Liver nodules mimicking metastatic disease

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Learning objectives

The aim of this exhibit is to describe the most representative imaging findings of a number of benign focal liver nodules in order to make a differential diagnosis from liver metastasis.

Background

Not all focal liver lesions detected by imaging can be classified as malignant disease. Common lesions as cysts, hemangiomas, focal nodular hyperplasia, and adenoma are well recognized by the radiologists. In other tumour like conditions, CT and MRI play an important role towards the diagnosis and management of the patient.

Imaging findings OR Procedure details

Classical behavior of liver metastases (LM)

- Most LM are multiple
- Almost always metastases elsewhere than the liver
- Colon CA, carcinoid and HCC may present with metastases limited to the liver
- CT routinely used, MRI as problem solver
- Characteristics similar to the primary tumor: hypo- or hypervascular
- Incomplete and central progression of lesion enhancement Fig.1 on page 5
- Early ring enhancement
- Peripheral wash-out on delayed scans (in 27% of hypervascular mets and 2% of hypovascular mets BUT a specificity of more than 90%)
- Margins can vary from well defined to ill defined
- Peripheral enhancement with hypoattenuating center : most common Fig.2 on page 6
- Homogeneous enhancement in small lesions
- Heterogeneous enhancement in large lesions
- Stays of high signal on b0 -->b1000 with DWI

Liver nodules mimicking metastatic disease

1. Focal Steatosis
• Hepatic steatosis can be either diffuse or focal
• Hyperechoic on ultrasound (US) and of low attenuation on CT
• Further work up MRI with combination of in-phase and out-of-phase GRE imaging to detect steatosis with the aid of the chemical shift technique
• Although focal steatosis has been described to concentrate FDG on PET/CT images [1] this is a extremely rare condition
• Characteristic location: near the gallbladder Fig.3 on page 7 and near the falciform ligament Fig.4 on page 8 [2]
• Lack of mass effect support the diagnosis of focal fatty infiltration of the liver
• Same contrast behaviour as normal hepatic tissue Fig.5 on page 9
• Focal Fat infiltration can disappear during follow up Fig.6 on page 9
• No changes on DWI Fig.7 on page 11
• Branches of the hepatic and portal veins traverse it without change in their course Fig.8 on page 11

2. Solitary Necrotic Nodule

• Solitary Necrotic Nodule of the liver is an uncommon lesion, which despite its name, may be multiple
• It may represent the end-stage of a range of benign lesions such as larval infestation, sclerosed hemangioma or (post-surgical, post-radiation) trauma [3]
• Differentiation by means of CT between these nodules and hepatic metastases remains very difficult or impossible. PET scan may aid in the diagnosis Fig.9 on page 12

3. Liver Infarction

• Uncommon, due to dual blood supply of the liver
• Well-circumscribed, peripheral, wedge-shaped Fig.10 on page 12
• May undergo atrophy

4. Cysts

• Most common liver lesion
• Can be confusing, if small, on CT scan (partial volume effect)
• No contrast uptake
• Bright on T2WI
• DWI bright on low b-values and dark on high b-values with high ADC (bright) Fig.11 on page 14

5. Liver abscess

• Fever, inflammatory tests
• Typical CT or MRI feature: rim enhancement Fig.12 on page 16
• DWI to differentiate from cystic or necrotic tumors [4]
• Filled with pus; if high viscosity and cellularity: decreased ADC
• May mimick metastases but ADC decrease is in the central part (> mets in the peripheral solid part)
• Often associated with pelvic abscess or with cholangitis

6. Von Meyenburg Complexes

• Biliary hamartomas
• Benign malformations of the intrahepatic bile ducts
• Well-defined focal collections of varying degrees, usually less than 5mm
  Fig.13 on page
• Prevalence ranges from 0.7 to 2.8% on autopsy series
• Three times more frequent in women
• Can be confused with liver metastases, microabscesses, liver cysts, Caroli’s disease and biliary adenoma [5]
• Primary tumors causing cystic liver metastases are usually colorectal CA, melanoma, carcinoid, breast CA, renal cell CA and ovarian CA

7. Hemangioma

• Small hemangioma difficult to differentiate on portal venous phase CT
• MRI is problem solver
• Capillary hemangioma mimicking metastases of a neuroendocrine tumor which are hyperintense on T2 ("light bulb" sign) Fig.14 on page
• The clue is the contrast pooling (same SI as the vessels at the equilibrium phase images)
• Hyalinized hemangioma has internal fibrotic changes, does not totally fill up with contrast Fig.15 on page

