COMPUTED TOMOGRAPHY OF THE LIVER

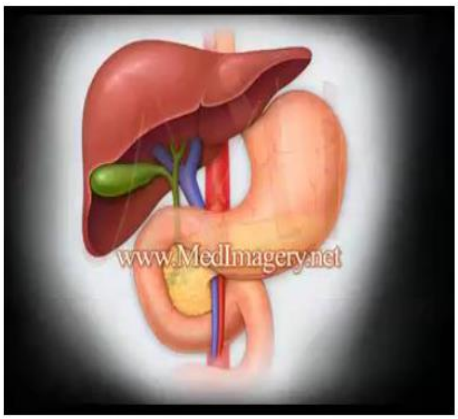
The clinical objectives of a diagnostic imaging examination of the liver depend on the type of lesion expected.

The pre-contrast scan (native scan, non-enhanced scan) are valuable for:

1. Assessing diffuse hepatic changes, such as fat infiltration and iron deposition
2. Assessing subtle calcification and haemorrhage.

Indications

- *To assess equivocal imaging findings*
- *Staging of hepatic neoplasms*
- *Metastatic workup of primary malignancies*
- *Diagnosis of diffuse hepatic diseases*
- *Assessment of biliary problems*
- *Diagnosis of vascular lesions*
- *Assessment of post-traumatic complications*

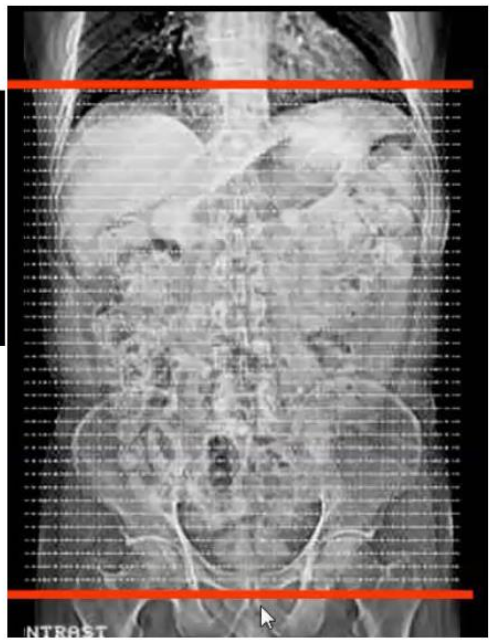


Patient preparation

No preparation required unless the patient is going to be sedated or injected with contract material, then the patient should be fast 4-6 hours

I.V contrast material:

- *Urographin*
- *Telebrix*
- *Urovison*
- *Isovist,…..*



Intravenous contrast enhanced studies:

The ability to detect liver lesions after the administration of contrast medium depends on the extent to which lesions differ from normal liver tissue in taking up the contrast agent: ***Hypervascular tumors*** take up more contrast agent than normal tissue and thus appear brighter (hyperdense), whereas ***hypovascular lesions*** are darker (hypodense).

As a result of the liver's dual blood supply (from the hepatic artery & portal vein), contrast- enhanced imaging of the liver is performed during several vascular phases defined in relation to the moment when contrast medium is injected.

1. ***early arterial phase***: when scanning is done within the first 20 s after an intravenousbolus injection, there is relatively little effect of contrast agent on the imaging appearance of liver tissue; this phase is useful indefining the hepatic arterial anatomy before surgery but has little value in detecting and characterizing tumors.
2. The ***late arterial phase***(when images are acquired 30 - 35 s after IV contrast administration).during this phase a sufficient amount of the contrastmedium bolus

reaches the liver , thus areas of increased vascular density such as hypervascular lesions appear hyperdense to the surrounding liver tissue.

3. The ***portal venous phase*** (when images are acquired 1 min. after IV contrast administration): at this phase contrast agent is also brought to the liver by the portal venous blood supply. During this phase the distinction between normal liver tissue and hypervascular lesions is lost, while hypovascular lesions become clearly visible as areas that are hypointense to normal tissue.

4. Imaging during the ***late phase*** (after several minutes), is useful todemonstrate persistent enhancement of some tumors(e.g., hemangiomas) and fibrotic lesions when contrast agent has been eliminated from normal liver tissue.

