Imaging of common diseases of hepatobiliary and GI system

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Normal plain radiograph
A = Common bile duct
B = Right hepatic artery
C = Portal vein
D = IVC
transverse scan
of the mid upper abdomen

- Splenic vein
- SMA
- Pancreas

Inset: Esophagus, Liver, Stomach, Colon, Small intestine
T1W in phase

T1W out of phase

T2W with FS

Heavy T2W with FS
A-phase

Equilibrium phase

PV-phase

Delayed 3 minutes
• Symptoms
• Signs
• Differential diagnosis
• Investigations
  • Laboratory: blood, urine, stool
  • Imaging
Common liver disease

Liver parenchymal disease
- Fatty liver
- Hepatitis
- Cirrhosis

Focal liver lesions
- Cyst
- Hemangioma
- Abscess
- Hepatocellular carcinoma
- Metastasis
Fatty liver

- Many causes → obesity, DM, malnutrition or exposure to ethanol or other toxins
- Imaging findings vary depending on amount of fat
- US → diffuse increased hepatic parenchymal echogenicity
- CT → diffuse decreased attenuation
HEPATITIS

- Most cases → normal
- US → Diffusely decreased hepatic parenchymal echogenicity, with accentuated brightness of the portal triads and periportal cuffing
- Hepatomegaly and thickening of gallbladder wall
Liver cirrhosis

- Causes
  - Viral hepatitis: B and C
  - Alcohol
  - Toxin
  - NASH
  - Autoimmune
Liver cirrhosis

- Morphologic change
  - Hypertrophy of lateral segment of left hepatic lobe and caudate lobe
  - Atrophy of medial segment of left hepatic lobe and right hepatic lobe
- Nodular hepatic surface
- Regenerative nodules
- Fibrosis
- Expanded gallbladder fossa sign
- Dilatation of right inferior phrenic artery
- Gastrointestinal wall thickening
- Portal hypertension
Liver cirrhosis

- Portal hypertension
  - Portosystemic collaterals: increased size and number of retroperitoneal vessels in
    - splenic hilum
    - gastrohepatic ligament
    - paraesophageal region
    - splenorenal shunt
    - canalization of paraumbilical vein
  - Splenomegaly
  - Ascites
Liver cirrhosis with portal hypertension
Cyst

- Greater prevalence in older patients
- Typically asymptomatic
- US → anechoic lesion with posterior enhancement
- CT →
  - Water density (<20 HU)
  - Not enhance
  - Well defined border without perceptible walls
  - No mural nodularity or wall calcification
- MR → non-enhanced low SI on T1W, high SI on T2W and heavy T2W
Hemangioma

- M/C benign liver tumor, prevalence up to 20%
- Usually incidental finding
- Occur in all age groups but more common in adults, particularly women
- Solitary or multiple lesions
Hemangioma

- Typical sonographic appearance \(\rightarrow\) well defined, homogeneous hyperechoic
- May appear hypoechoic within background of a fatty infiltrated liver
Hemangioma

CT findings
- Well defined hypodensity mass

MRI findings
- T1W – low SI
- T2W and heavy T2W – high SI, giant hemangioma → central area of either bright, dark or mixed SI and a network of multiple fibrous septae of low SI

Typical enhancement pattern → peripheral nodular enhancement with centripetal fill-in on later phases
Abscess

- **Causes**
  - Pyogenic hepatic abscess (M/C)
    - Clostridium species
    - Gram-negative bacteria: *E.coli*, *Bacteroides* species
    - Coalescent, grouped appearance
  - Amebic abscess: *Entamoeba histolytica*
  - Fungal abscess: *Candida albicans*
- Single or multiple
- Can be small or large
- Hepatomegaly
- Pleural effusion
- Gas within abscess (esp. *Klebsiella*)
Liver abscess

- US findings
  - Hypoechoic lesion with well defined mildly echoic rim
  - Posterior acoustic enhancement
  - Low-level echoes/ fluid-debris level
  - Intensely echogenic reflections with reverberations
Liver abscess

- CT findings
  - Centrally hypodense lesion
  - Peripheral enhancing rim
  - Perilesional hyperemia
  - Air bubbles may be present
Hepatocellular carcinoma

- M/C primary malignant hepatic neoplasm
- Predominant causal factors → cirrhosis from alcoholism, viral hepatitis and toxin exposure
Hepatocellular carcinoma

Ultrasound

- Lower sensitivity and specificity than CT or MR in diagnosing HCC
- Variable echogenicity: hypoechoic, hyperechoic and mixed echogenicity
- Thin hypoechoic band of capsule
Hepatocellular carcinoma

CT findings
- Hypodensity mass ± necrosis, fat, calcification
- Early enhancing mass with rapid washout on the late phase
- Late enhancement of capsule
- Tumor thrombus → detection of early enhancement of thrombus during arterial phase
Hepatic Metastasis

- Most common malignant focal liver lesions in the non-cirrhotic liver
- Features of metastasis is vary, may be expansive, infiltrative, surface spreading or miliary, depending on origin of primary tumor
Hepatic Metastasis

