Al-Mustaqbal University
College of Health and Medical Technologies
Radiological Techniques Department

Magnetic Resonance Imaging

First Semester

Lecture 20+19 : MRI of abdomen

By

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Introduction :

Learning about abdomen MRI is essential for MRI technologist to

1- perform MRI exams effectively,

2- interpret MRI results accurately,

3- ensure patient safety,

4- understand anatomy and pathology, and

5- collaborate with other healthcare professionals.

•Anatomical overview:

The abdomen is generally considered as the region of the body between **the chest and pelvis**. Typically, the vertebral column contains five lumbar vertebrae, Forming the posterior border of the abdominal cavity.

Liver:- The largest gland in the body, found in the upper abdominal cavity on the right side. It consists of four lobes:-

-Right lobe.

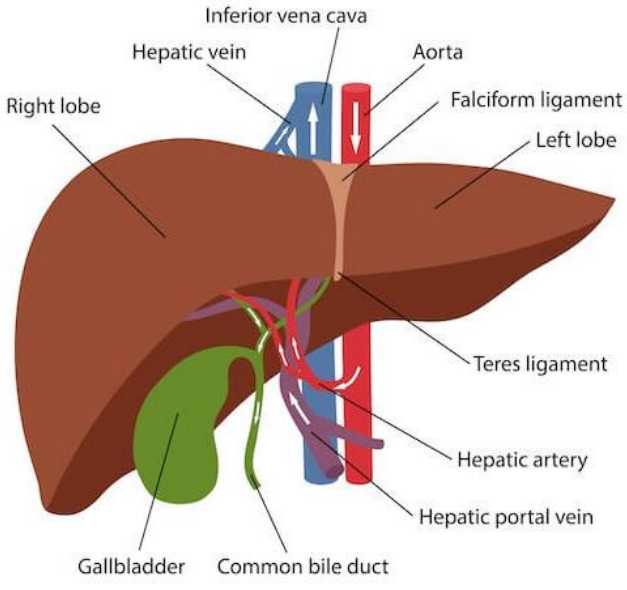
-Left lobe.

-Caudate lobe.

is situated on the posterior aspect of the liver, adjacent to the inferior vena cava.

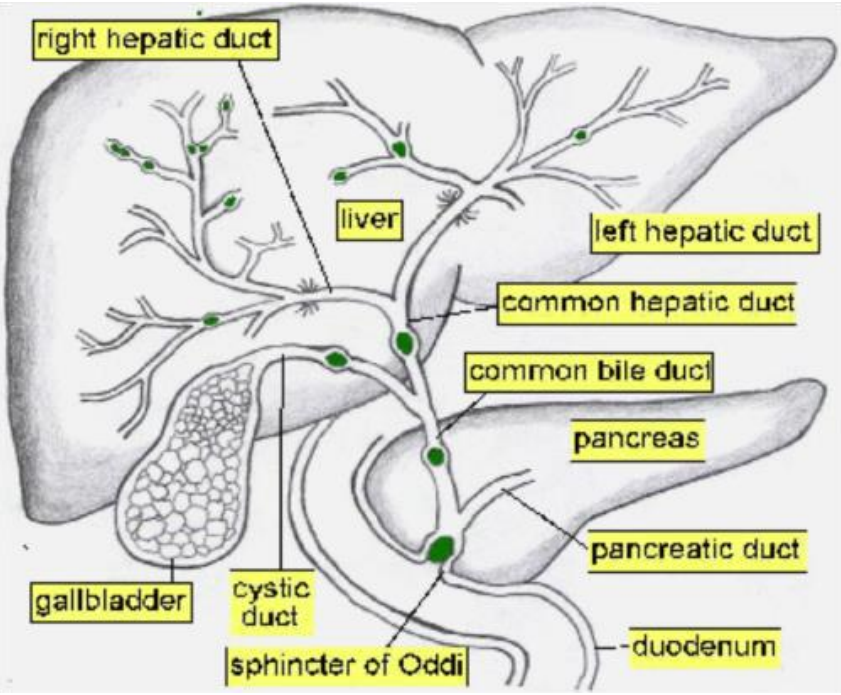
-Quadrate lobe.

is found on the anterior surface of the liver, situated between the left lobe and the gallbladder.