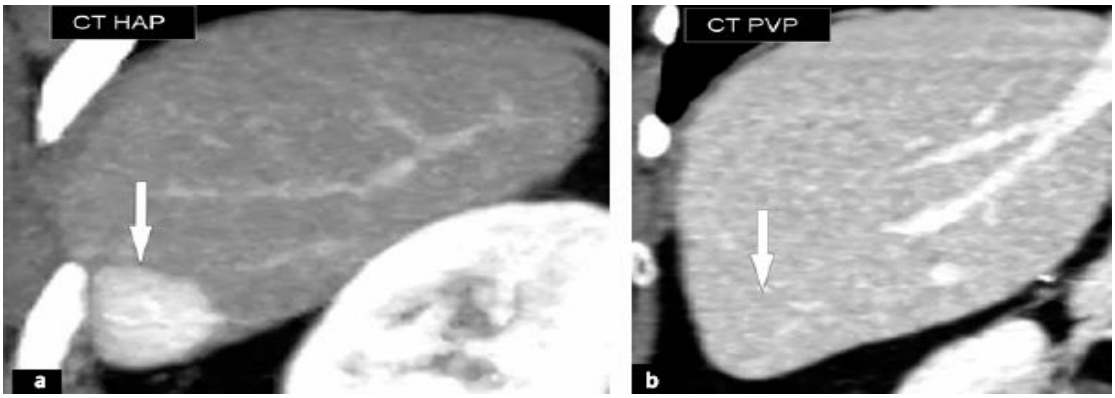
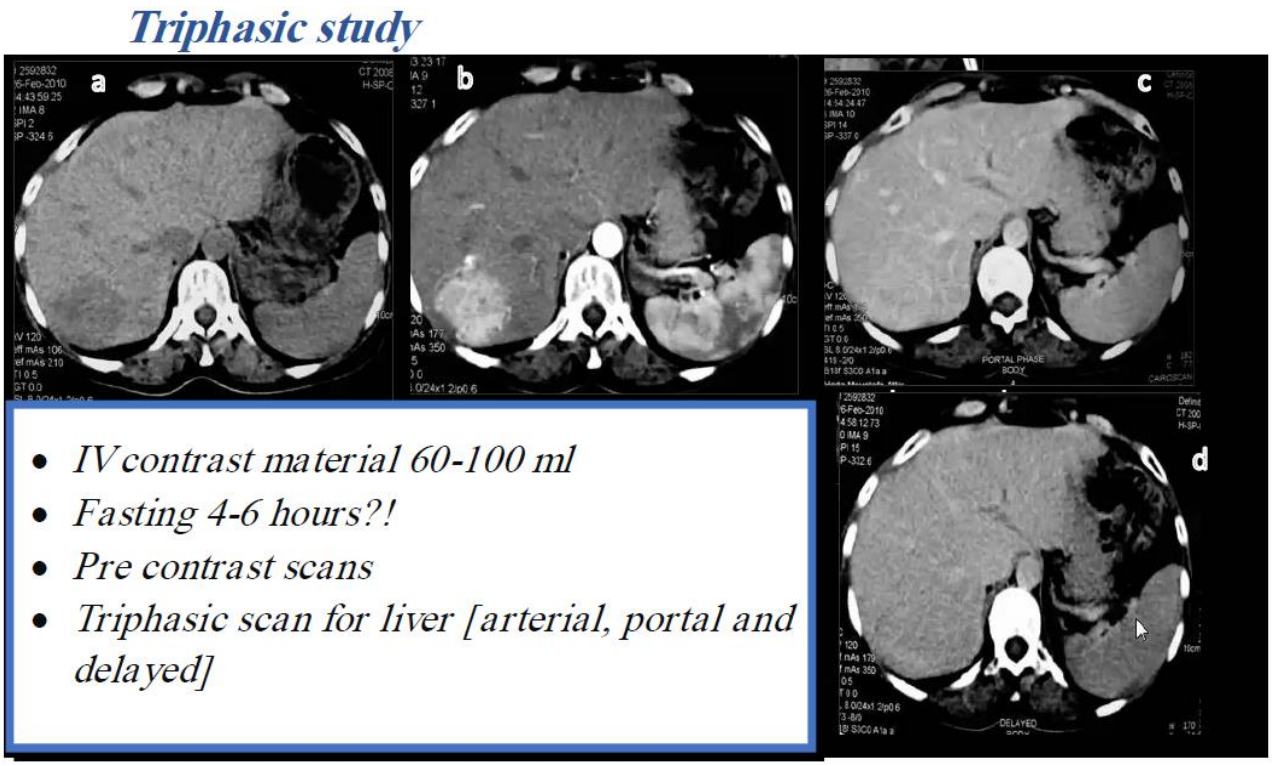


Fig. 1: Hepatocellular carcinoma detection: coronal reformatted CT images of the liver in the **arterial phase (a)**&**portal venous phase image (b)** showing intensely enhancing hepatocellular carcinoma (HCC) (arrow). Note better lesion-to-parenchymal contrast in the arterial phase(a) in comparison with the portal venous phase image (b) where the lesion is not appreciated



The majority of liver tumours lesions have a predominantly arterial blood supply whereas the liver parenchyma receives 75–80 per cent of its blood supply via the portal vein.[1]Since the increased vascularity of tumors, relative to normal tissue, develops from the arterial blood supply, these lesions are best imaged during the brief arterial phase after the administration of contrast medium. The best visualization of hypervascular tumors is obtained during the arterial phase with the use of highly concentrated contrast media (small volume) and high injection rate.

