

CT abdomen and pelvis

■ General indications:

- Assessment of vague abdominal symptoms (pain, colics, distension,...)
- Verification of a lesion discovered by other diagnostic modalities as US, barium, IVP,...
- Staging of extraabdominal malignancies (breast cancer, bronchogenic ca.,...)
- Assessment of patients with lymphoma
- Assessment of abdominal masses

■ Specific indications:

Assessment of certain intraabdominal organ (liver, spleen, pancreas, kidneys, suprarenal, aorta, IVC, pelvic organs,...)

Examples:

- Diagnosis and staging of intraabdominal malignancies
- Blunt or penetrating abdominal trauma
- Diagnosis of intraabdominal vascular lesions (aortic aneurysm, IVC thrombosis,...) (CT angiography)
- Diagnosis of pelvic lesions: inflammatory or neoplastic

Technique of examination

Patient's preparation: For adequate examination of the abdomen and pelvis by CT, sometimes we need to opacify the gastrointestinal tract by an orally administered contrast material [gastrographin 38%] .. The contrast material is diluted by water to a concentration of 2-4% and taken orally by the patient at intervals to opacify the GI tract from the stomach to the anus.

- The amount of contrast material and the intervals of intake are subject to great variations
- Oral contrast is not usually given in the diagnosis of some emergency cases such as acute abdominal trauma, acute renal colic,... It is also not given for dehydrated children
- Oral contrast may be given for patients suspected to have
 - acute viscus perforation
 - acute intestinal obstruction

Patients indicated for IV contrast injection are injected with 4-5 ampules (20 ml each) as a bolus just before the start of examination

- Almost all patients examined by CT for abdominal or pelvic lesions are indicated for contrast injection except some limited circumstances [e.g acute renal colic,..]
- Fasting for 4-6 hours prior to contrast injection is necessary.

NB Non contrast scans should be obtained before contrast Injection when examining specific organs such as the liver, kidney and urinary bladder.

- CT sections are usually obtained at 10mm intervals for general indications and most of the specific indications. 5mm sections are obtained when assessing small organs such as the pancreas, suprarenal glands and urinary bladder or pelvic organs in general.
- Using the multidetector CT [MDCT] facilities we may obtain reconstructed images in the sagittal and coronal planes which are very helpful in the diagnosis specially in cases of:
 - Diaphragmatic lesions
 - Thoracic lesions extending into the abdomen and vice versa
 - Renal and suprarenal masses
 - Vascular lesions specially the aortic and iliac vessels
 - Pelviabdominal masses
 - Abdominopelvic lymphadenopathy
 - Peritoneal and mesenteric pathology
- MDCT angiography is also helpful in the diagnosis of vascular lesions such as :
 - **Aortic lesions:** arteriosclerosis ,aneurysms, dissection,..
 - **Renal arteries:** renal artery stenosis, donors of renal transplantation
 - **Mesenteric vessels:** abdominal angina, vascular occlusions, aneurysms,..
 - **CT portography** for portal venous abnormalities: portal hypertension, esophageal variccs, portal vein thrombosis,..

■ Triphasic study of the liver

- Is now the accurate way to detect and diagnose hepatic lesions
- Using the MDCT and automatic pump injector for contrast injection [to avoid human error]
- The patient lies supine on the CT machine
- Frontal scanogram is performed
- Precontrast scans for the hepatic area are obtained [from the diaphragm to the iliac crest]
- Start contrast injection by the pump, the rate of injection is 2-4 mL/ sec.
- The injected contrast- material will reach the hepatic artery in about 20 sec. from the start time of injection then we scan the liver [arterial phase]
- The contrast material will reach the portal vein after about 50 sec. from the start of injection then we scan the liver again [portal phase]
- Then we wait for about 3 minutes and scan the liver again [delayed phase]
- The triphasic study is now completed
 - Arterial phase
 - Portal phase (venous phase)
 - Delayed phase

Normal Anatomy

■ Liver [Rt hypochondrium]

- * Average hepatic size 15 cm cranio caudal diameter i.e 15 CT sections provided the section thickness is 1 cm. Allow ± 1 section for respiration. The use of MDCT can avoid this misregistration as the patient can hold his breath during the scanning period for each phase
- * The normal density of the liver is homogenous with no focal lesions.
- * Normal intra hepatic bile ducts are not usually seen on CT scans
- * Hepatic CT density is almost similar to that of the spleen after contrast injection
- * Hepatic vessels appear as tubular enhancing structures after contrast injection
- Hepatic veins are seen in the higher sections entering the IVC while lying in its fossa on the visceral surface of the liver

- Hepatic artery branches are not seen on regular CT scan but can be seen in the arterial phase of the triphasic study
- The rest of vascular structures seen through out the liver parenchyma are portal venous radicles
- * The porta hepatis represents the hilum of the liver. It contains fat, lymph nodes, CBD, hepatic artery and portal vein. All these structures are not usually seen on regular CT scan except for fat and portal vein.