Gallbladder:- It is a sac located under the liver. It stores the bile produced in the liver.

-Common bile ducts:- Transports bile from the gallbladder (via the cystic duct) and the liver (via the hepatic duct) to the duodenum. (fig.1).



(Fig.1) Liver and biliary system

-Indications of liver MRI:

1-Characterization of lesions.

-Primary versus metastatic.

-Malignant versus benign.

2-Hepatocellular carcinoma.

3-Hemangioma.

4-Hydatid cyst.

5-Diffuse liver disease; e.g. cirrhosis.

6-Biliary obstruction; including choledocholithiasis.

Lesion	T1-weighted	T2-weighted
Malignant (general)	Hypointense	Hyperintense
Benign (general)	Isointense/Hypointense	Hyperintense
Hepatocellular Carcinoma	Hypointense	Hyperintense
Hemangioma	Hypointense/Isointense	Very hyperintense
Hydatid Cyst	Hypointense	Hyperintense
Diffuse Liver Disease (Cirrhosis)	Hypointense	Hyperintense
Biliary Obstruction	Hypointense	Hyperintense (bile)

-MRI procedure:

-Patient position:

1-Patient should be in supine-position (head first or feet first).

2-Set up the body coil for the MRI exam.

Body coil/volume torso array or multi-coil

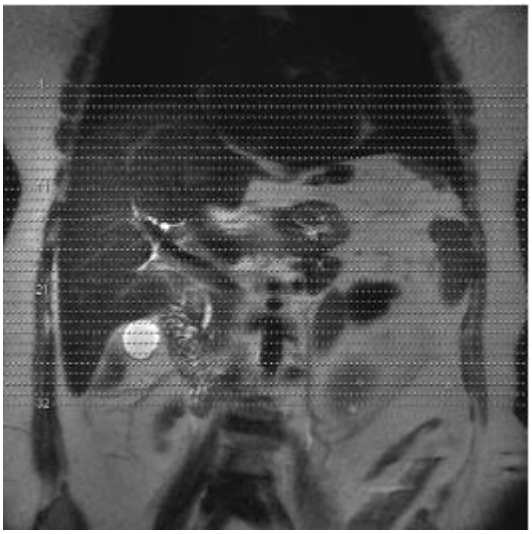
Placement of the gating leads

Patient position: Torso array coil
Place the patient supine, feet first on the table.

- Respiratory gating triggers data acquisition during expiration (when least diaphragmatic movement occurs)
- Respiratory compensation acquires MR data continuously and orders it according to respiratory phase

- Scout slice placement:

1-Coronal localizer for axial slice



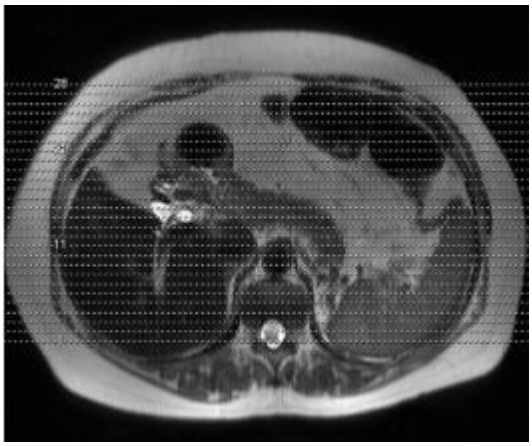
- Alignment: True axial plane.
- Coverage:
A-Superior to inferior: Dome of the liver to the lowest border of the liver.
B- Lateral to medial: Ribs on each side.
C-Posterior to anterior: Peritoneum to anterior abdominal wall.

