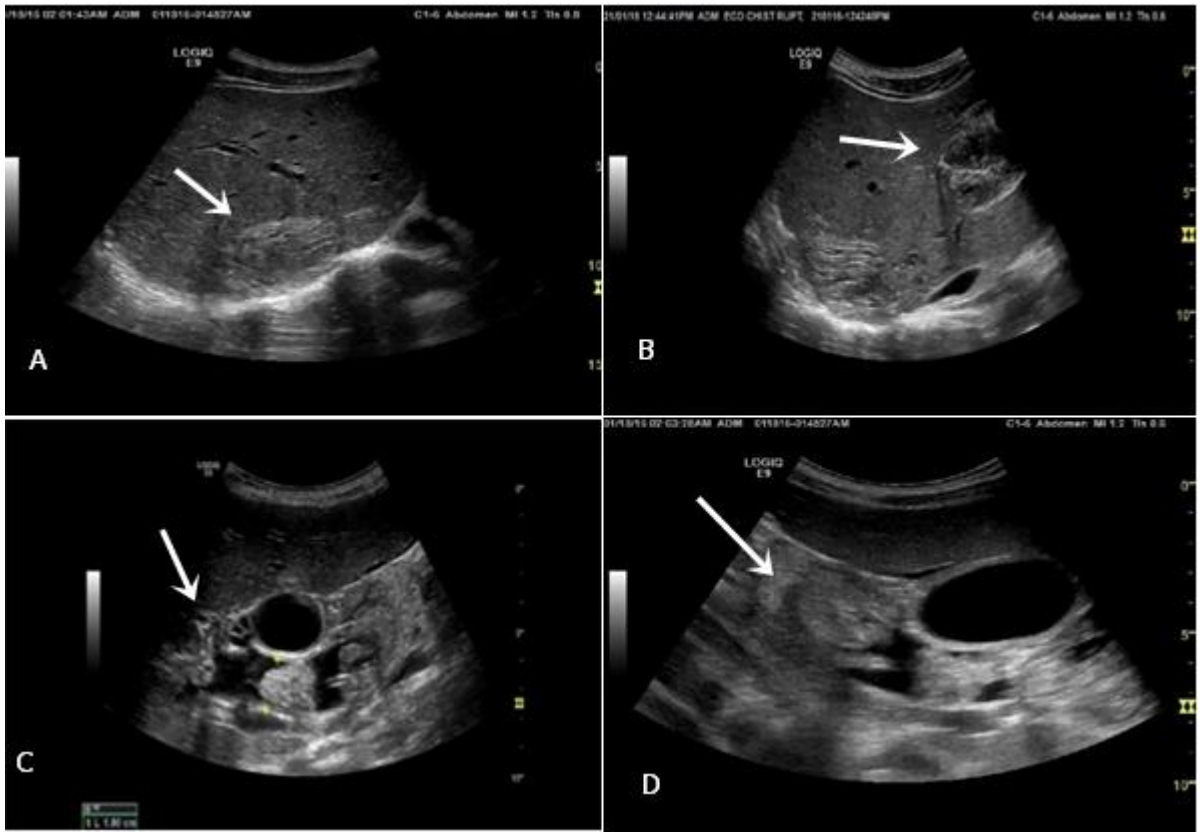


Fig. 23.1

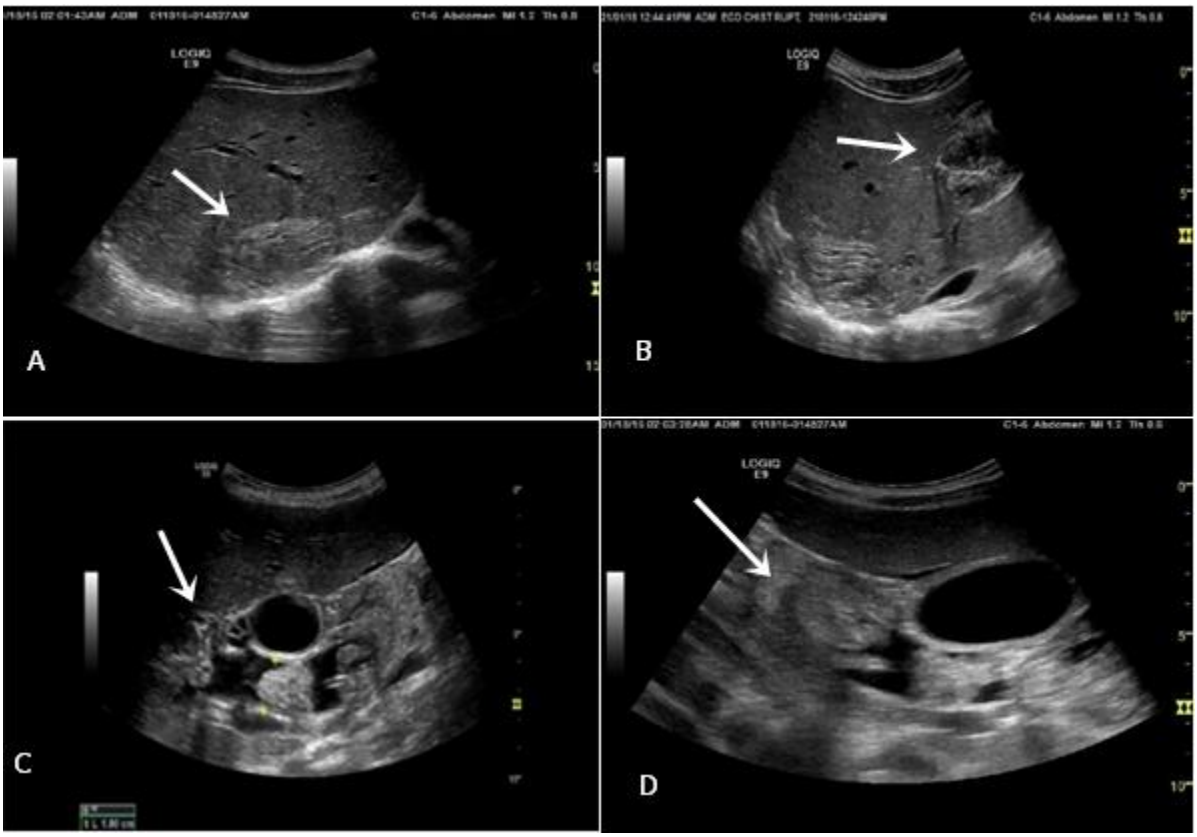


Fig. 23.1.A, B - *Inhomogenous liver lesions* of 4 cm diameter in right liver lobe, segment IV (above the portal bifurcation) and another one of 6 cm in segment VII

Fig. 23.1. C, D - Moderately dilated biliary ducts and dilated main biliary duct of 1.8 cm, with echogenic material in the main billiary duct (D) - hydatid membrane?

- **CEUS** was performed (Fig. 23.2. A, B) .

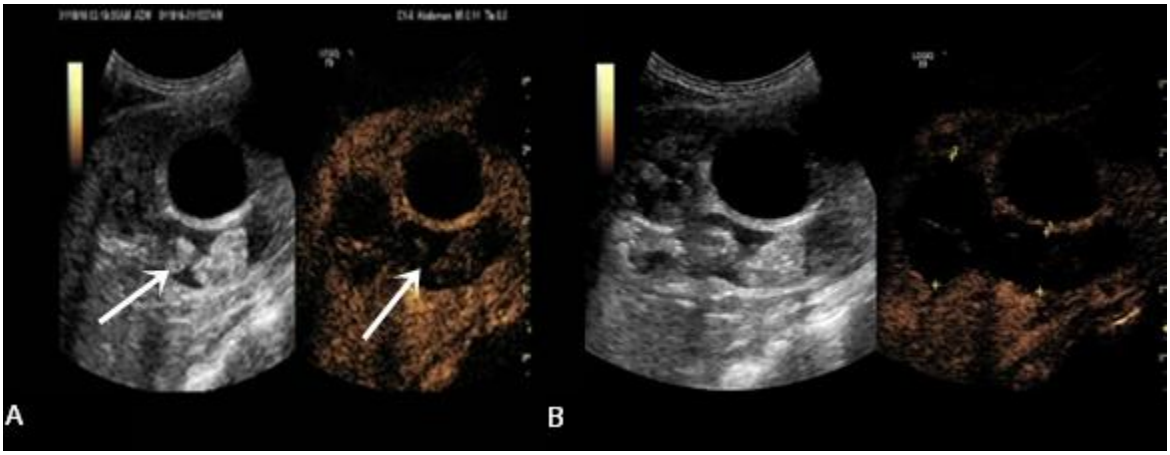


Fig. 23.2. CEUS of the main biliarry duct - revealing unenhancing material inside the MBD

- **Additional Imaging**

Fig. 23.3 (A-C). MRI appearance of the hydatid cyst in segment IV (A); reconstruction of the biliary tree, with an amputation of a branch (B). MRI appearance of the hydatid cyst in segment VII (C).

