

## TOPIC – FMRI I SEMESTER MSC ZOOLOGÝ MIDHIL& MOH&N Assistant Professor on contract

## fMRI

## FUNCTIONAL MAGNETIC RESONANCE IMAGING(fMRI)

f MRI is based on the increase in blood flow to the local vasculature that accompanies neural activity in the brain. This result in a corresponding local reduction in deoxyhemoglobin, because the increase in blood flow occurs without a increase of similar magnitude in oxygen extraction. Since deoxyhemoglobin is paramagnetic, it alters T2 weighted magnetic resonance image signal. Thus, deoxyhemoglobin is sometimes referred to as a endogenous contrast enhancing agent, and serves as the source of the signal for fMRI. Using a appropriate imaging sequence, human cortical functions can be observed without the use of exogenous contrast enhancing agents on a clinical strength( 1.5T)scanner.

Functional activity of the brain determined from the magnetic resonance signal has confirmed know anatomically distinct processing areas in the visual cortex, the motor cortex ad Broca's area of speech ad languagerelated activities.

The recent discovery that magnetic resonance imaging can be used to map changes in brain hemodynamics that correspond to mental operations extends traditional anatomical imaging to include maps of human brain function . *The ability of observe both the structures and also which structures participate in specific functions is due to a new technique called functional magnetic resonance imaging Fmri*, and provides high resolution , noninvasive reports of neural activity detected by a blood oxygen level dependent .

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This new ability to directly observe brain function opens a array of new opportunities to advance our understanding of brain organization, as well as a potential new standard for assessing neurological status ad neurosurgical risk.

fMRI is a relatively new procedure that uses MR imaging to measure the tiny metabolic changes that take place in active part of the brain.

f MRI is becoming the diagnostic method of choice for learning how a normal, diseased or injured brain is working , as well as for assessing the potential risk of surgery or other invasive treatments of the brain.

f MRI is performed the following cases:

 $\checkmark$  to examine the anatomy of the brain.

- To determine precisely which part of the brain is handling critical functions such as thought, speech, movement ad sensation, which is called brain mapping.
- To help assess the effects of stroke , trauma or degenerative disease (such as Alzheimer's )on brain function.
- $\checkmark$  To monitor the growth and function of brain tumors.
- To guide the planning of surgery , radiation therapy , or other surgical treatments of the brain.

## PROCEDURE OF f MRI

- For f MRI, the head of the patient may be placed in a brace ,designed to help hold it still. This brace may include a mask that is created especially for the patient. He /she may be give special googles and/ or earphones to wear, so that audio – visual stimuli (eg a protection from a computer screen or recorded sounds) may be administrated during the scan.
- If a contrast material will be used in the MRI exam, a nurse or technologist will insert a intravenous (IV) line into vein in your hand or arm. A saline solution will drip through the IV to prevent blockage of the I V line until the contrast material is injected.
- The patient moved into the magnet of the MRI unit and the radiologist and technologist will leave the room util the contrast material is indicted

During a MRI examination, the patient performs a particular task during the imaging process, causing increased metabolic activity in the area of the brain responsible for the task. This activity, which includes expanding blood vessels, chemical changes and the delivery of extra oxygen, can then be recorded on MRI images.

It may include number of small tasks, such as tapping the thumb against each of the fingers on the same hand, rubbing a block of sand paper, or answering simple against each of the fingers o the same hand, rubbing a block of sand papers, or answering simple questions when the examination is completed, he/ she may be asked to wait until the technologist or radiologist checks the images in case additional images are needed. The intravenous line is removed. The main advantages to fMRI as a technique to image brain activity related to a specific task or sensory process include:

- > The signal does not require injections of radioactive isotopes.
- The total scan time required can be very short, ie, on the order of 1.5 to 2.0 min per run (depending on the paradigm), and
- The in-plane resolution of the functional image is generally about 1.5 \*
  1.5 mm although resolutions less than 1 mm are responsible.
- To put these advantages in perspective ,functional images obtained by the earlier method of positron emission tomography, PET ,require injections of radioactive isotopes, multiple acquisitions, and , therefore, extended imaging times. Further ,the expected resolution

 Additionally, PET usually requires that multiple individual brain images are combined in order to obtain a reliable signal. Consequently, information on a signal patient is compromised and limited to a finite number of imaging sessions. Although these limitations may serve many neuroscience applications, they are ot optimally.

- ✓ LIMITATIONS OF fMRI OF THE BRAIN
- ✓ High -quality images are assured only if one is able to remain perfectly still or hold the breath, if requested to do so, while images are being recorded. If one is anxious, confused or in severe pain, it may be difficult for the patient to lie still during imaging.
- ✓ A person who is very large may not fit into the opening of a conventional MRI machine.
- The presence of an implant or other metallic object sometimes makes it difficult to obtain clear images and patient movement can have the same effect.

- fMRI generally is not recommended for patients who have been acutely injured , however ,this is a clinical judgement .This is because traction devices ad many types of life support equipment must be kept away from the area to be imaged. Furthermore, the examinations takes longer than other imaging modalities (typically x-ray and CT) and the results may not be immediately available as is often necessary in trauma situations.
- Although there is no reason to believe that magnetic resonance imaging harms the fetus, pregnant women usually are advised not to have an MRI exam unless medically necessary.
- MRI typically costs more and may take more time to perform than other imaging modalities.