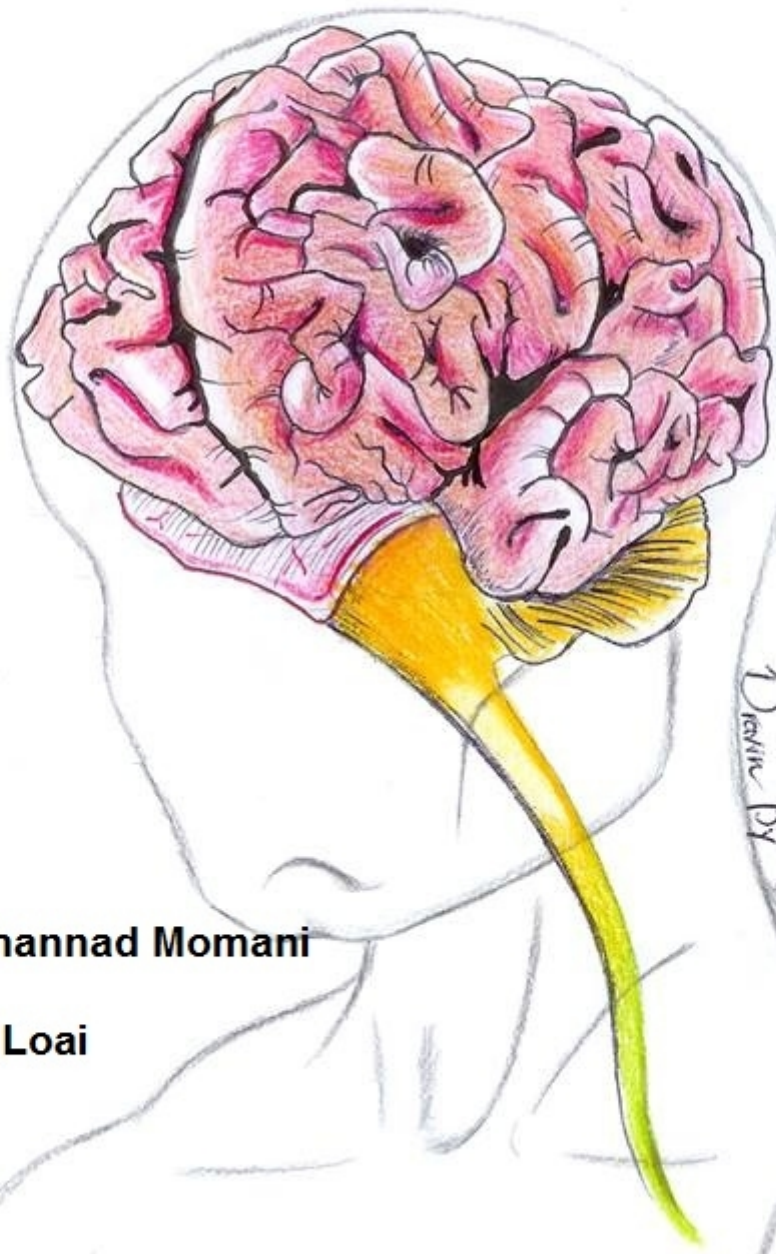


CENTRAL NERVOUS SYSTEM

- Handout
- Sheet
- Slide

- Anatomy
- Physiology
- Pathology
- Biochemistry
- Microbiology
- Pharmacology
- PBL



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Lec #: **19**



Parietal lobe lesions

This sheet was done according to sec2 and last year recording

I've rearranged a lot of stuff here and there, I also added some info from wiki for further clarification because believe it or not writing this sheet was a struggle

It's has interesting topics so you might as well enjoy studying it.

Before we begin here is some random information that is needed to understand some of the principals in this lecture.

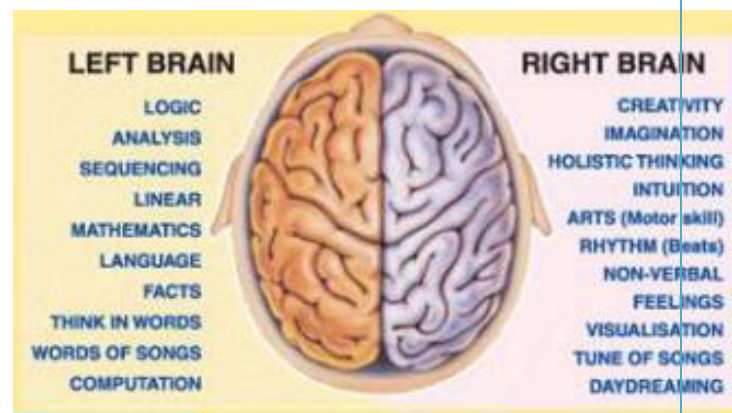
The sensory control of the right and left parietal lobe is contralateral.