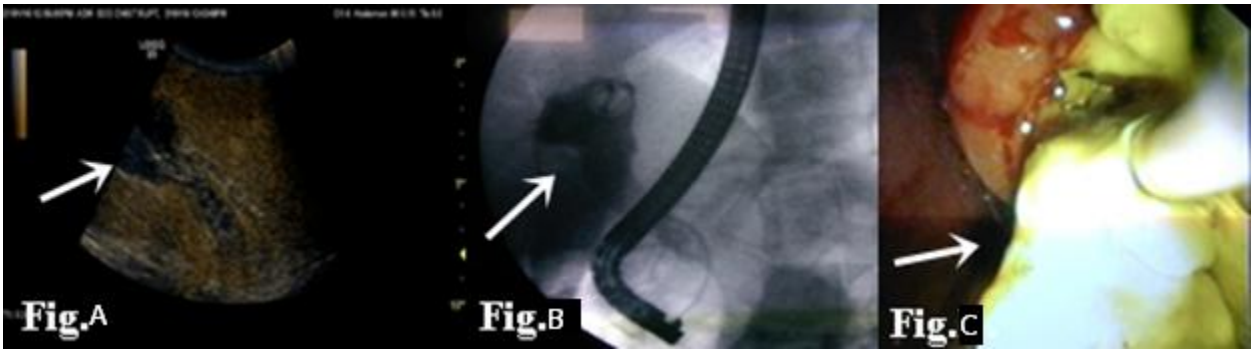


Fig. 23.4 (A). Fusion B mode and CEUS mode image of the Choledocus;
Fig. 23.4 (B). Radiologic imaging of the main biliary duct filled in with contrast-medium in ERCP;
Fig. 23.4 (C). Endoscopic imaging of the ERCP drainage procedure.

Fig. 23.5. Post ERCP US evaluation of the main biliary duct.

Discussion

- A diagnosis of obstructive jaundice is suspected due to a complication of intra-biliary ruptured hydatid cyst [1]. The patient has undergone ERCP that showed an enlarged main biliary duct with filling defect at this level. Sphincterotomy and multiple biliary drainage sessions and irrigation using hypertonic saline were performed.
- A MRI was performed that showed an active fistula between the hydatid cyst in the segment IV and the billiary branch.
- Intrabiliary rupture of the hydatid cyst is one of the most common complications in hydatid disease (approx. 10-15%), due to the increased intracystic pressure. Almost a third of them can have occult leakage and up to a quarter can present with frank rupture. Surgical management is associated with high morbidity and mortality.
- Endoscopic management of the frank ruptured hydatid cyst into the biliary tree proved its efficiency both for diagnostic and for therapeutic purpouse.
- The particularity of this case was the necessity of multiple ERCP drainage sessions, because of the active fistula, and the use of hypertonic saline irrigation.

Final diagnostic: Obstructive jaundice due to intrabiliary rupture of liver hydatic cyst.

Reference:

1.Erzurumlu K, Dervisoglu A, Polat C, et al. Intrabiliary rupture: an algorithm in the treatment of controversial complication of hepatic hydatidosis. World J Gastroenterol 2005; 11: 2472-6.

Case 24 Liver (A)

- **History:** a 46 years-old-male, otherwise healthy, was admitted in our department with intense abdominal pain in the upper abdomen with sudden onset, 10 days prior to the admission. At palpation a firm, painful, immovable tumor of 10/5cm is felt in the right upper quadrant and flank.
- **Laboratory findings** revealed Increased liver function tests (AST: 87 U/L [5-45], ALT: 117 U/L [5-55], Total bilirubin: 2.2 mg/dL [0-1.2], Direct bilirubin: 1.4 mg/dL [0-0.3], Hb: 9.5 g./dl [12-15 g/dl], WBC: 18700/mmc, PCR: 24- mg/l).
- **Abdominal ultrasound** (Fig. 24.1-24.2):

Fig. 24.1

Fig. 24.2

Fig. 24.1 Near the right liver lobe, a fluid inhomogeneous area 10/2.5 cm in size, which extends outside and in front of the liver, down to its inferior margin.

Fig. 24.2. The gastric wall is thickened – 7 mm.

- **Possible diagnoses:** considering the clinical and biologic data, the ultrasound aspect is suggestive for a subphrenic abscess. Thickened wall of the antrum is suggestive for a gastric cancer
- **CEUS examination** was performed (Fig.24.3)

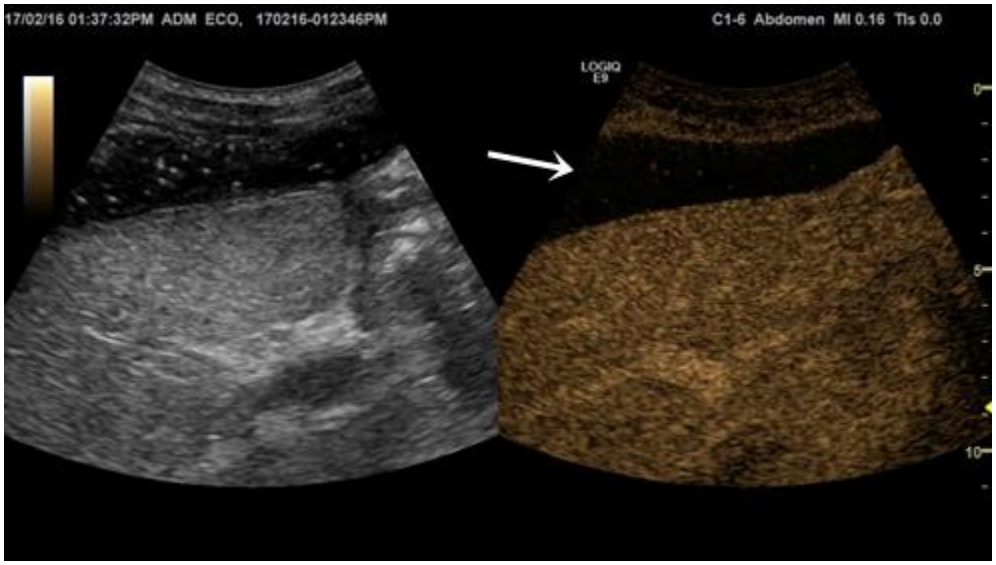


Fig. 24.3. CEUS examination - the perihepatic fluid collection did not enhance following contrast bolus in any of the vascular phases- an aspect highly suggestive for a subphrenic abscess.

Discussion

- Intra-abdominal abscesses are a significant pathology that usually implies serious diagnosis and treatment problems.
- In our case report, US diagnosis of subphrenic abscess eventually led to the diagnosis of gastric cancer.
- An Abdominal CT has been made and the results supported the US diagnosis.
- Intra-operative examination: subphrenic and perihepatic inflammatory block with the evacuation of 200 ml purulent fluid.
- Upper digestive endoscopy showed a 1.5 cm ulcer on the lesser curvature that revealed signet ring cell gastric carcinoma at the histopathological examination.
- Subtotal gastrectomy has been performed in the same session with drainage of the subphrenic abscess.

Final diagnostic: Subphrenic abscess - an inaugural complication of gastric cancer.