■ Liver segments:

- Left lobe: Medial segment (MS) , lateral segment (LS)
 - Rt lobe : Anteriorsegment (AS), posterior segment (PS)
- Caudate lobe is present between the porta hepatis and IVC

■ Spleen [left hypochondrium]

- Average size is 12 cm cranio caudal diamiter
- More than 12 cm= splenomegaly... less than 12 cm = normal spleen
- Density is homogenous.. no focal lesion

■ Pancreas [Retro peritonium]

- Lies obliquely in the upper abdomen, head lower than body and tail
- Density is homogenous less than that of the liver and spleen
- Pancreatic size: head (3cm), body (2.5cm), tail(2cm)in normal adults. Atrophic changes of the pancreas are normally seen in old age where the pancreas is small in size and shows fatty infiltration of its parenchyma
- The normal common pancreatic duct is not seen on regular CT
- Splenic vein lies along the posterior border of the pancreas. The splenic vein joins the SMV to form the portal vein in the upper CT sections.
- The normal anatomic landmark of the pancreatic head is the SMA and SMV
- The pancreatic head lies within the concavity of the doudenal loop, if the loop is not adequately opacified by oral gastrographin, it will not be distinguished from the pancreatic head→ impression of enlarged head of pancreas.

■ **Suprarenal glands [Retroperitoneum]**

- Best seen in obese patients with large amount of retroperitoneal fat
- It is sometimes difficult to identify the suprarenal glands in children and thin patients by CT
- The suprarenal gland lies at the upper pole of each kidney
- The left suprarenal gland is easily identified compared to the Rt one, because the Rt suprarenal gland is closely related to the Rt hepatic lobe
- The suprarenal gland has an inverted Y configuration with main stem, medial limb and lateral limb

■ **Kidneys [Retro peritoneum]**

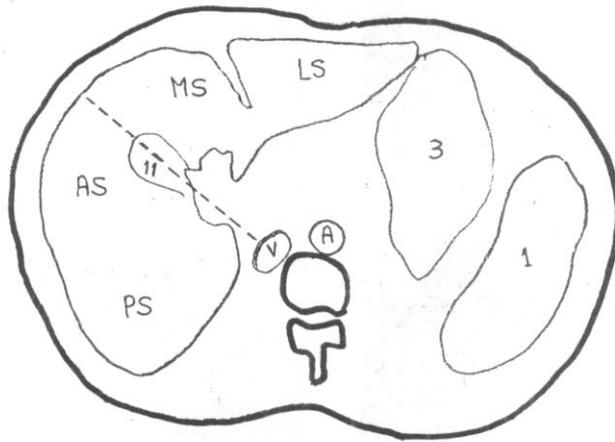
- CT evaluation of the kidneys should include pre and post contrast scans
- Renal size is approximately 12 cm x 6cm x 3cm [length, width, thickness]
- The renal hilum contains fat, renal pelvis, artery and vein. The left renal vein is a constant finding. It crosses the midline in front or behind (retroaortic) the aorta to join the IVC
- The renal outline is smooth and regular, apart from fetal lobulations (normal variant)
- The Gerotta fascia surrounds the kidney and separates the perirenal from the pararenal spaces. The fascia itself is not usually seen on CT unless thickened

■ **Urinary bladder [pelvis]**

- CT evaluation of urinary bladder lesions should include pre and post contrast scans
- Urinary bladder usually shows contrast fluid level [urine is above the contrast material]
- Posterior to the urinary bladder the seminal vesicles and rectum are seen in males, the uterine cervix and rectum are seen in the females
- The ovaries are better assessed by ultrasound or MRI
- The ischiorectal fossa is a triangular shaped fat containing area on either side of the anal canal

■ **Abdominal muscles:**

- The psoas muscle lies on either side of the vertebral bodies
- In the pelvis the psoas blends with the iliacus muscle which lies on the inner aspect of the iliac bone to form the iliopsoas muscle
- The rectus abdominis muscles form the anterior abdominal wall on either side of the midline



- 1- Spleen
 - 2- Liver
 - 3- Stomach
 - 4- Hepatic veins
 - 5- Suprarenal glands
 - 6- Upper pole of the kidney
 - 7- Tail of pancreas
 - 8- Body of pancreas
 - 9- Head of pancreas
 - 10- kidney
 - 11- Gall bladder
 - 12- urinary bladder
 - 13- uterine cervix (female)
 - 14- seminal vesicles (male)
 - 15- Rectum
 - 16- Ureter
 - 17- psoas muscle
 - 18- Rectus abdominis muscle
 - 19- Gluteus maximus muscle
 - 20- Intestine
- LS = lateral segment MS = medial segment
 AS = anterior segment PS = posterior segment
A = aorta **V** = IVC **SV** = splenic vein **SMA** = superior mesenteric artery
SMV = superior mesenteric vein

