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I.D = 16766

Discipline = BS (RAD) 5th Semester

Mid term Exam

paper = Magnetic Resonance imaging (MRI)

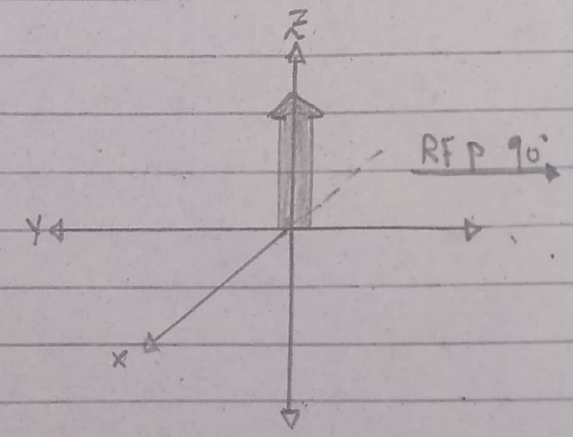
Q1:- How protons do helps in MR imaging:
under normal circumstances, these hydrogen proton "bar magnets" spin in the body with their axes randomly aligned. When the body is placed in a strong magnetic field, such as an MRI scanner the protons' axes all line up.
This uniform alignment creates a magnetic vector oriented along the axis of the MRI Scanner.

Q2:- Differentiate between longitudinal and transverse magnetization?

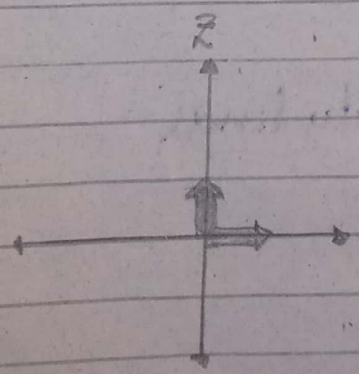
When protons align parallel and Anti parallel to external magnetic Field Along positive and negative sides of Z-axis. Force of proton on negative and positive side cancel each other. However, there are always more protons spinning on the positive side or parallel to Z-axis than negative side so after canceling each other few protons remain on positive side, which are not cancelled. Forces of these protons add up together to form a magnetic vector along Z-axis. This is **Longitudinal magnetization**. longitudinal magnetization along external magnetic Field cannot be measured directly. Because this is maximum magnetic Field. For measurement it has to be transverse.

Transverse magnetization

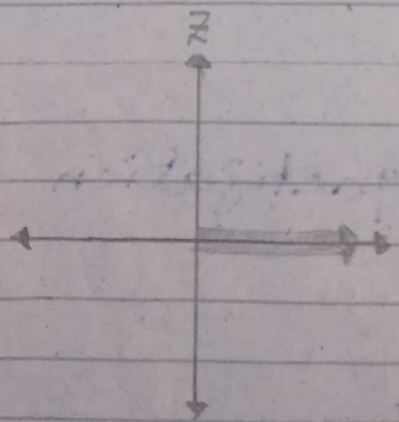
When patient is placed in the magnet longitudinal magnetization vector Form along Z-axis and in the long axis of the patient. At this stage radiofrequency puls is sent. precessing protons pick up some energy From radiofrequency pulse. some of these protons go to higher energy level and start precessing Anti-parallel. This results in reduction in the magnitude of longitudinal magnetization. Force of protons now add up to Form a new magnetic vector in transverse (x-y) plane.
This is called **Transverse magnetization**.



LM



LM Decresing
TM increasing



TM Formated
No LM component

23. Describe four basic steps of MR imaging?

Four basic steps

1. Placing the patient in the magnet.
2. Sending radiofrequency (RF) pulse by coil.
3. Receiving signals from the patient again by coil.
4. signals are sent to computer for complex processing to get image.

24. Write a note on gradient Fields?

To localize from where in the body signals are coming three more magnetic fields are superimposed on main magnetic Field along X, Y, Z and Z axes These magnetic Fields have different strength in varying location hence these Fields are called "gradient Fields" or simply gradient.

The three gradients are
1. Slice selection gradient
2. Phase encoding gradient
3. Frequency encoding gradient.

25. Write the typical values of long and short TR/TE in spin-echo sequence and Gradient-echo sequence?

Spine-echo Sequence

Spin-echo sequence consists of 90 degree pulse followed by 180 degree puls. at the end of which echo (signal) is received.

TR (Time to Repeat) is the time interval between start of one RF pulse and start of next RF pulse.
Typically in spin-echo sequance time interval between beginnings of 90 degree pules is TR.

TE (Time to Echo) is the time interval between start of RF pulse and reception of the echo (signal)

Short TR and short TE gives = T_1-weighted image
Long TR and long TE gives = T_2-weighted image
Long TR and short TE gives: proton density image.

~~Typically long TR~~

Spine-echo sequence		Gradient-echo sequence.
Short TR	300 - 800	> 50
Long TR	> 2000	> 100
Short TE	10 to 25	1 to 5
Long TE	> 60	> 10

Q6:- Define the following terms

a) TR

b) TE

c) Transverse relaxation

d) Longitudinal relaxation

e) T_1 weighted image (on the basis of TR and TE

f) T_2 weighted image (on the basis of TR and TE)

g) proton density image (on the basis of TR and TE

TR

Start to one RF pulse to start from next RF is called TR

OR

TR is the time interval between start of one RF to start of next RF is called TR (RF puls present 90 to 180.

TE

TE (Time to Echo) is the time interval between start of RF pulse and reception of echo (signal)

T_1 weighted image

short TR and short TE

T_2 weighted image

long TR and long TE

Proton density image

long TR and short TE

Transverse relaxation

Reduction in the magnetiude of Transverse magnetization is calle Transverse relaxtion.

Longitudnal relaxation

The Time taken by longitudnal magnetization to recover its orignal value RF is switch off is called longitudnal relaxtion.