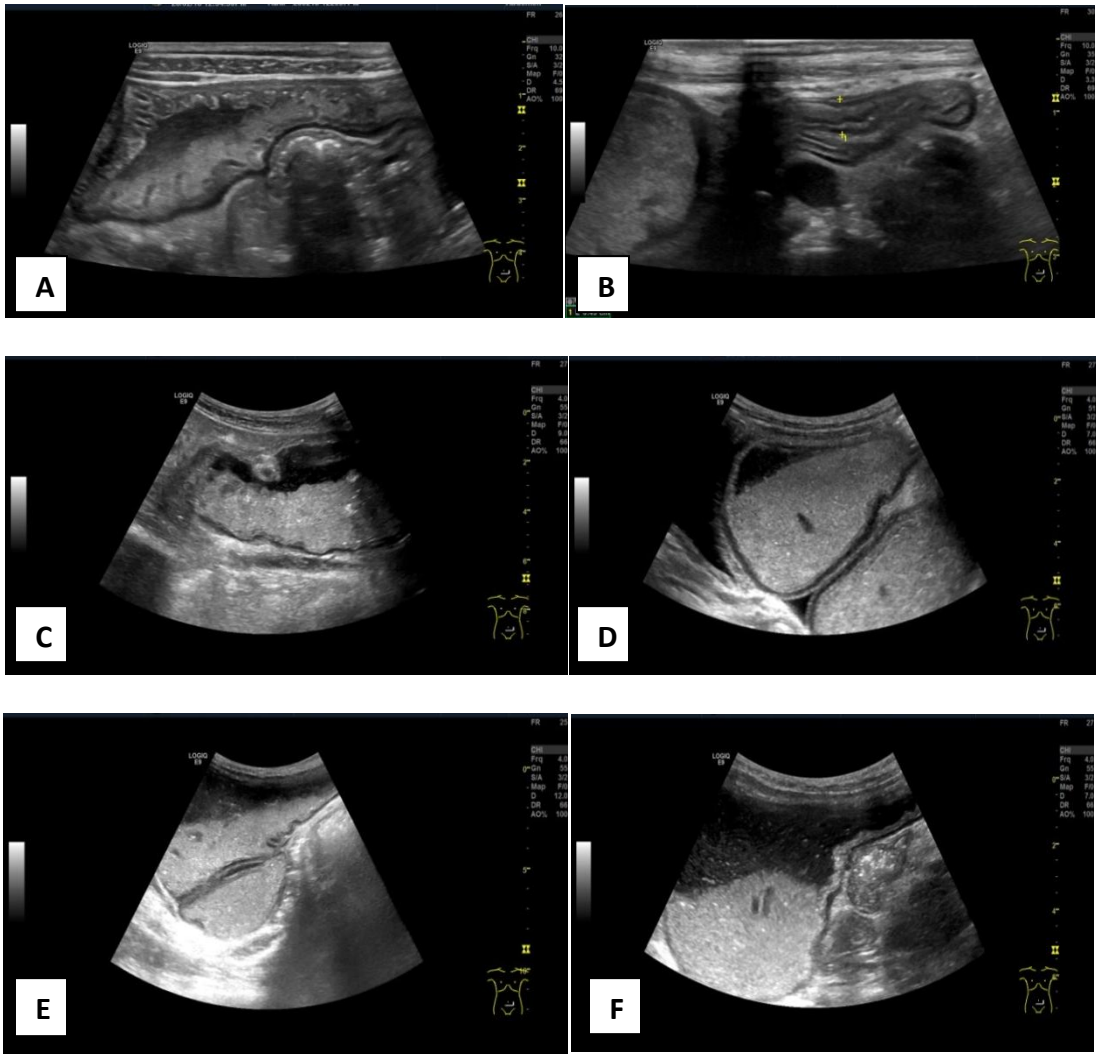
Reference:

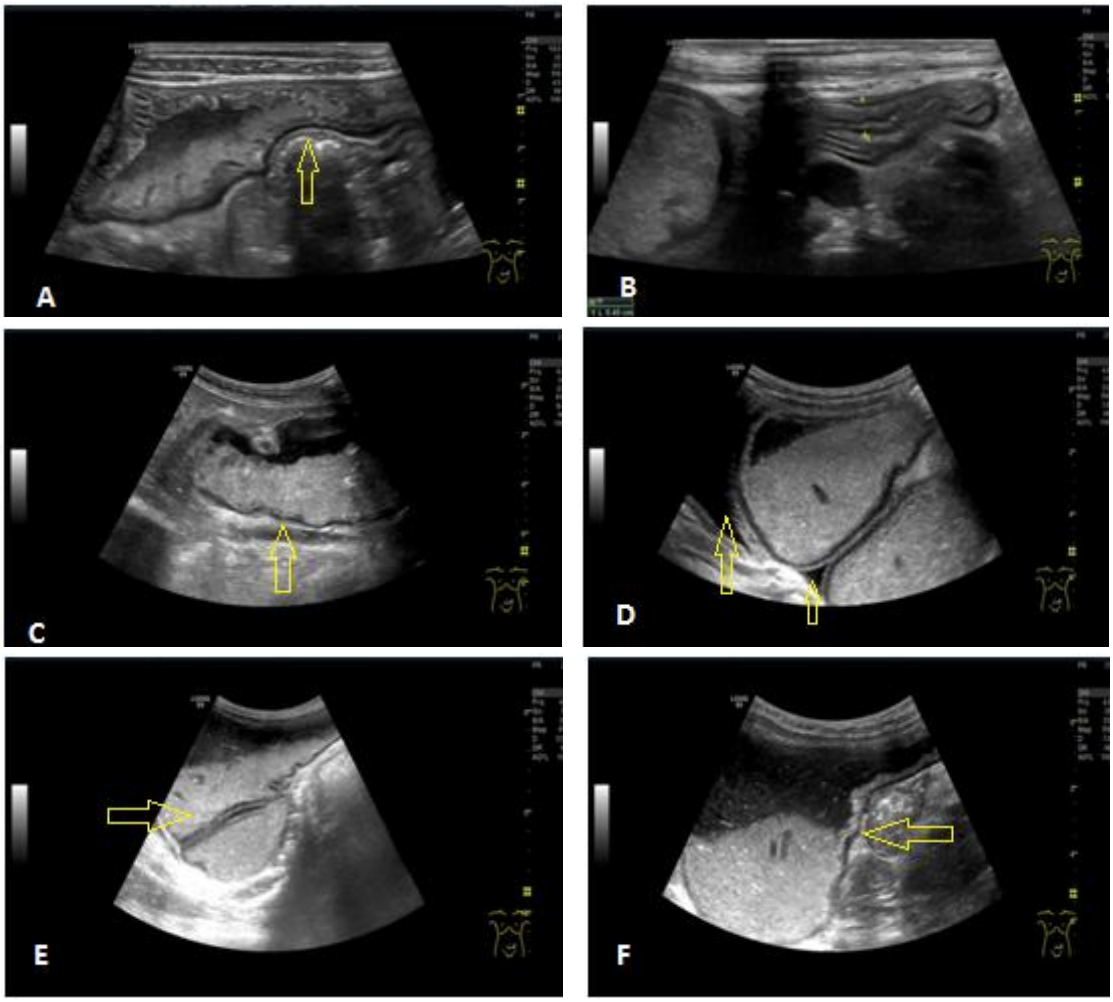
1. Tajana A, Manzullo V, Orio A. Subphrenic abscess. Importance of its pathology and ever present diagnostic and therapeutic problems. Minerva Med. 1986 Apr 28; 77 (18):721-34.

Case 25 Gastrointestinal tract (A)

- **History: a** 19-year-old male patient with a past medical history of chronic anemia diagnosed at age 12, presented in July 2017 with abdominal pain, malaise, chronic diarrhea, and malnutrition. He was diagnosed with ileo-colonic Crohn's disease and was started on treatment with Azathioprine 50 mg/day with the improvement of symptoms. In February 2018, the patient returned with significant abdominal pain, soft and reduced stools, and severe malnutrition.
- **Clinical exam** showed: skin pallor, percussion clamping, borborisms to stethoscope auscultation, BMI = 14 kg/m^2.
- **Lab tests**: anemia (Hb = 11.5 g/dl), inflammatory syndrome (increased CRP, ESR and fibrinogen), hypoalbuminemia, increased calprotectin levels (404 ug/g), negative Clostridium Difficile test.

- **Ultrasound examination: (Fig. 25.1 A, B, C, D, E, F).**





- **Fig. 25.1.A and Fig. 25.1.B** - Bowel segment obvious thickened up to 10 mm in the ileum projection area, with loop dilatation above suggesting stenosing Crohn´s disease. Intestinal wall with the loss of stratification suggesting transmural inflammation.
- **Fig. 25.1. C, D, E, F** - dilated colon and cecum; minimal amount of fluid between bowell loops; distension of intestinal segments in all abdomen.

- **Colonoscopy** showed: multiple scars in the left colon, with disorganization of the vascularization and in the ascending direction to the cecum, multiple inflammatory polyps, small and aftoid lesions. In the ileocecal valve, a few aftoid lesions, multiple inflammatory polyps and inflammation-like stenosis that makes difficult the passage in the ileum.
- **Histology** shows typical features of Crohn's disease with severe activity.
- We considered the patient non-responder to Azathioprine and decided to start treatment with Adalimumab (Humira). Treatment was started in April 2018.
- **Present time**: patient without abdominal pain, one normal stool/day, gained weight, no anemia, normal calprotectin levels.