As shown in this figure the right and left parietal lobe have different functions,

But to be more accurate, there is a dominant lobe and a less dominant lobe for each function, that's why in

physical therapy a patient with lesion in one of them will regain some of the lost abilities

Regarding ipsilateral sensory information, the ipsilateral dominant lobe will send information to the other contralateral lobe and help it with the processing, this is going to be discussed later but keep it in mind.



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#right parietal lobe lesions

◆Medial occipitotemporal gyrus (in the middle part)

Also called Fusiform gyrus, it is linked to various neurological phenomena In the following section we're going to talk about prosopagnosia and its related disorders.

•Prosopagnosia;

Also called **face blindness**, is a cognitive disorder of face perception where the ability to recognize familiar faces, including one's own face (self-recognition), is impaired, while other aspects of visual processing (e.g., object discrimination) and intellectual functioning (e.g., decision making) remain intact. Uni or bi lateral lesion can cause this condition but with different severities

Capgras Delusion, is the irrational belief that a familiar person or place has been replaced with an exact duplicate. So the patient will know and recognize his wife but he will never admit that she is related to him! She is just an alien or a CIA agent to him; that is taught to act and talk like his wife.

The patient can even suspect his own house with an alternative; from another planet!

He may be misdiagnosed with schizophrenia. So in the future keep this disorder in mind before referring him to the psychiatric department.





What happens normally is; after visual information is received

- 1) it goes to area 18 & 19 to be recognized
- 2) then continues to the rest of the brain (the subconscious part, the unconscious part also to the limbic system) for further processing,

In those patients the 2nd stage is interrupted due to a lesion in the pathway or a stroke.

Seeing your girlfriend for example is nothing but a mixture of information in the brain that links her face with the conscious part to tell you her name and the unconscious part which makes you feel happy. In those people as we previously said the feeling part is gone thus the information regarding her is not complete.

Capgras Delusion differs than **prosopagnosia** that the deficiency here is in the unconscious part of the processing. On the other hand, in prosopagnosia the problem is in the conscious part of the processing.

The prognosis for the disease is poor; they don't respond to any of psychiatric drugs, the only treatment is behavior treatment.



We already know that there are two pathways in visual processing:

1- Ventral pathway (or what pathway) which is involved in color, shape, and object recognition.

2- Dorsal pathway (or where pathway) which is involved in movement recognition and spatial relationships (direction). The pathway starts from the visual cortex up to the parietal lobe.

We are going to talk in this lecture about the “where” pathway and its related disorders.

But first, talking about its significance can play a role in appreciating its impact

- When someone asks you to go from the faculty of medicine to art faculty for example; you'll create a map in your brain to know exactly from where to start your way or from what street to walk till you reach your final destination and this is done by your cognitive map in the lingual gyrus.
- When you try to fill a cup of tea you are going to see the gradual filling of the cup until it's all filled.
- So its main function is to send information about motion s and our place in the environment...there are many other functions but the doctor only mentioned those.



We are going to discuss 3 important neurological phenomena regarding the “where pathway”

1) Akinetopsia

Seen in patients with lesions in the temporo-occipito-parieto-junction, motion perception is impaired. So if you have this lesion and were stupid enough to drive your car, while driving you can't see moving cars; you'll only see them when they stop. Accidents may happen and you will only see the crash, and the death of your beloveds.

The doctor is describing a woman trying to fill a cup of tea. She can't see the glass being filled; her perception is nothing but a static pictures for the glass, like flashcards. This condition happens in case of a unilateral lesion, bilateral lesion will make things way much worse.



2) Topographical agnosia ,

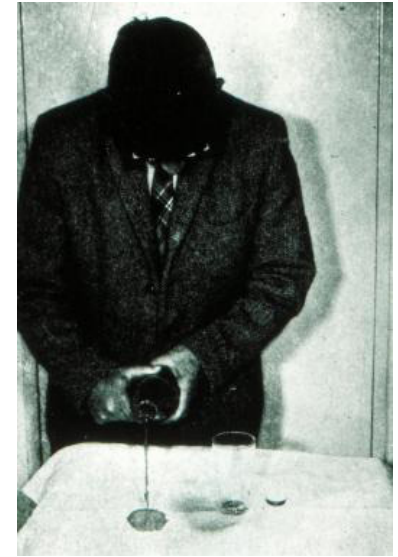
Is the inability to orient oneself in one's surroundings as a result of fusiform gyrus damage. This disability may result from the inability to make use of selective spatial information (e.g., environmental landmarks) or to orient by means of specific cognitive strategies such as the ability to form a mental representation of the environment, also known as a cognitive map. So you can't actually go from one faculty to the other as mentioned in the previous example.

