



CNS

Physiology



Sheet



Slide

Number

8

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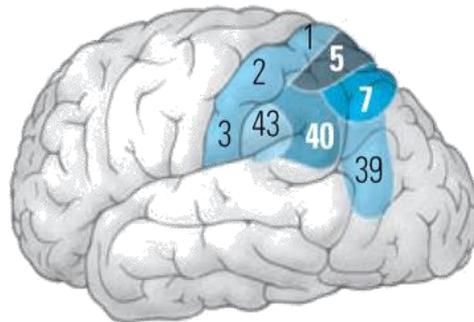
Doctor:

Loai Alzghoul

In this lecture we will talk about another area which is the posterior parietal association areas.

Posterior Parietal Association Area

It's one of the most important association areas which collects multi-sensation together to give one information.



➤ Location

Just posterior to the primary and secondary somatosensory cortices (area 3, 1 & 2) in the parietal lobe.

➤ Function

The main function is “the relations and the sequence of actions”. For example: number 3 is smaller than 5 and the difference between them is two steps, and number 5 is smaller than 9 and the difference between them is four steps... so the posterior parietal association area which is responsible about this sequence of numbers and the relations between them.

Now, let's go in more details about this area

The posterior parietal association area exists on the right and the left cerebral hemisphere, and as the rest of the brain, the sequence and relations on the (right cerebral hemisphere) are more about music, art, spatial relationships, 3D position and location, while the more discrete type of sequence which is mainly on the (left cerebral hemisphere) is more about analysis and math.

So, the right visual field goes to the left cortex and processed (identification and movement in where pathway in the right cortex, and relationship in the left cortex) then go to be stored

in the right cortex, so it found in both brain sides. On the other hand, the left visual field goes to the right cortex and processed (identification and movement in the right cortex) and stay at the right, so it only represented there.

And therefore, the spatial relationship is important in the vision because processing and memory happened together in the right hemisphere and any lesion in the right hemisphere will disrupt mainly the left side of the visual field and this is what we called **neglect syndrome**, while left hemisphere lesion will not have deficit in symptoms.

➤ **Hemineglect syndrome (lesion in right parietal association cortex)**

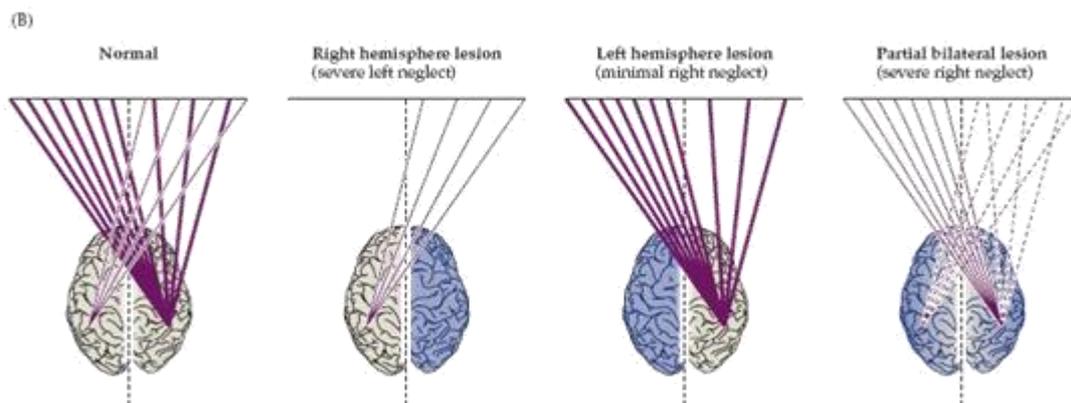
Results from a unilateral parietal lobe lesion; neglect of one-half of the body or environment. Neglect is most prominent after damage to the right hemisphere of the human brain, causing a patient with neglect to behave as if the left side of sensory space is non-existent (although they can still turn left), patients will have no visual field deficits, so they can see which differ from **anopia** (is hemianopic visual field loss on the same side of one eye or both eyes).

Neglect not only affects present sensation but memory and recall perception as well. For example: If asked the patient to draw a clock face from memory, they will draw only the numbers 12 to 6, or all 12 numbers might be on the right side. And they might only apply make-up to the non-neglected side... or like the artist who draw only his half face although he knows that he had a complete face, but he focused on the right half and neglect the left half and even with treatment the left half still has a minimal neglect.