- Demonstrates:

1-Individual inspection of liver segments.

2-Disruption of the biliary tree and vascular supply due to invasive disease.

2-Axial localizer for coronal slice.



-Alignment: True coronal plane.
-Coverage:
A-Superior to inferior: Distal lung fields to tail of segment VI.
B-Lateral to medial: Ribs on each side.
C-Posterior to anterior: Peritoneum to anterior abdominal wall.

-Demonstrates:

1-Lesions in the inferior tail and lateral tip of the left lobe.

2-Lesions high within the liver immediately under the diaphragm.

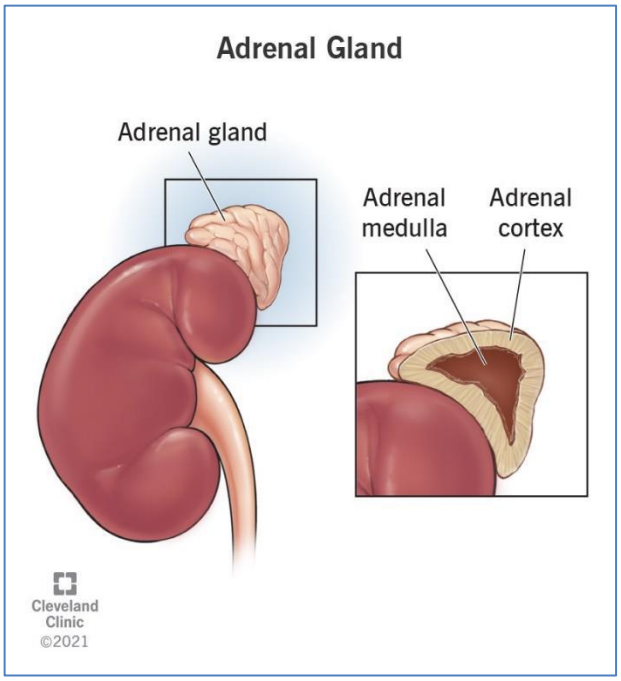
•MRI Sequences:

1	T1WI (FSE)	Slice thickness 5-8mm Useful : provides detailed anatomical information of abdominal structures, including the liver, spleen, kidneys, and blood vessels).
2	T2WI (FSE)	Slice thickness 5-8mm Useful : demonstrate differences in tissue water content, making it useful for identifying areas of inflammation, edema, or abnormal tissue within the abdomen.
3	Fat suppression sequences	Useful : Distinguish between fat-containing and non-fat tissues, which can be useful for characterizing lesions and assessing fatty infiltration of organs.
4	DWI sequence	slice thickness 5-8mm Useful : measures the diffusion of water molecules in tissues and can assist in the evaluation of tissue cellularity and identifying certain abdominal lesions, including tumors.
5	Dyn-study+ con (GAD-based contrast)	Slice thickness 5-8mm Useful : evaluates tissue perfusion and vascularity, aiding in the characterization of lesions, particularly for detecting and characterizing liver lesions.
6	(GRE) Sequences	Slice thickness 5-8mm. Useful : Sensitive to blood products and hemorrhage, making it useful for detecting vascular abnormalities, such as hemangiomas or vascular malformation.

• Kidneys and adrenal glands:

-Kidneys: The bean-shaped, **retroperitoneal organs** on either side of the vertebral column **typically centered at the level of the 1st lumbar vertebra.** Anomalies in formation are common during development, resulting in variations in the **shape and location of the kidneys**. Within the kidney, fluid and waste products are filtered from the blood to form urine, which is collected in the renal pelvis and drains into the ureters (Fig. 2).

-Adrenal glands: Also referred to as the **suprarenal glands**, these **soft, glandular organs** are located on the **top pole of the kidneys**. Roughly **pyramidal in shape**, their average dimensions in the adult are approximately 5-cm long, 3-cm wide, and 1-cm thick.