Discussion

- Crohn´s disease predominantly involves the distal ileum and the colon.
- Ultrasound examination of the bowel can be used not only for diagnostic purposes, but it has also been suggested that it could play a role in the management of IBD patients [1,2].
- Studies showed that US is a valuable tool for detecting small intestinal Crohn's disease, having similar diagnostic values as CT. In known Crohn's disease, it is useful for follow-up, in evaluating relapses and extramural manifestations[3,4].

Final diagnostic: Suboclusive syndrom in a patient with Crohn's disease.

References:

1. Onali S, Calabrese E, Petruzziello C, et al. Endoscopic vs ultrasonographic findings related to Crohn's disease recurrence: a prospective longitudinal study at 3 years. . J Crohns Colitis. 2010;4:319–328.
2. Calabrese E, Petruzziello C, Onali S, et al. Severity of postoperative recurrence in Crohn's disease: correlation between endoscopic and sonographic findings. Inflamm Bowel Dis. 2009;15:1635–1642.
3. Tarján Z, Tóth G, Györke T et al.Ultrasound in Crohn's disease of the small bowel. Eur J Radiol. 2000 Sep;35(3):176-82.
4. *Kucharzik T*, *Kannengiesser K*, *Petersen F*. The use of ultrasound in inflammatory bowel disease. *Ann Gastroenterol*. 2017.

Case 26 Gastrointestinal tract (A)

- **History:** a 64 years-old-male presented with inappetence, three days of worsening nausea and vomiting. He also complained of a seven kilograms weight loss over the previous two months.
- **Laboratory findings** did not reveal any changes. The patient`s past medical history showed type 2 diabettes, treated with oral antidiabetics.
- **Abdominal ultrasound examination:** Fig. 26.1-26.4.

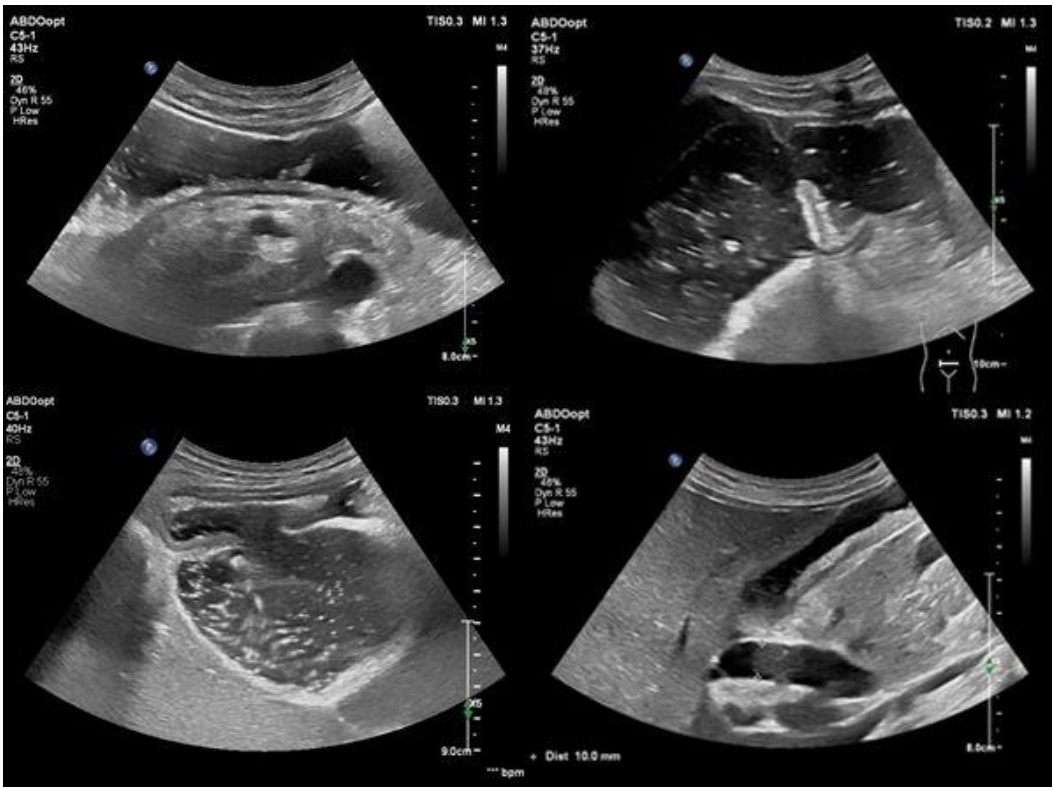
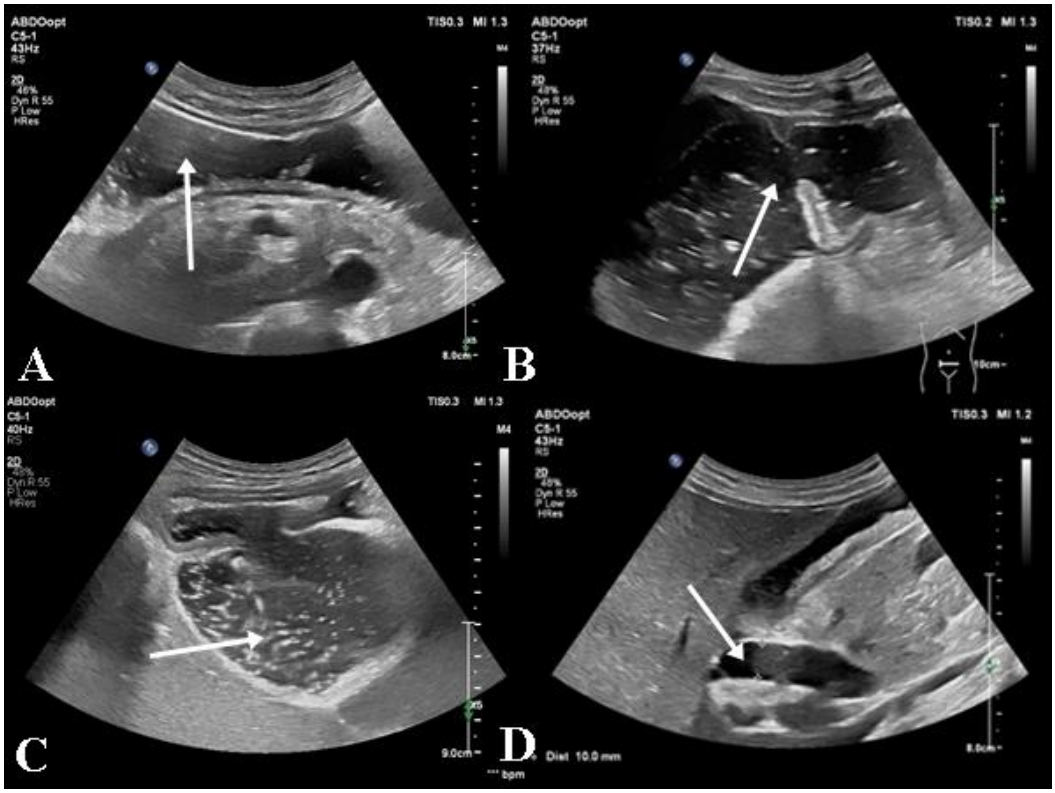


Fig. 26.1-26.4



- **Fig. 26.1-A, 26.2-B and 26.3-C.** Reveals a typical aspect of gastric outlet obstruction, with the distension of the gastric antrum and an anechoic content of the stomach. In Fig. C you can clearly depict the pylorus sfincter.
- **Fig. 26.4-D.** reveals the enlarged CBD (common bile duct).

- Ultrasound evaluation showed marked gastric and duodenal distentions with large amount of gastric contents, visible through the pylorus up to the duodenum. Also the main billiary duct was enlarged, up to 1 cm, with distented gallbladder but without intrahepatic biliary ducts dilatation.