Optimizing the protocols and timing of these phases to maximize lesion-to-liver contrast now varies with system acquisition speed.

The typical MDCT protocol (Table 1) starts with a bolus injection of iodinated contrast medium at a flow rate of 4 ml/s. The slice thickness is commonly 5 mm.

For ***hyper-vascular lesions*** (both benign tumors and hypervascular metastases), a **dual-phase acquisition** is performed: First, the liver is imaged during the late arterial phase 35 s after injection; then, imaging is performed during the portal phase, 60 s after injection,with the same scanning parameters sometimes, imaging is also performed in the late phase, after 3 min (**Triple phase acquisition**). Both the dual phase & triple phase acquisitions are called dynamic **contrast enhanced studies.**

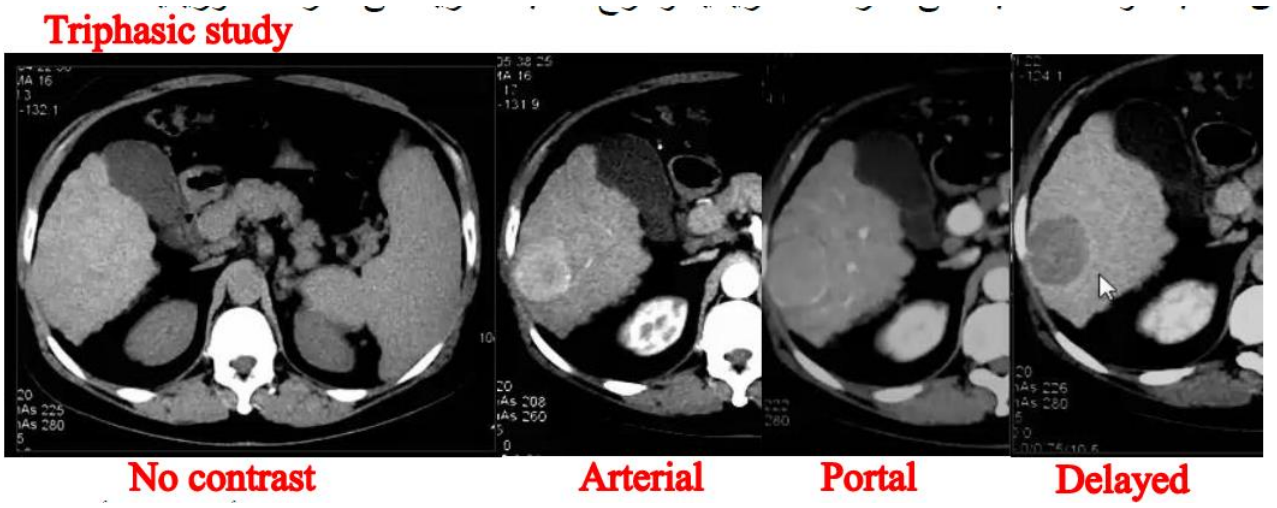
Alternatively, for ***hypo-vascular*** metastases, a single acquisition 60 s after the administration of contrast medium is often sufficient.(The normal liver tissue will have been enhanced by the contrast agent delivered by the portal vein, while the hypovascular lesions will appear hypodense relative to the normal liver parenchyma & thus become highlighted).

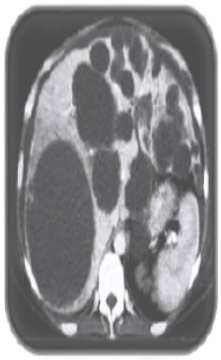
Table 1. Typical parameters for MDCT of the liver

X-ray generation	
Kilovolt	120 kV
Effective current	160 mA
Scan parameters	
Rotation time	0.5 s
Collimation	2.5 mm
Table feed per rotation	12.5 mm
Slice thickness	5 mm
Increment	3 mm
Contrast medium administration	
Iodine concentration	400 mg/ml
Volume	1.7–2.0 ml/kg body weight
Flow rate	4 ml/s

NormalAppearance:

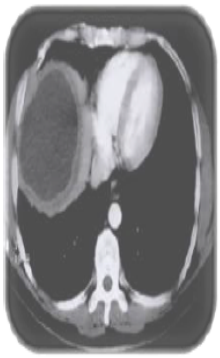
The liver parenchyma is homogeneous with attenuation values of 54–60 HU, usually 8–10 HU greater than the spleen. The vascular structures can be identified by their location on the unenhanced images and confirmed by enhancement with IV contrast medium. The peripheral intrahepatic biliary tree is not normally visualized, although the main right and left hepatic ducts and the common hepatic and bile ducts are normally seen.