8. HC Adenoma

• Rare, mostly in women, associated with the use of contraceptive pills
• Decreases in hormone dosage have led to a decrease in incidence
• Consists of sheets of hepatocytes without bile ducts or portal areas
• Large tumors may bleed or can transform to carcinoma
• Hypervascular nature, may mimick hypervascular metastases
• Clue to diagnosis: no clear diffusion restriction and presence of intralesional fat Fig.16 on page

9. Vascular disorders

• Can mimic hypervascular metastases
• Frequently in cirrhotic liver
• Typically not round Fig.17 on page 20
• No diffusion restriction

10. Inflammatory pseudotumor (IPT)
appears as a well-defined mass
- Resemblance with malignancy on imaging Fig.18 on page 20
- Early arterial enhancement (active inflammation) and increased contrast retention (chronic inflammation due to fibrosis) Fig.19 on page 22
- Clue to DD with metastasis: DWI with high b-values: low SI (>< mets high)
- Rare benign lesion that shows regression over the course of a month on repeated imaging modalities
- Reason for (needless) surgical resection in many cases
- Consist of a fibrous stroma and an inflammatory cell infiltrate
- Etiology in the liver remains doubtful, although infection, biliary obstruction, chronic cholangitis and primary sclerosing cholangitis have been suggested

11. Nodular Regenerative Hyperplasia (NRH)

- = Nodular Transformation, Non-Cirrhotic Nodulation, Adenomatous Hyperplasia
- Rare; 0.72% of autopsies
- Diffuse micronodular transformation of the hepatic parenchyma with fibrous septa in between
- Associated with autoimmune diseases or haematological disorders
- Hypervascular nature, may mimick hypervascular metastases Fig.20 on page 22
- Clue to differential diagnosis: NRH appears hyper- to isointense on T1

Images for this section:
**Fig. 1:** 65-year-old man, history of colorectal cancer with liver metastases. A-B ill-defined hypodense lesions with a heterogeneous nature C-D T2-weighted HASTE without and with fat suppression showing moderately hyperintense lesions with a central hypointense area due to necrosis E-G DWI b50, b600 and b1000 persistent high SI at the active tumoral parts of the metastases.
Fig. 2: Fig.2 CE pattern of metastases: A. Hypervascular nature with areas of necrosis in larger mets from a neuroendocrine tumor B. Hypervascular nature with iso-intensity at the portal phase in a met from a primary breast cancer C-D: Metastases from colorectal adenocarcinoma, early peripheral rim-enhancement with peripheral wash-out at the delayed phase (D).
**Fig. 3:** 46 year old woman, history of breast cancer. A. Focal hypoechogenic nodule in a steatotic liver adjacent to the gallbladder. B-C. MRI confirms a lack of signal loss on out-of-phase images in comparison with in-phase images: area of focal non-steatosis.

**Fig. 4:** 36 year old male, history of a dysplastic adenoma in the colon. A. Hypodense region boarding the falciform ligament on CT scan before and after iv administration of contrast in arterial and portovenous phase, best seen on the latter. B. MRI does not reveal a lesion in the in-phase T1-weighted GRE images, but demonstrates a loss of signal on the out-of-phase images: Intracellular focal fat deposition. Focal fatty
change tends to occur around the falciform ligament, usually at the anterolateral edge of the medial segment as in this patient.

**Fig. 5**: Fig.5. 80 year old man, no known primary. A. Suspicious lesions on CECT scan. B. On the T2-WI vague hyperintensities are noticed due to the fat deposition, which are clearly demonstrated with the drop of signal on the out-of-phase images. C. No focal lesions on the DWI at b50-b600-b1000.
**Fig. 6:** Fig. 6. 59 year old man. A. Multiple hypodense rounded nodules on CECT in a steatotic liver, simulating infiltrative metastatic disease. B MRI one week later diffuse signal drop on the out-of-phase T1 images compared to the in-phase T1 images, but no focal lesions were seen. C. On the repeat CECT scan 2 months later the focal lesions have disappeared.

**Fig. 7:** Fig. 7. 50 year old woman, history of breast CA. CECT shows a hypodense liver lesion in segment IV. B. Focal steatosis is clearly diagnosed on the in-phase and out-of-phase GRE images. C. No lesions are seen on the DWI.
**Fig. 8:** 65 year old woman, history of colon CA, LM treated with RF ablation. A. CECT shows a vaguely bordered hypodense lesion in the right lobe. The intrahepatic vessels do not show any deformation while traversing this lesion. B. PET scan and combined PET/CT show a small FDG uptake at the centre of the hypodensity, which is compatible with a focal LM within the fatty deposition, which masks the LM on CT scan. At the anterior border of the liver we can see a post RF ablation zone, without FDG uptake.

