

Cortical Thickness in Pre Central and Post Central Human Brain Cortex of Patient with Headache: MRI finding

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Abstract

It is new clear that the brain of the headache sufferers are different from those of people without headache, the imaging study showed thickening in specific area of brain related to communication of sensory processing called somatosensory cortex (post central region) in this study we examine 36 patient, 28 of them have headache of variable duration, 8 healthy patient used as control (i.e. has no headache). The result has found that the cortex area of brain is thicker in pre central and post central cortex, especially predominant in post central cortex and this thickening is increasing with duration of headache and not related to the age of patient, the explanation of these structural changes will be discussed in this study.

Keywords: Headache, Migraine, Cerebral Cortex, Sensory Neurons, Motor Neurons, MRI.

Introduction

From anatomical point of view the pre central gyrus lies immediately anterior to the central sulcus and is known as the motor area. Large motor nerve cells in this area control voluntary movement on the opposite side of the body. In motor area the body represented in an inverted position that the feet located in the upper part and those controlling the movement of face and hand in the lower part. The post central gyrus lies immediately posterior to the central sulcus, and is known as sensory area. The small nerve cell in this area receive the interpret sensation, temperature, touch and pressure from opposite side of body⁽¹⁾. The motor area is region from which most of cortico spinal and cortico nuclear nerve fiber arise, and the region where low intensity stimulation most readily elicits movements of contra lateral side of the body. Sensory area is the region to which the impulse ascending in the medial lemniscus and spino thalamic tracts are transmitted⁽²⁾.

Headache is very widespread disease, and according to the WHO, we have 243 types of headache, one of the most common this disorder of the nervous system. Migraine affects 15-45 of women and 6-8 man⁽³⁻⁶⁾. The path physiology of migraine is not yet fully understood, and the available treatment and cure attach are not optimal. Migraine patient have visual symptom in 94% of cases⁽⁷⁾, but symptom may involve sensory and speech deficits⁽⁸⁾.

Recently two published article reporting cortical thickness differences in migraine sufferers^(9 and 10). In the first paper⁽⁹⁾ we examined the visual areas involved in motion processing were thickened in migraineurs. The second article⁽¹⁰⁾ reported increase thickness in somatosensory cortex of migraineurs, especially in the area the head and face representation. What do these cortical thickness increase mean and what are the potential implication, indeed be explain in several ways which are discussed later.

In 2007 researcher have identified specific differences in brain of migraine sufferers linked to the processing of sensory information including pain. In earlier research Harvard medical school investigator used MRI to show structural differences between brain of people with and without migraine, specially the imaging showed thickening in a specific area of the brain

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related to communication of sensory processing called somatosensory cortex. It is not clear if migraine cause the brain changes or if the brain differences causes migraine. Researcher Nouchin Hadjikhani that is the big question she says “A person could be born with these cortical differences making them susceptible to migraines, later in life, but we just don’t know”.

In newly reported imaging study researcher compared the brain of 24 people with migraine and 12 people withoutmigraine. they found that somatosensory was an average of 21% thicker in migraine sufferer. The thickness changes were especially pronounced in the part related to sensation of head and face⁽¹¹⁾.

Patient and Method

28 Patient s have headache of variable duration undergo CT scan of brain in radiology department college of medical Al-Nahrain university were matched for age and sex with 8 healthy subjects(without headache). In all these patients measure the thickness of pre central and post central cortical thickness in millimeter and pre central and post central gyrus.

Result

36 patients, 28 patients with headache and 8 patients without headache, 17 patient’sfemales with headache and 11 patient’smales with headache. Average age of patients [17- 66] years and duration of headache from one to ten years. The results were summarized in table⁽¹⁻⁴⁾.