Additional Imaging

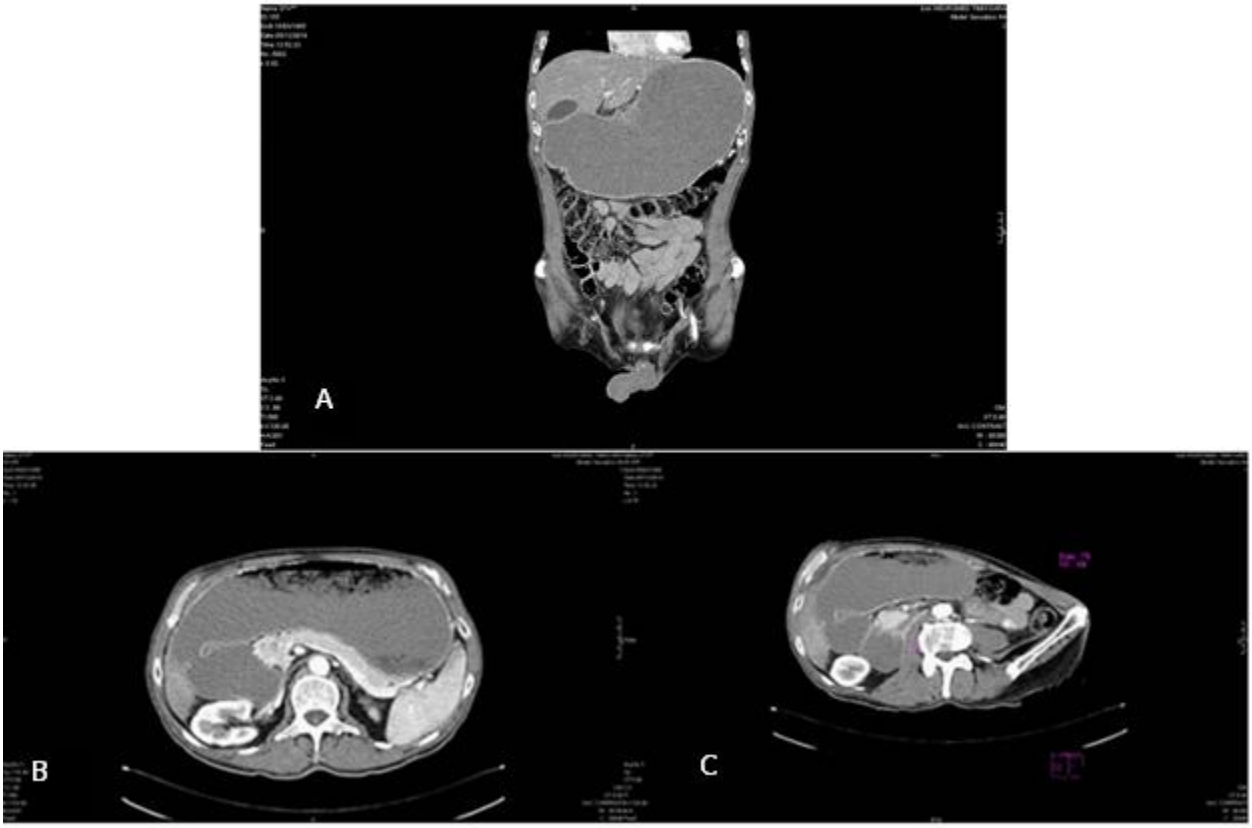


Fig. 26.5. A-C. Contrast enhanced CT reveals in the coronal section (A) a distended stomach. The obstruction seems to be lower then the pylorus which appears to be normal in the transverse section (B). No obvious cause of obstruction is seen at CE-CT.

Discussion

- The major benign cause of gastric outlet obstruction is pyloric stenosis caused by peptic ulcer disease followed by gastric polyps, ingestion of caustic substances, Chron disease, extrinsec obstrctions such as pancreatic pseudocyts or chronic pancreatits, bezoars, gallstone (Bouveret syndrome) and malignacy causes are distal gastric cancer, pancreatic adenocarcinoma with invasion in duodenum, gastric lymphoma or metastatic malignancy.

- Because the stricture seemed to be in the duodenum, the Superior mesenteric artery syndrome was thought to be the cause and a CT scan was performed, but it didn`t show any changes except an enlarged stomach and duodenum, with compresion on the suprapancreatic part of the choledochus.
- A diagnosis of peptic ulcer was suspected so an upper endoscopy was performed after the gastric content was removed through a nasogastric tube and revealed an esophageal reflux disease, a large stomach, permeable pylor and large duodenum. The evaluation was possible only up to the second part of the duodenum and no lesions were found.
- Surgical management was considerred and the patient was transferred in a Surgical Compartiment where the final diagnosis was established. A cephalic pancreatic tumor was found which was sent to hystopathology examination.

Final diagnostic: Gastric outlet obstruction and obstructive jaundice secondary to a cephalic pancreatic tumor

Reference:

1.Carlos Fernandez-del Castillo. Clinical manifestations, diagnosis, and staging of exocrine pancreatic cancer. Up-to-date- Literature review current through: Apr 2020. | This topic last updated: Feb 27, 2020.

Case 27 Gastrointestinal tract (A)

- **History:** a 42-year-old female patient, with no significant pathology (no prior hospitalization or surgery), presented to the emergency room for chronic diarrhea (3-4 watery stools/day with mucous, but no bloody diarrhea), cramping abdominal pain, weight loss, bloating, nausea and fatigue. The clinical symptoms have occurred for two months but have worsened in the last week.
- **Clinical exam -** revealed pallor, soft tenderness over the lower abdomen and umbilical region at deep palpation. Auscultation: bowel sounds present.
- **Laboratory tests** – CBC – severe anemia Hb=6.2 mg/dl, elevated C-reactive protein of 60 mg/L, and Erythrocyte Sedimentation Rate ESR of 47 mm/h, mild hypoalbuminemia.
- **An abdominal ultrasound** examination: **Fig. 27.1 (A, B, C, D).**