In some severe cases, the lesion extends more anteriorly to damage the somatosensory cortex, so the patient doesn't only neglect his left visual hemifield but also cannot feel his left side, so he will notice sometimes that there is a limb attached to his left side which he cannot feel and the patient might attend to cut the alien limb since he doesn't feel it as a part of his body, this is what we called (**alien limb syndrome**).

And the lesion may extend to damage the motor area, so patients may also deny their deficit, and this is **an anosognosia**.



Watch this part (1.48 - 2.12) from the video and notice that the patient neglect the left side and he is only focus on the right side ...

<https://www.youtube.com/watch?v=d4FhZs-m7hA>

- The posterior parietal association area including area 5 & 7 which is responsible for spatial orientation, so any lesion there (especially the area of the end of where pathway) will cause **visuospatial dysgnosia**, the association of movement with position, navigation and 3D dimensions will be lost, and the most common syndrome of it is **Topographagnosia**, and these patients are unable to identify specific buildings, such as their own house and famous landmarks. Can be caused by right ventral temporo-occipital lesions (damage the identification in the what pathway) like Right lingual gyrus. Also, right retrosplenial region lesions may cause Topographagnosia (lesion in the connection between what & where pathways). For example: if you ask them to identify where is the kitchen or the bedroom in their house, they will not know.

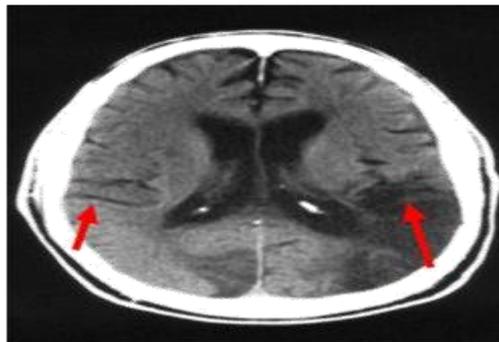
Now, let's talk about the lesions in the left parietal lobe.

We said that the sequence and relations on the left cerebral hemisphere is more about analysis, motor and math. Also, it involves language.

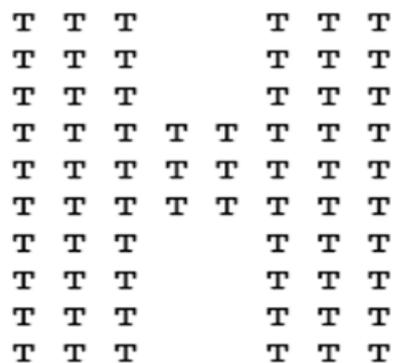
A lesion to the left parietal lobe will cause:

- **Acalculia:** loss of the ability to perform simple calculations.
- **Language problems**
- **Agraphia:** a loss in the ability to communicate through writing.
- **Apraxia:** difficulty with the motor planning to perform tasks or movements when asked.

In some disorders, Damage to the parietal cortex will be bilaterally which is called **Bilateral Parietal Damage (Balint's Syndrome)**, these patients have small deficit on the right and the left so they don't have neglect or complete apraxia, but they will have three main symptoms which are:



- **Simultanagnosia:** Inability to interpret the totality of a picture scene (can identify individual portions of the whole picture, like the picture on the left below, he will not be able to see the big H or the small T, so he will see only one of these two letters, or he will be able to see only one event from the picture on the right).



Watch this part (5.23 – 6.50) from the video and notice what the patient told the doctor in every time the doctor asked him and the movement of patient's hand to catch the object...

<https://www.youtube.com/watch?v=nZ-kKIBZN8w>

- **Optic ataxia:** (incomplete ataxia) Defects of visually guided hand movement since the parietal eye field (responsible for the movement guided by vision) is damaged, can happen in one side depending on the lesion, the patient will have problems reaching for stuff in front of him.
- **Oculomotor apraxia:** the inability to do voluntarily guided eye movements, changing to a new location of visual fixation. The rapid eye movements are abnormal. Because of this, most patients with Oculomotor apraxia have to turn their heads in order to follow objects coming from their peripherals.

NOTES about Area 5 & 7:

1- Area 5 & 7 receive information from vision (in where & what pathway), so this area needs to be familiar with conscious and unconscious way of the movement of the eye.