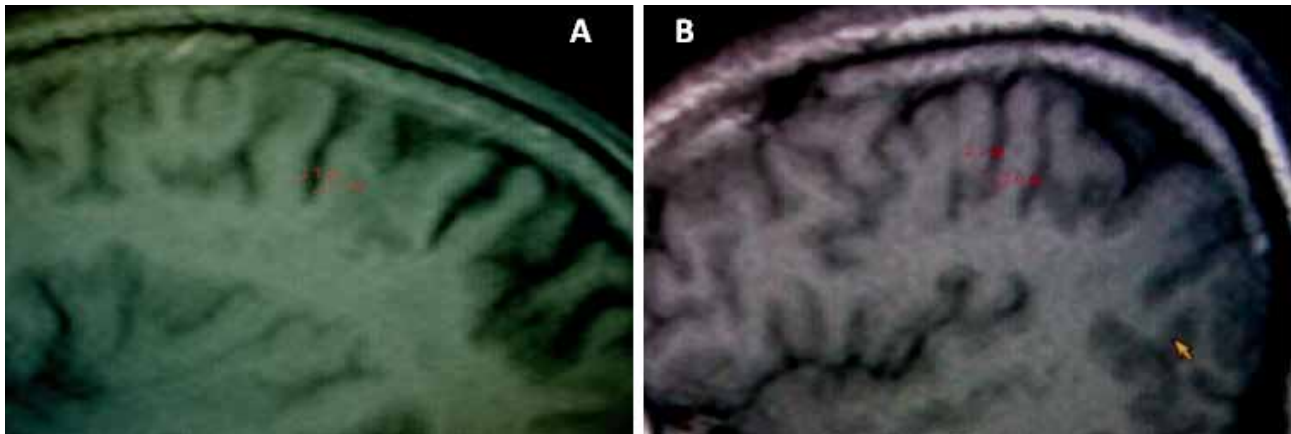


Fig. 1: MRI of normal person, age 40-44years, has no headache showing normal pre central and post central cortical thickness.

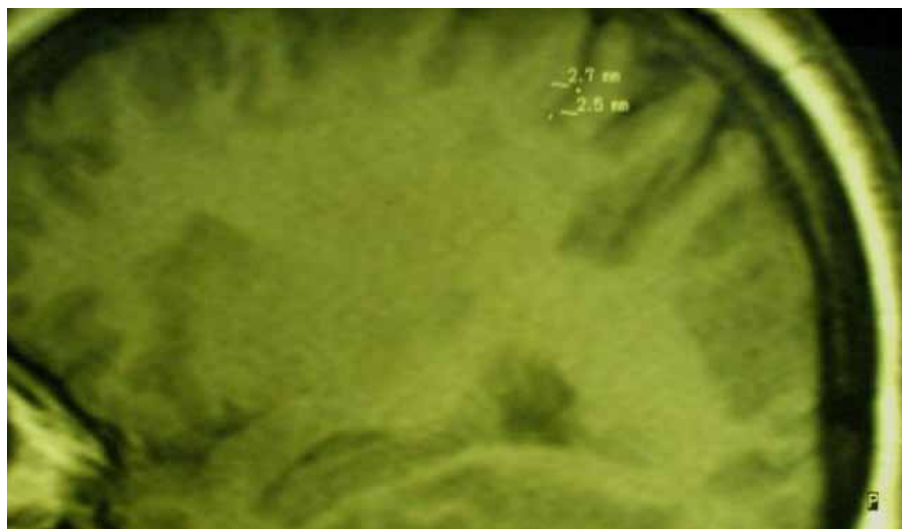


Fig. 2: MRI of patient age 46 year has headache of one-year duration showing slight increasing cortical thickness of pre central and post central cortical area.