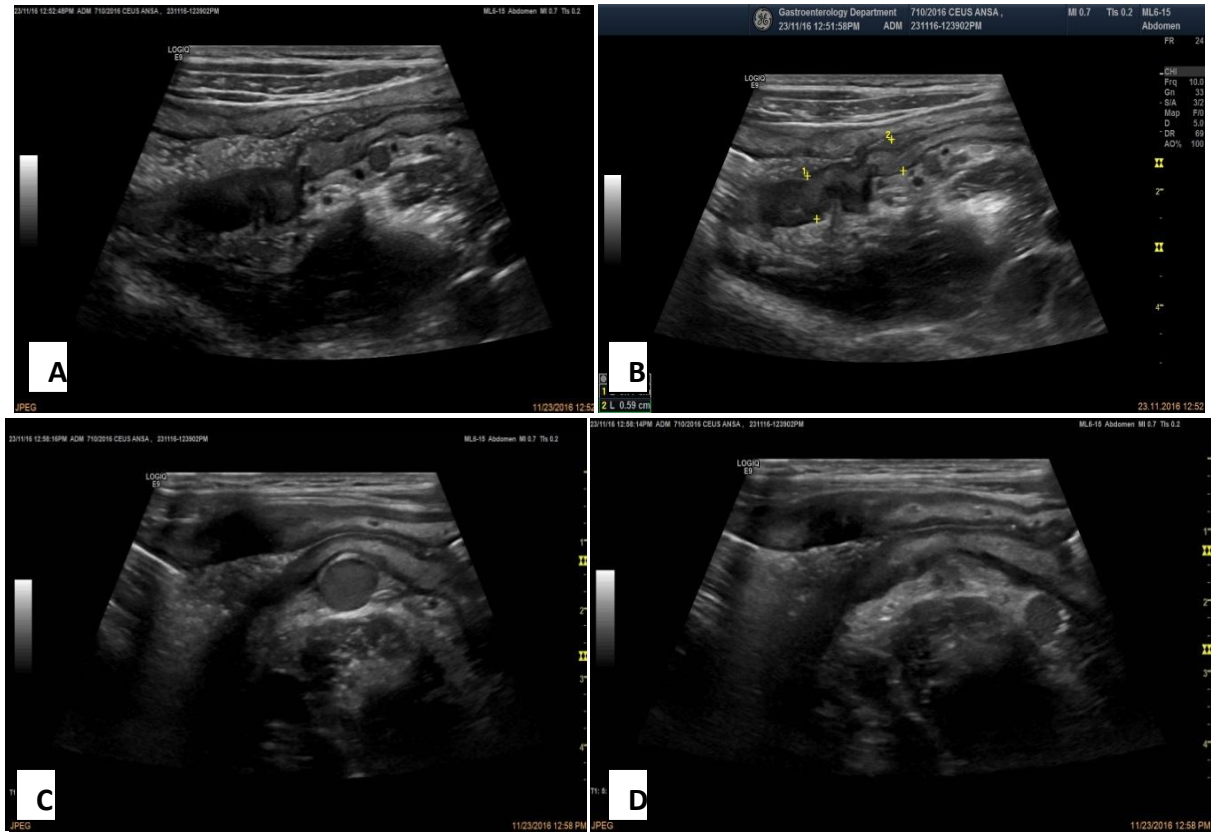
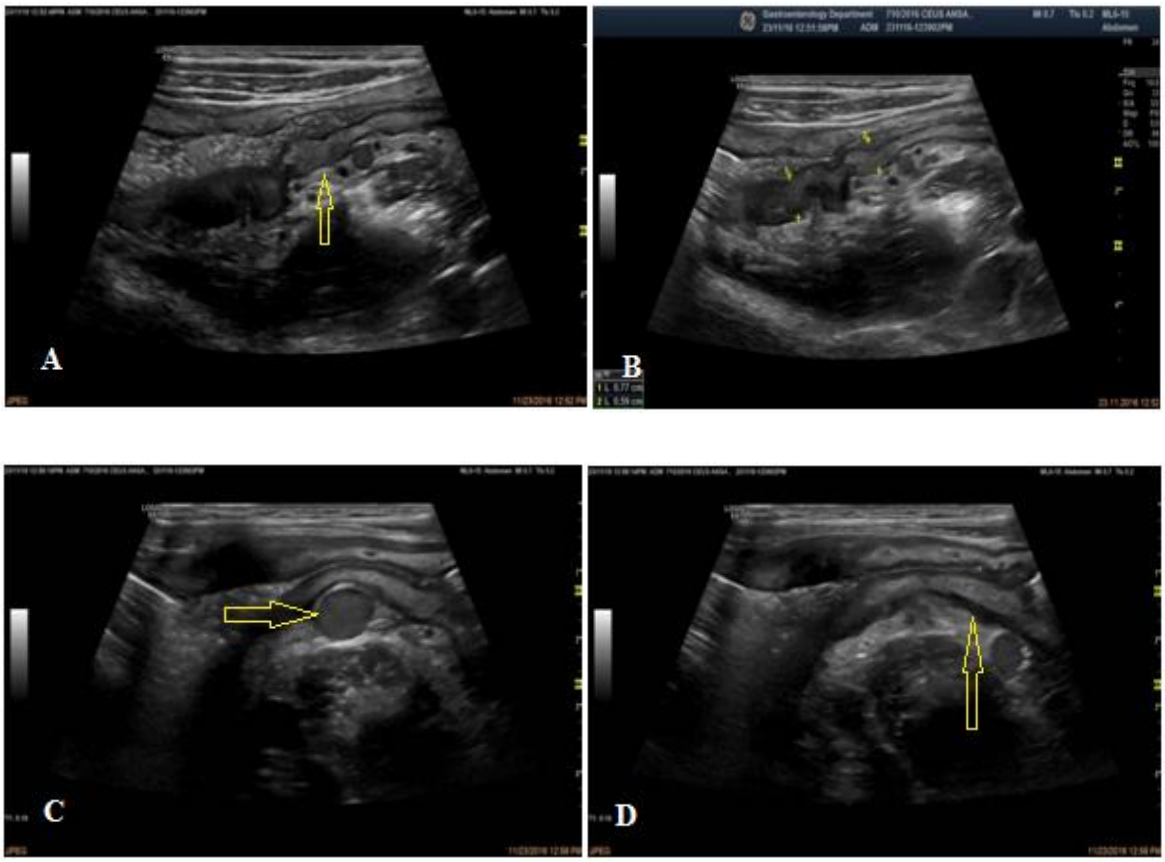


Fig. 27.1 A, B, C, D.



- **Fig. 27.1 A, B, C and D** - markedly thickened bowel segment up to 10 mm in the ileum projection area, with loop dilatation above suggesting stenosing Crohn´s disease; intestinal wall with the loss of stratification suggesting transmural inflammation, and enlargement of mesenteric lymph nodes.

- **Colonoscopy** examination revealed ulcerative mucosal lesions in the ileocecal and ascending colon and also three areas of fibrous concentric stenosis at this level, the biopsy was positive for inflammatory bowel disease.

Discussion

- Crohn´s disease predominantly involves the distal ileum and the colon.
- Ultrasound examination of the bowel can be used not only for diagnostic purposes, but it has also been suggested that it could play a role in the management of IBD patients [1,2].
- Studies showed that US is a valuable tool for detecting small intestinal Crohn's disease, having similar diagnostic values as CT. In known Crohn's disease, it is useful for follow-up, in evaluating relapses and extramural manifestations [3,4].
- US in IBD has widely accepted indications and is part of national and European guidelines [4].

Final diagnostic: Crohn’s disease of the small bowell and colon.

References:

1. Onali S, Calabrese E, Petruzziello C, et al. Endoscopic vs ultrasonographic findings related to Crohn's disease recurrence: a prospective longitudinal study at 3 years. J Crohns Colitis. 2010;4:319–328.

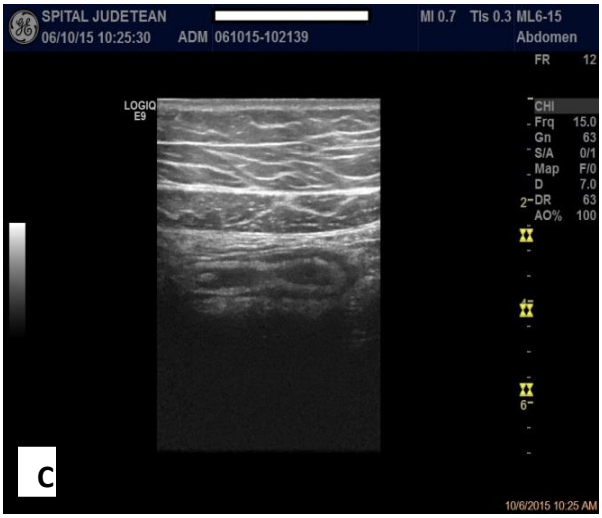
2. Calabrese E, Petruzziello C, Onali S, et al. Severity of postoperative recurrence in Crohn's disease: correlation between endoscopic and sonographic findings. Inflamm Bowel Dis. 2009;15:1635–1642.

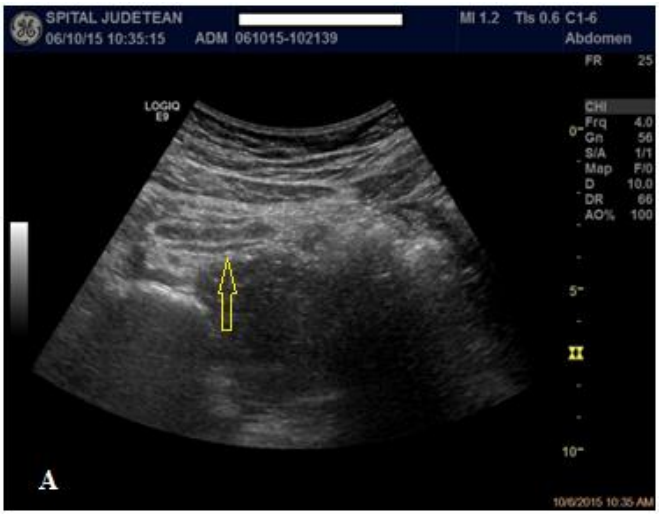
3. Tarján Z, Tóth G, Györke T, et al. Ultrasound in Crohn's disease of the small bowel. Eur J Radiol. 2000 Sep;35(3):176-82.

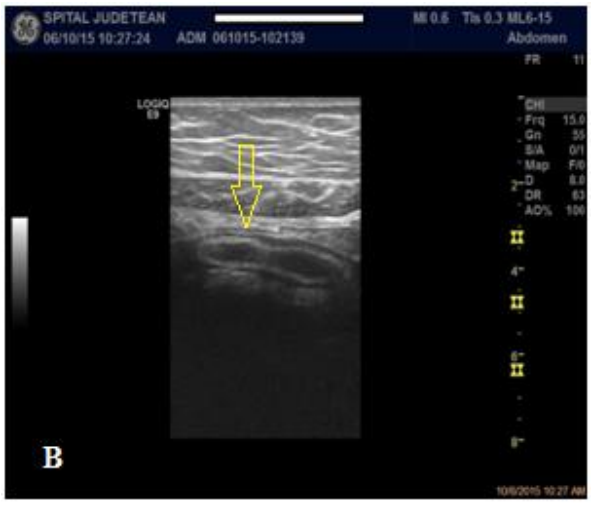
4. Kucharzik T, Kannengiesser K, Petersen F. The use of ultrasound in inflammatory bowel diseaseAnn Gastroenterol. 2017; 30(2): 135–144.