If the lesion is a little bit bigger toward the parietal lobe this will lead to spatial relationship distortion



3) Spatial relationships distortion

If the lesion was large enough and made more damage in the right parietal, in addition to not knowing the maps of areas, the patient will not be able to draw the map of their own house (they will draw each room right but the relationships between rooms is distorted). And if the lesion was larger and more involved in the right parietal, when you ask them to assemble the structures of the body, they will do that as in the picture.



Let's talk a little bit about our parietal lobes' function in appreciating the environment around us,

Obviously we have 2 of them; right and left. About the function; they process and spot the sequence and relations of the received spatial information in our visual field, and since we have right and left; one can only assume that each one is responsible for the contralateral half of your visual field, but the truth must be said and such dreadful mistake shall not pass; because the ***right*** one is dominant and is the one responsible for both left and right halves of our visual field. On the other hand, the left one



plays a little role in processing the special information for the contralateral side.

If a damage happened to any of them a deficiency may occur regarding this function, making it impossible to focus and direct all your senses to specific stimuli or a specific objects . Of course with different severities depending of the site of the lesion, as we are going to talk in the next page when we talk about neglect syndrome.

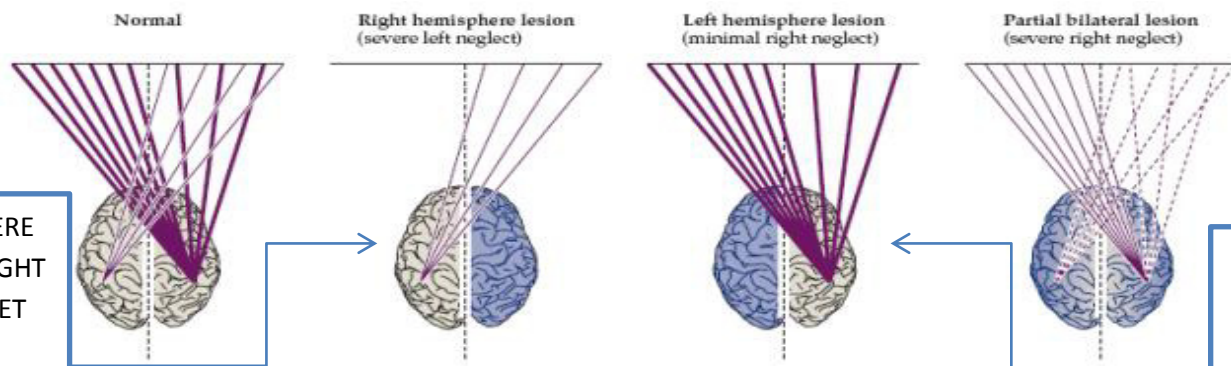
The doctor said that the right parietal lobe is the one which is responsible for understanding the sequence of the musical notes; do re mi...etc

•Neglect syndrome

From a lesion to the **RIGHT** superior posterior parietal lobe

A less severe case than **Spatial relationships distortion**

Is a neuropsychological condition in happens after a damage to one parietal lobe of the brain. A deficit in attention or awareness of one side of space is observed. It is defined by the inability of a person to process and perceive stimuli on one side of the body or environment



MOST SEVERE BECAUSE RIGHT IS DOMINANT

LEAST SEVERE BECAUSE RIGHT CAN COMPENSATE



The patient will be unable to direct his conscious, subconscious and the unconscious toward a specific object. He may neglect his left half of his own body and treat it as if it is a foreign body (discussed in the next page)

These are some of the findings observed when a patient was asked to read and draw what he sees

As you can see here the patient could only read the right side of the paragraph. <Well the first line doesn't count because it disapproves our diagnosis. >

The cat ran up the tree to catch a squirrel for his lunch. The squirrel was smart and ran out to the end of a thin branch. The branch broke, but the cat landed on his feet. No fat squirrel for lunch today. No sir!