(fig.2) kidney and adrenal gland

-Indications:

1- Adrenal adenoma or adrenocortical carcinoma.

2-Renal cell cancer.

3-Renal cyst.

4-Metastases.

5-Adrenal myelolipoma.

6-Cushing's syndrome.

Lesion	T1-weighted	T2-weighted
Adrenal Adenoma	Hypointense/Isointense	Hypointense
Adrenocortical Carcinoma	Hypointense	Hyperintense
Renal Cell Cancer	Hypointense	Hyperintense
Renal Cyst	Hypointense	Hyperintense
Metastases	Hypointense	Hyperintense
Adrenal Myelolipoma	Hyperintense	Hypointense/Isointense
Cushing's Syndrome (adenoma)	Hypointense/Isointense	Hypointense

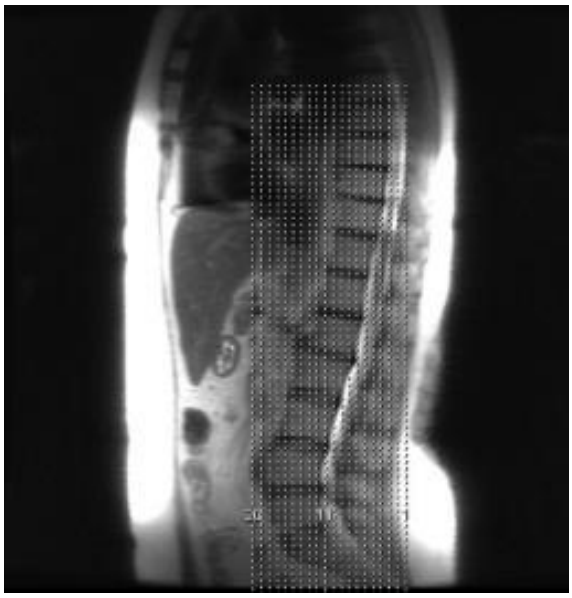
-MRI procedure:

-Patient position:

1. **Patient should be in supine-position (feet first), place the patient's arms over the head.**
2. **Set up the multi-channel coil and it should be covering the region from the diaphragm to iliac crest.**

- Scout slice placement:

1-Sagittal localizer for coronal slice.



-Slice Acquisition: anterior to posterior.

-Slice Alignment: parallel to spine.

-Anatomic Coverage: from diaphragm to the pubis.

demonstrates:

1-enlargement of the adrenal glands and/or kidneys.

2- lesions within the poles of the kidneys.

2-Coronal localizer for axial slice.

-Slice Acquisition: superior to inferior.

-Slice Alignment: straight; no angulation of slices is necessary.

-Anatomic Coverage: from diaphragm to iliac crest.

- demonstrates:

1-enlargement of the adrenal glands and/or kidneys.

2-encroachment of masses on renal collecting system.

•MRI Sequences:

1	T1WI (GRE)	Axial slices Slice thickness 3-5mm Useful :provides detailed information of the kidneys and surrounding structures.
2	T2WI (HASTE) (Half Fourier single-shot turbo spin-echo)	axial and coronal slices Slice thickness 3-5mm Useful :(Highlights differences in tissue water content, aiding in the identification of renal lesions, inflammation, and structural abnormalities.
3	DWI sequence	Axial slice thickness 3-5mm, Useful :measures the diffusion of water molecules in renal tissues and can assist in the evaluation of tissue cellularity and identifying renal lesions, including tumors).
4	Dyn-study+ con (GAD-based contrast)	Slice thickness 3-5mm, Useful :tumor enhancement characterization.

Which MRI finding is indicative of hepatocellular carcinoma (HCC؟(

A. Splenomegaly

B. Portal vein thrombosis

C. Hyperintense lesion on T1-weighted images

D. Hypointense lesion on T2-weighted images