Simple hepatic cyst

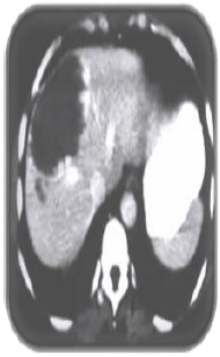
1- Sharply defined margin *2-Paper thin wall* *3-Clear water contents*
4-No septations *5- No calcifications* *6- No enhancement* *7-No mural nodules*



Abscess

1-Marginal enhancement *2- peripheral zone of edema*

3- Gas containing abscesses uncommon

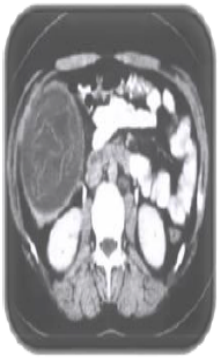


Hemangioma

U.S: Typically well defined hypodense lesion

CT Arterial phase: peripheral nodular discontinous enhancement

CT Portal-delayed phases: continued filling in of the hemangioma

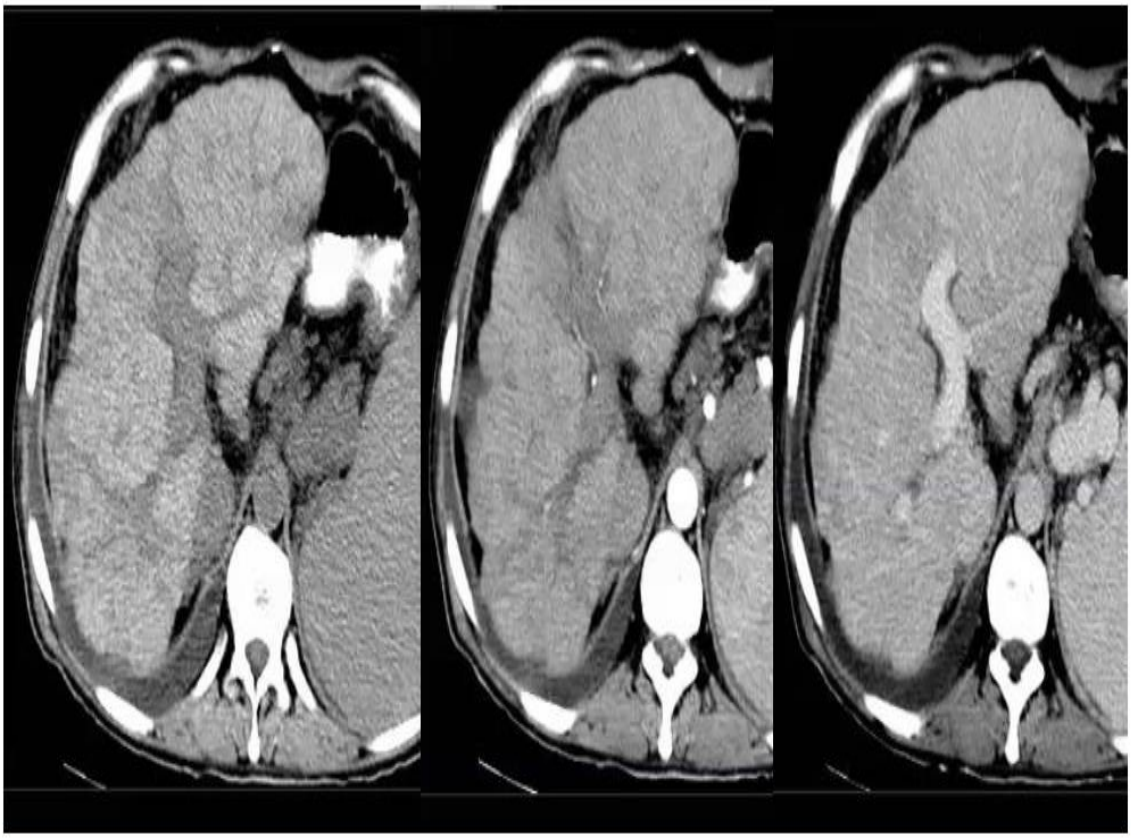


Hydatid cyst

1- Central and peripheral calcification **2-** Floating shadows

3-Daughter cysts can be inside the large cyst

Cirrhosis, 2ry to hepatitis B



*Increase density of the liver with irregular nodular surface and parenchyma, consistent with **cirrhosis**. No enhancing nodules seen during the arterial to suggest HCC. Huge splenomegaly is seen*