A



B



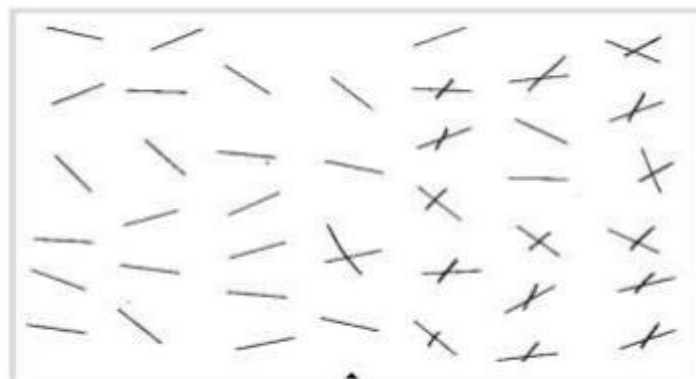
Model



Patient's copy

Also when asked to draw a clock he drew all number on one side, another manifestation that he only drew the right half of the clock only.

The patient of left neglect doesn't have any problem in vision and gets sensation of the left side normally, but doesn't care about anything there. If you ask the patient to cross the lines that he sees, he'll cross the ones on the right side only





If the lesion included more rostral areas in his parietal lobe (somatosensory & prefrontal gyrus) he may develop anosognosia.

• Anosognosia

Is a deficit of self-awareness, a condition in which a person who suffers some disability seems unaware of the existence of his or her disability-wiki

This patient shaves only the right side of his face, and even forgets his left hand! If the lesion enlarges more, it may impair the sensory and the motor in the left side and here the patient denies that these left limbs are his and denies that all the left side are parts of his body. For example the patient says “someone’s hand is attached on me!” Or in other cases the patients know that they have left limb but deny that they are impaired; for example if you ask a nosognosia patient that has left paralysis to lift up his left hand, he will tell you “I did” but indeed it wasn’t lift and if you try to convince him that it wasn’t lift as in front of a mirror, he won’t believe that this deficit is his left hand.

If the lesion included more rostral areas in his parietal lobe (somatosensory & prefrontal gyrus) he may develop alien hand syndrome, and may chop off his limb because it is not his limbs according to his mentality.

With therapy left neglect syndrome can be improved and he may be able to focus on both halves but with less accuracy. Such condition may be improved thanks to cortical plasticity; the following picture shows the work of an artist that was recovering from left neglect syndrome





<**Alien hand syndrome (AHS)** is a rare neurological disorder that causes hand movement without the person being aware of what is happening or having control over the action. The afflicted person may sometimes reach for objects and manipulate them without wanting to do so, even to the point of having to use the controllable hand to restrain the alien hand.>- wiki

#**Left parietal lobe** lesion will cause

• **Acalculia;**

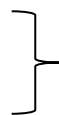
The relation between numbers and digits will be impaired; he will only be able to do simple mathematical tasks like $7-3$ or $6*8$ but not $106-89$ or $22*79$ because it requires spatial processing (which is borrowing). It's not the problem of numbers or memory because these are in the ventral stream and temporal lobe; it's just the problem of spatial processing here in the parietal lobe.

• **Language problems;**

Understanding the sequence of letters into words are done first by receiving those letters from the auditory cortex to the parietal lobe for processing. So you can be able to differentiate between "cat" & "can", people with posterior left parietal lesion will suffer from language problems regarding the previous point.

• **Agraphia**

• **Apraxia**



Discussed in the next page



According to the book "Language has many of the same demands as arithmetic. The words "tap" and "pat" have the same letters, but the spatial organization is different. Similarly, the phrases "my son's wife" and "my wife's son" have identical words but very different meanings. Patients such as H. P. may have a clear understanding of individual elements, but they are unable to understand the whole when the syntax (the arrangement of words and phrases to create well-formed sentences in a language) becomes important."

Now one of the functions of the left posterior parietal lobe is not only processing the letters but also sending them to the prefrontal and the premotor cortex,

So when a musician plays the guitar and hits the "do re mi fa..." notes; information will be formed from the posterior parietal up to the pre frontal & premotor cortex, in order to play those notes.



Same applies in writing or initiating any skilled movement; that's why a lesion in the left posterior parietal lobe will cause Apraxia and Agraphia

End of the sheet el7amdolleah

Done by Mohammed Momani

Dedicated to Issa M Khashant, Tareq Halaseh, Mustafa Al-Mollah

And a special thanks goes to Mazen Hindi for giving me his laptop to write this