Ultrasound

- Diagnostic sensitivity over 90% in detection of metastasis
- Sonographic patterns
  - Hyperechoic
  - Bull’s eye or target pattern
  - Hypoechoic
  - Cystic
  - Calcified
  - Infiltrative
- Multiple lesions
METASTASES

Hypervascular metastasis

Hypovascular metastasis

Cystic metastasis
Common diseases of biliary system

- Gallstone
- Cholecystitis
- Cholangitis
- Cholangiocarcinoma
Gallstone

Ultrasound

- Imaging tool of choice, accuracy 96%
- Highly reflective echo, mobile and associated with posterior acoustic shadowing
Acute cholecystitis

- Ultrasound
  - First imaging modality of choice
  - Most specific findings
    - Gallstone, esp. impacted stone in cystic duct or gallbladder neck
    - Positive sonographic Murphy sign
  - Thickening of gallbladder wall (>3 mm)
  - Distention of gallbladder lumen (diameter > 4 cm)
  - Pericholecystic fluid collection
  - Hyperemic gallbladder wall on Doppler US
Acute Cholecystitis
Cholangitis

- Sonography is advocated as the first imaging modality to determine the cause and level of obstruction and to exclude other diseases

- Sonographic findings
  - Dilatation of the biliary tree
  - Choledocholithiasis and possibly sludge
  - Bile duct wall thickening
  - Hepatic abscess
Cholangitis with CBD stone
Cholangiocarcinoma
Common diseases of pancreas

- Pancreatitis
- Adenocarcinoma
Acute pancreatitis

- Acute inflammatory process of pancreas with variable involvement of other regional tissue or remote organ systems
- Etiology
  - Alcohol, stone, metabolic, infection, trauma, drug
- Clinical
  - Severe mid epigastric pain radiating to back
  - Increased serum amylase and lipase
- Diagnosis based on clinical and laboratory findings
Acute pancreatitis

- Role of ultrasound
  - Detection of gallstone or bile duct stone
  - Survey complication as peripancreatic fluid
  - Follow up complication
  - Guide intervention

- CT is primary modality of choice to identified necrotic parenchyma and extraparenchymal involvement
Acute pancreatitis

Sonographic findings
- Negative in mild form
- Focal pancreatitis \(\rightarrow\) focal isoechoic or hypoechoic enlargement of pancreas
- Diffuse pancreatitis \(\rightarrow\) increasingly hypoechogenic relative to normal liver and increased size
- Focal hemorrhage – focal echogenic mass
Acute pancreatitis

- CT findings
  - Focal or diffuse pancreatic enlargement
  - Heterogeneous enhancement with non-enhancing necrotic areas
  - Rim enhancement of fluid collection, abscess and pseudocyst
  - Infiltration of peripancreatic fat
  - Gallstone
  - Pseudoaneurysm
  - Pleural effusion and atelectasis of basal lungs
Chronic pancreatitis

- An inflammatory disease process that leads to progressive and irreversible structural damage of pancreas → permanent dysfunction of both endocrine and exocrine pancreatic function

- Etiology
  - Alcohol abuse
  - Genetic factors
  - Hypertriglyceridemia
  - Hypercalcemia
  - Autoimmunity
  - Pancreatic duct obstruction
Chronic pancreatitis

Radiography
- Calcifications projecting over epigastrium can be seen in 30-70%
- Specific but poorly sensitive
Chronic pancreatitis

Ultrasound findings
- Pancreatic calcifications (40%), may be focal or diffuse
- Pancreatic enlargement or atrophy
- Ductal dilatation
- Pseudocyst
Pancreatic adenocarcinoma

- Malignancy arises from ductal epithelium of exocrine pancreas
- Presentation varies with location
  - Head $\rightarrow$ obstructive jaundice, pain and weight loss
  - Body & tail $\rightarrow$ weight loss and massive hepatic metastasis
- Mean age at onset 55 years
- Location
  - Head 60%
  - Body 20%
- CT scan is recommended for staging, pre- and post therapeutic evaluation, evaluating complication
Pancreatic Adenocarcinoma

CT findings

- Heterogeneous poorly enhancing mass
- Parenchymal atrophy and ductal dilatation upstream from tumor
- Lesion in head may cause CBD obstruction
Common diseases of GI system

- Bowel obstruction
- Bowel perforation
- Infection/inflammation
- Cancer
Small bowel obstruction
Large bowel obstruction
Large bowel obstruction from colonic cancer
Colitis
Esophageal carcinoma
Gastric cancer
malignancy arising from gastric mucosa

- Polypoid or circumferential mass with no peristalsis through lesion
- Morphology → polypoid, ulcerated, infiltrative lesions

CT
- Negative contrast agent
- Polypoid mass ± ulceration
- Focal wall thickening with mucosal irregularity or focal infiltration of wall
- Gas filled ulcer crater within mass
- Wall thickening with loss of normal rugal fold pattern
- Enhancing thickened wall
- CA cardia → irregular soft tissue thickening; lobulated mass
CA colon

- BE
  - Sessile/pedunculated lesion
  - Semiannular lesion
  - Annular (apple core) lesion

- CT
  - Asymmetric mural thickening ± irregular surface