*The pathway which will go to the superior colliculus area, will go to area 5 & 7 and this is what will help in the eye movements.

*the superior colliculus area explains the presence of the blind area.

for more understanding about this point, watch vision videos on the eLearning website.

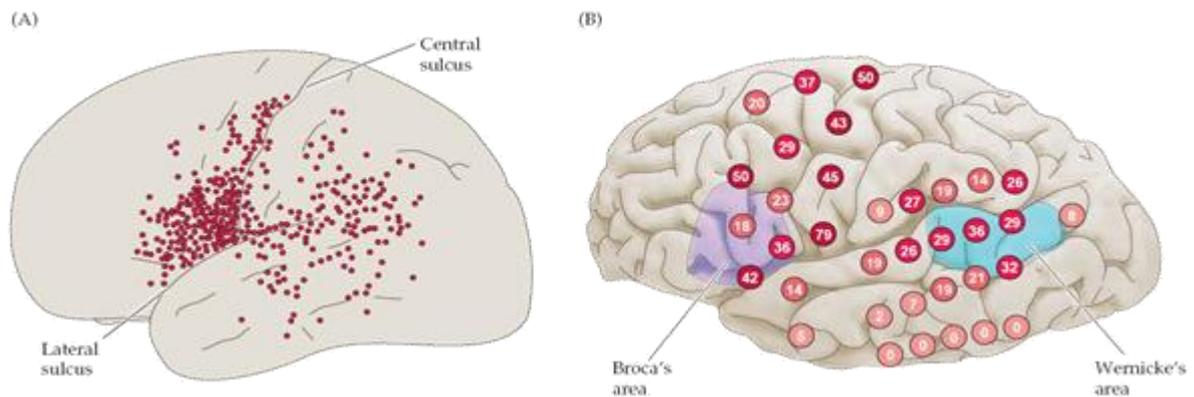
2- Vestibular system go to Area 5 & 7 to coordinate the movements.

* Vestibular system is the only system has not primary and secondary sensory cortices.

Let's talk in more details about the Language

Also, the posterior parietal association area involved the language which is one of most complex behaviors of ours.

That's why around 120 areas of the cortex are involved in its receiving, understanding, and production, and the most of these areas distributed in the frontal and posterior parietal lobe (tempo-parietal region).



Language divided into **understanding and production**.

The Receiving and understanding of language involved in activation of sensory modalities like vision or auditory, receive input and process it to letters, process this information to words and maybe interpret some meanings or to understand what is said or written.

The Production of language is concerned with motor orders to tongue, lips, and vocal cords to produce spoken language. It also sends motor orders to facial muscles to produce expressions and to the hands to produce sign language and written language.

If the lesion is in the association areas of language, the patient is able to move their tongue, lips, and vocal cord, and do complex movements with them to produce all the letters since primary and secondary motor areas are intact (**NO paralysis, NO apraxia**), yet the patient is unable to produce proper and clear language and this case is called **aphasia**.

So, a lesion in the area of language production results in Broca's aphasia or expressive aphasia.

And The first well-known case of stroke in the association area of language production was a one of Dr. Broca's patients, this patient lost

almost the whole area after a stroke and lived 15-20 years with the only sound being able to produce is “tan”, and he was unable to learn any word again, and can’t learn sign language as well.

This lesion includes **the Association area of language production (pars opercularis and pars triangularis /Brodmann’s areas 44 and 45) and commonly which is called Broca’s area.**

Finally, watch this video...

<https://www.youtube.com/watch?v=1apITvEQ6ew>

Sarah was in an English class reading out loudly when she suddenly felt tingling in the right upper and lower limb and became unable to read. In the hospital they discovered that she had a stroke in the area of language production (Broca’s).

Since the area of language understanding is intact, Sarah is able to understand what she and other people say, that’s why when she mispronounced her name as “Scott” she realized she said it wrong and then corrected it to “Sarah Scott”.

When asked about her age, the only answer Sarah had is “I can’t”, she couldn’t say it so she tried to write it instead, but again she couldn’t. Even though she knows that her age is 19, she’s still unable to express it. With stroke in Broca’s area, Sarah became completely unable to express somethings (including her age), that’s why even after the doctor told her that she’s 19, Sarah only replied with “yeah”.

THE END

*Don't wait for the PERFECT moment. Take the
moment and make it PERFECT...*