Al-Mustaqbal University
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Radiological Techniques Department

Magnetic Resonance Imaging

First Semester

Lecture 28 : MRA AND MRV

By

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Introduction :

MRA and MRV stands for **magnetic resonance angiography and magnetic resonance venography**, respectively. Both are non-invasive imaging techniques that use a strong magnetic field and radio waves to produce detailed images of **blood vessels.**

Scientific Content:

-Magnetic resonance angiography is an alternative to conventional angiography and CT angiography, eliminating the need for ionizing radiation and iodinated contrast media.

- Indications: -

1-Arterial aneurysm.

2-Arteriovenous malformation.

3-Aortic dissection.

4-Cerebral stroke.

5-Carotid artery disease.

6-Peripheral (extremity) atherosclerosis.

7-Congenital heart disease.

-MRA has evolved into several techniques and these include:

1-contrast-enhanced MR angiography (MRA).

2- non-contrast enhanced MR angiography (MRA).

1- Contrast-enhanced MR angiography (MRA) is a technique involving 3D spoiled gradient-echo (GE) sequences, with the administration of gadolinium-based contrast agents (GBCA). It can be used to assess vascular structures of almost any part of the body. Its key features are:

- T1 weighted spoiled gradient-echo sequence (flip angle 25-50° allows T1-weighting).

- use of GBCAs to shorten T1 interval of the blood which appears bright as a result.

2- Non-contrast-enhanced MR angiography is a type of MR angiography that does not use gadolinium contrast to image the blood vessels, unlike the contrast enhanced MR angiography.

- Technique (non-contrast enhanced MRA): The earliest method that is **used to image the blood vessels is by exploiting the inflow effect of the blood**, also known as **"time-of-flight" (TOF).**

The inflow effect is due to differential exposure of the stationary tissue and inflowing blood to radiofrequency (RF) excitations.

Stationary tissue is repeatedly exposed to RF pulse, thus causing its longitudinal magnetization to reach approximately zero (Mz=0), **producing no signal.** Meanwhile, inflowing blood are not exposed to RF pulse, causing it to express full longitudinal magnetization of (Mz=1), **thus producing detectable signal**. The signal intensity of the flowing blood depends on **blood velocity, repetition time (TR), and cross-sectional area of the blood vessel. The faster the blood velocity relative to the TR, the higher the signal of the blood.**

-MRV: Magnetic resonance venography is an imaging test that is used to visualize veins in the body.

-Technique:

1-Time-of-flight (TOF) MRV: The main **advantages** are sensitivity to slow flow, and no need for contrast media, as well as relatively rapid acquisition time.

2- Phase-contrast MRV: The technique offers excellent contrast compared to background signal, and can determine the direction of flow.

3-Contrast-enhanced MRV: The main benefits are relatively short acquisition time and absent artifacts caused by e.g. background signal.