Case 28 Gastrointestinal tract (A)

- **History:** a 25-year-old male patient, with no significant pathology (no prior hospitalization and surgery), presented to the emergency room due to sudden, sharp pain in the *right lower quadrant, nausea and vomiting 2x during the night.* The pain was continuous and non-radiating. He denied any abnormal stool.
- **Clinical examination** revealed guarding and tenderness in the right lower quadrant to light palpation. Auscultation: bowel sounds present but hypoactive.
- **Laboratory tests** – normal complete blood count excepting WBC= 12 /10^3/µL – elevated (N: 4.0 - 9.5 /10^3/µL).
- **An abdominal ultrasound** examination: Fig 28.1 (A, B, C).







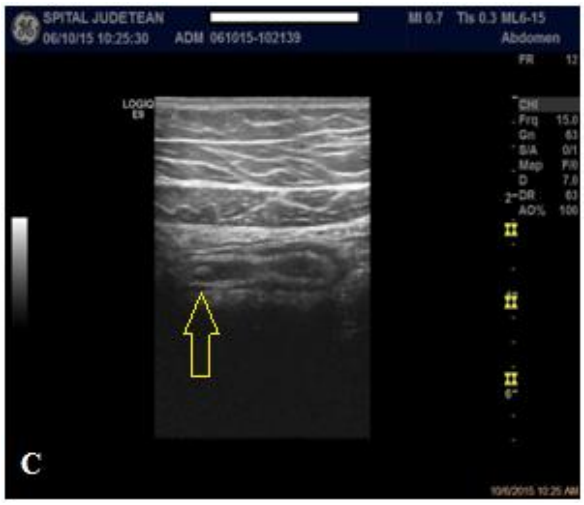


Fig. 28.1 A and Fig. 28.1 B - non-compressible appendix with wall layers preserved but mildly thickened.

Fig. 28.1 C - a hyperechoic appendicolith within the lumen.

- Ultrasound examination revealed a point of maximum tenderness at the examination over the appendix.

The patient was admitted to the General Surgery Department, where appendicectomy was performed.

Intraoperative findings: distension, inflammation, and vascular congestion of the appendix, without perforation or rupture.

Discussion

- Acute appendicitis is one of the most common abdominal surgical emergencies, and the diagnosis can be challenging.
- Ultrasound examination of the appendix is both operator and patient dependent.

- Studies showed that a staged US and CT imaging protocol in which US is performed first in children suspected of having acute appendicitis is highly accurate and offers the opportunity to reduce radiation substantially [1,2,3].

Final Diagnostic: Acute edematous appendicitis.

References:

1. Moș C. Ecografia clinica a apendicului. Ed. Univ. Oradea, 2015,129-145.
2. Krishnamoorthi R, Ramarajan N, Wang NE, et al. Effectiveness of a staged US and CT protocol for the diagnosis of pediatric appendicitis: reducing radiation exposure in the age of ALARA. Radiology. 2011;259(1):231-239.
3. Fox JC, Solley M, Anderson CL, et al. Prospective evaluation of emergency physician performed bedside ultrasound to detect acute appendicitis. Eur J Emerg Med. 2008;15:80-85.

Case 29 Gastrointestinal tract (A)

- **History:** a 56-year-old male patient, with no significant digestive pathology (no prior hospitalization and surgery), presented to the Department of Gastroenterology due to an poor general condition, fatigue. The patient presented *two weeks earlier pain in the right lower quadrant, nausea, and vomiting 2x during the night after a fatty meal.* The pain was continuous and non-radiating in nature. He denied any abnormal stool.
- **Clinical examination** revealed tenderness in the right lower quadrant to profound palpation. Auscultation: bowel sounds present but hypoactive.
- **Laboratory tests** – normal complete blood count excepting WBC= 19 /10^3/µL – elevated (N: 4.0 - 9.5 /10^3/µL), elevated C-reactive protein of 80 mg/L and ESR of 47 mm/h.
- **An abdominal ultrasound** examination was performed: **Fig. 29. 1 (A, B, C, D)**.

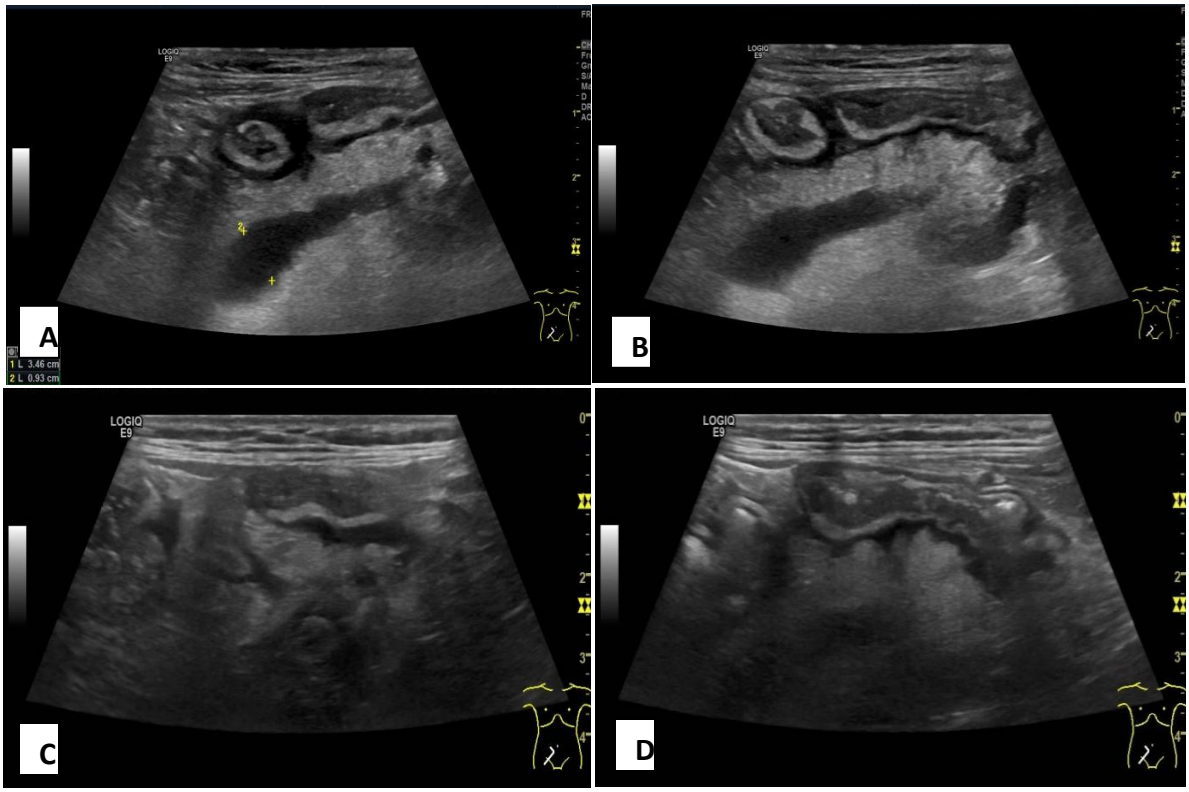
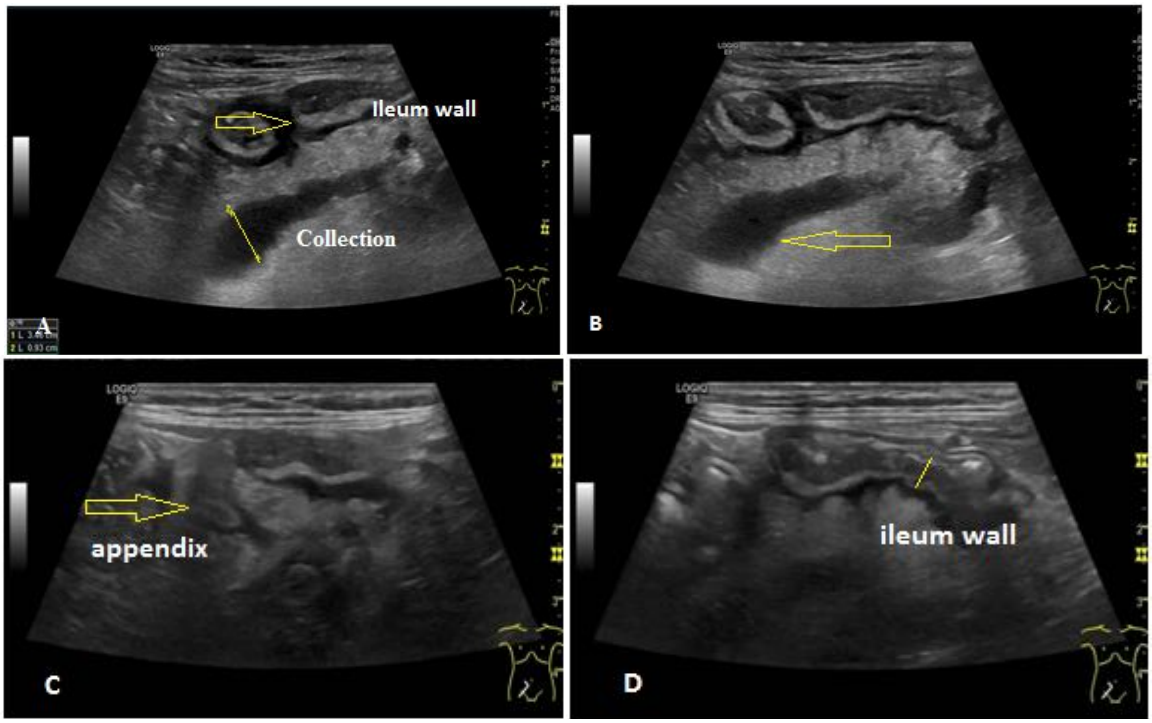