**Fig. 9:** 50 year old female, undergone an extensive Whipple operation for a pancreatic adenocarcinoma. A. One week later the CECT scan showed multiple hypodensities in the liver parenchyma. PET scan and the biopsy remained negative. These nodules disappeared on follow up imaging (not shown), although new metastases appeared in other locations.
Fig. 10: Fig.10. 21 year old man, history of lymphoma and a known thromboflebitis migrans. A. The unenhanced CT scan shows no lesion, while the portal venous phase shows clearly a hypodense triangular mass like lesion. B. Linear hypodensity arising from the portal vein, suggesting thrombosis (arrow). C. No pathologically increased FDG uptake is seen in this region, although PET scan does not reveal an avascular zone. D. Two months later this region is almost completely perfused again, but still shows the presence of an intraportal thrombus.
**Fig. 11**: Fig.11. 68 year old man, history of prostatic CA. A. CECT shows in a fatty liver a nodule with a hyperdense rim, suggesting LM. B-C. Hyperintense on T2 and hypointense on T1. D. Drop in SI on the opposed-phase image due to fatty liver but sparing area around the cyst. E. No contrast enhancement. F. T2 shine through effect on the b50 DWI, while no lesion was seen on the b600 and b1000 (not shown).
**Fig. 12:** 39 year old woman, abdominal pain. A. Multiple hypodense nodules (arrow) in the liver in this patient were suspicious for metastatic disease. B. MRI of the liver shows nodules that are hyperintense on T2 and hypointense on T1. C. On DWI, the nodules are hyperintense on b600 DWI and are barely visible on the ADC map. D. After administration of iv Gadolinium there is a rim visible around the lesions. Biopsy at that moment did not reveal any malignancy. F. MRI scan was repeated two months later. The lesions had grown in size. G. Hyperintense on high B-value and on the ADC map the lesions are hypointense with a slightly hyperintense rim. H. Biopsy confirmed the suspicion of abscesses, which were due to Bartonella Henselae (cat-scratch disease).
**Fig. 13:** 44 year old woman with breast CA (arrow in A.) B. ill-defined, hypervascular lesion in segment VIII, suspicious for metastasis; a second, hypervascular lesion in segment IV, compatible with FNH on CECT (arrows). C. Furthermore, the lesion in segment VIII displays FDG uptake on PET/CT. D. No lesion is seen on the T2WI. E. Fatty contents is seen on the chemical shift technique (arrow). F. In the arterial phase a strong enhancement is noticed (arrow), with a wash-out on the portal phase. G. Only in the b50 we can see a focal hyperintensity which does not persist on the b600 and b1000: no clear diffusion restriction. This hypervascular lesion with fat content and no restriction on DWI is an adenoma. Usually not hypermetabolic.

![Fig. 13: 44 year old woman with breast CA.](image1)

**Fig. 14:** 37 year old woman, Rendu Osler Weber disease. A. CECT shows patchy enhancements in the arterial phases which disappear in the portal phase. B. Angiography of the hepatic artery with capillovenous malformations throughout the liver.

![Fig. 14: 37 year old woman, Rendu Osler Weber disease.](image2)
Fig. 15: 66 year old woman, history of colon CA. A. CECT scan shows a demarcated hypodense focal nodule in segment 5 of the liver. B. Corresponding PET/
CT image: increased glucose metabolism in the lesion. C. Biopsy of the lesion showed focal granulomateous hepatitis with numerous eosinophils. The diagnosis of an IPT (focal hepatitis) was established. D. After 2 months the focal FDG uptake had disappeared.

**Fig. 16:** Fig.19. 22 year old man. A. T2WI irregular hyperintense lesion in segment VII with a necrotic part. B.-D. Hypointense lesion with early enhancement without fast wash-out (contrast pooling). Enhancement similar to that of LM with peripheral wash-out. During follow-up this lesion shrinks and after 4 months it disappeared completely (not shown). This was an inflammatory pseudotumor as well.
Fig. 17: Fig.20. 18 year old male, history of Ewing sarcoma and haemochromatosis. A. CECT shows a hypervascular lesion (arrow) in segment IV. B. On T2WI there are 3 hyperintense lesions (arrows). C. Native T1 shows isointensity of the lesions, arterial phase confirms the hypervascular nature (arrows), the lesions are less obvious on portal phase. D. DWI stays slightly hyperintense. Pathology after surgery does not confirm malignancy and suggests NRH.
Conclusion

A profound knowledge of the radiological characteristics is essential in the diagnosis and patient’s management.

Imaging features along with the clinical history may guide towards the diagnosis, although image guided biopsy is often required to confirm the diagnosis.

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References