Fig. 29. 1 (A, B, C, D)



- **Fig. 29. 1 (A, B, C, D)**: appendiceal wall thickening; hyperechoic pericecal and periappendiceal fat; periappendiceal fluid collection; ileum wall thickening.

The patient was stable, and a wide-spectrum antibiotic treatment was started, followed by appendicectomy.

Discussion

- Acute appendicitis is one of the most common abdominal surgical emergencies, and the diagnosis can be challenging. Complicated appendicitis is more common with advanced age, due to late or atypical presentation of appendicitis, delay in diagnosis, and to the age-specific physiological changes [1].
- Ultrasound examination of the appendix is both operator and patient dependent [2].
- The imaging differential diagnosis includes Crohn disease, which may affect the appendix, and other causes of terminal ileitis.
- If the patient is stable, initial nonoperative management, including antibiotics, is safe. If an abscess is present, imaging-guided percutaneous drainage can be performed. Appendectomy should eventually be performed to prevent recurrent appendicitis [3,4].

Final diagnostic: Acute appendicitis.

References:

1. Omari AH, Khammash MR, Qasaimeh GR et al. Acute appendicitis in the elderly: risk factors for perforation. World J Emerg Surg. 2014;9 (1): 6.

2. Moș C. Ecografia clinica a apendicului. Ed. Univ. Oradea, 2015, p129-145.

3. Avanesov M, Wiese NJ, Karul M, et al. Diagnostic prediction of complicated appendicitis by combined clinical and radiological appendicitis severity index (APSI). European Radiology2018; 28 (9): 3601-3610.

4. Oliak D, Yamini D, Udani VM, et al. Initial non-operative management for periappendiceal abscess. Diseases of the colon and rectum 2001; 44 (7): 936-941.

Case 30 (Kidney-B)

- **History:** a 58-year-old male patient, with alcoholic cirrhosis, presented in ER for right lumbar pain with onset during the day.
- **Clinical exam -**mild pain in the right lumbar region, dysuria, BP 110/50 mmHg, AV 64 beats/min rhythmic.
- **Biology:**
    - Leukocytosis (L=12,500/mmc), with neutrophilia (85%), no anemia, platelets 110,000/mmc
    - cytolysis (ALT 1.5xUVN, ALT 1.7xUVN), no cholestasis,
    - mild hypoalbuminemia (2.8 g/dl), normal bilirubin, normal INR
    - mild kidney injury (creatinine - 1.9 mg/dl),
    - microscopic hematuria in the urine summary
- **Abdominal ultrasound:**

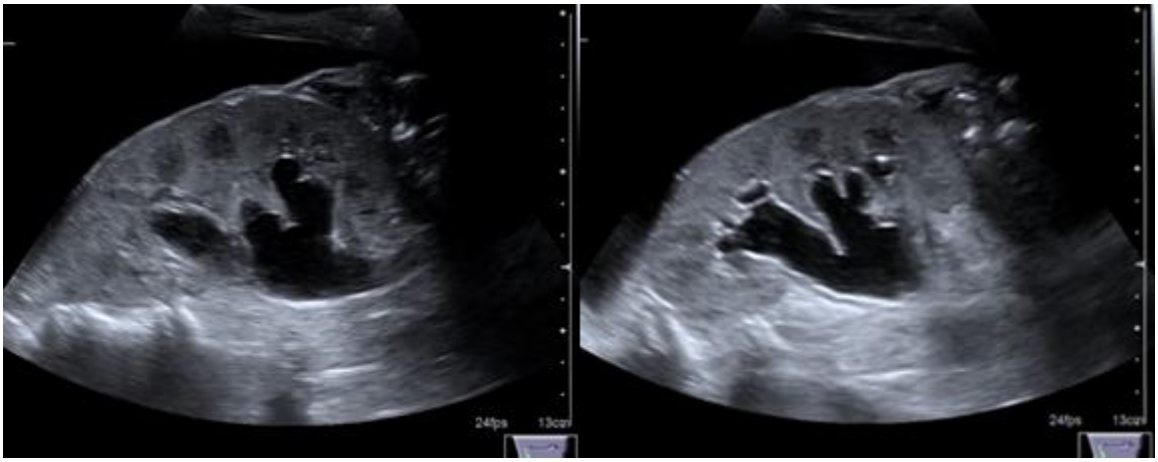


Fig. 30.1 **Fig. 30.2**

•**Abdominal ultrasound:**

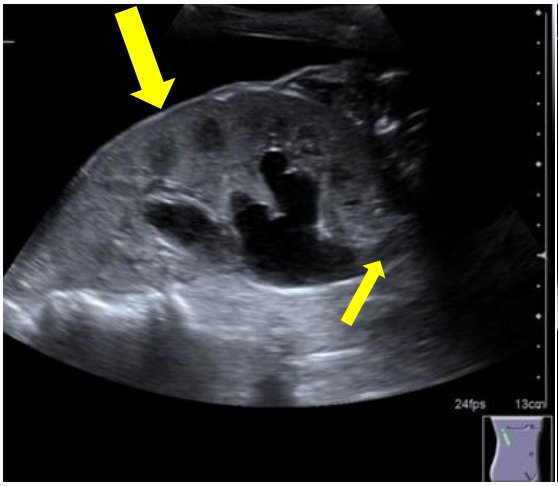


Fig. 30.1

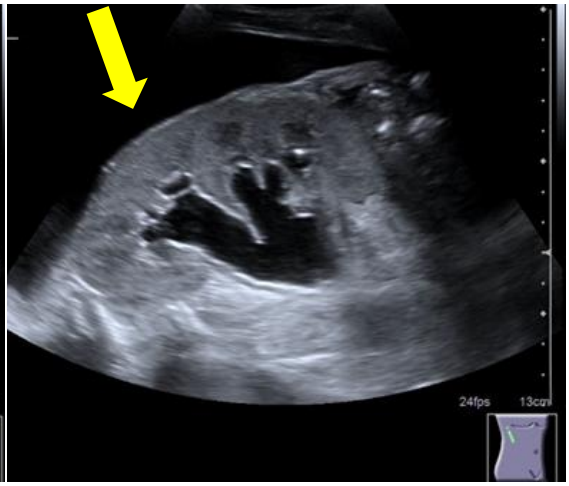


Fig. 30.2

- **Fig. 30.1 and Fig. 30.2 -** the kidney shows pyelocaliceal dilatation, including dilatation of the ureter (thin arrow). Around the kidney, anechoic aspect (thick arrow) - ascites.

Discussion

- The diagnosis of Uretero-Hydronephrosis Grade I comes into question in this case, URO-CT was performed to identify the etiology. A kidney stone, blocked at the uretero-vesical junction was identified.
- The transonic content surrounding the kidney suggests the presence of ascites due to the decompensation of the patient's alcoholic cirrhosis.
- Paracentesis was performed and then the patient was referred to the urology department where ureteroscopy was performed and the stone was extracted.
- The evolution was uneventful.

Final diagnosis: Uretero-hydronephrosis and ascites

References:

1. Alshoabi SA. Association between grades of Hydronephrosis and detection of urinary stones by ultrasound imaging. Pak J Med Sci. 2018;34(4):955-958.