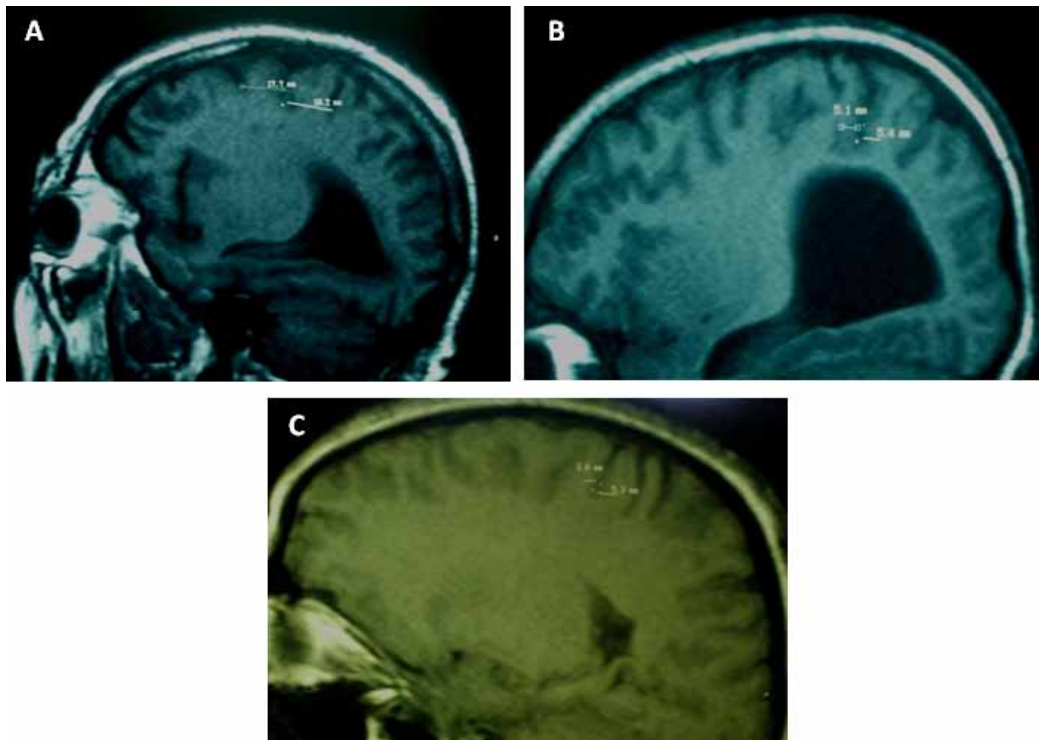


Fig. 3: MRI of patient, (A); Age 64 years has headache of 4-year duration showing increasing thickness of pre central and post central gyrus). (B); Age 17 years has headache of 5 years duration showing increasing thickness of pre central and post central cortical region). (C); Age 26 years has headache of 10 years duration showing increasing thickness in pre central and post central cortical regions).

Table [1]: Patients with headache.

Thickness of post-central gyrus (mm)	Thickness of pre-central gyrus (mm)	Thickness of post-central GM (mm)	Thickness of pre-central GM (mm)	Duration of headache (years)	Age of patient (years)	No. of patient
15	12	3.6	3.2	3	47	1
21	16	2.8	2.5	1	46	2
15	17	3	2	2	20	3
24	19	2.4	2.8	2	40	4
19	16	3	3.4	4	22	5
16	20	2.9	2.6	3	37	6
19	13	5.4	5.1	5	17	7
15	11	2.6	2.4	1	28	8
22	13.6	4.2	3	6	62	9
19	16	5.3	3.6	10	26	10
19.2	17.7	2.9	2.6	4	64	11
19	17	2.5	2.4	2	66	12
18	13	4.2	3.6	4	49	13
13	10	2.8	2.5	1	14	14
20	17.1	3.3	2.8	3	53	15
17.3	14	3.5	3	3	20	16
17	12	4.2	3.7	4	20	17

Thickness of post-central gyrus (mm)	Thickness of pre-central gyrus (mm)	Thickness of post-central GM (mm)	Thickness of pre-central GM (mm)	Duration of headache (years)	Age of patient (years)	No. of patient
16	14	3.5	3.2	2	17	18
13	16	3.6	2.5	1	54	19
17	13	3.3	3.1	2	22	20
13	14	2.8	2.4	1	53	21
17	18	3.5	3.4	2	33	22
16.3	13	3.2	3.7	3	25	23
16	11.5	2.3	3.2	2	61	24
19	14.1	4.4	4.2	5	43	25
15	12.1	3.7	3.3	3	45	26
14	12	2.6	2.5	2	32	27
17.3	15	3.6	3.5	4	43	28

Table [2]: Normal person (without headache).

post-central gyrus (mm)	pre-central gyrus (mm)	post-central GM (mm)	pre-central GM (mm)	Age (years)	No. of patient
13	12	1.8	2.2	54	1
12.7	13.2	2.3	2.6	32	2
13.2	11.1	2.5	3	55	3
11.6	13	2.4	2.6	43	4
11.3	12.4	2.2	2.7	40	5
12.2	10.9	2.6	2.5	46	6
10.1	11.5	2.3	2.2	44	7
13.2	12.8	2.2	2.4	51	8

Table [3]: Patient with headache and normal patient.

	Pre central cortical thickness mm.	Pre central gyrus mm.	Post central cortical thickness mm.	Post central gyrus mm.
Normal (without headache)	2.2 - 3.0	10.9 - 13.2	1.8 - 2.6	10.1 - 13.2
With headache	2.0 - 5.1	11.0 - 20.0	2.4 - 5.4	13.0 - 24.0

Table [4]: Duration of headache.

Duration of headache(year)	Pre central cortical thickness mm.	Pre central gyrus mm.	Post central cortical thickness mm.	Post central gyrus mm.
One year	2.4 - 2.5	10.0 - 16.0	2.6 - 3.6	13.0 - 21.0
6 - 10 year	3.0 - 3.6	13.6 - 17.7	4.2 - 5.3	17.0 - 24.0

Conclusion

Patients with headache have pre central, post central cortical thickness, and pre central and post central gyrus more than normal patients. Fig. [1,2, and 3].

More specific post central cortical thickness and post central gyrus is more than pre central cortical thickness and gyrus, Fig. [3].

The pre central, postcentral, cortical thickness and gyrus is increased with duration of headache and not related to the age of patients. Table [1 and 4].

Discussion

Structural changes in migraineurs is unknown. diagnosis of migraine relies on patient history and finding different in brain of migraineurs might help to contribute the basic research aimed at better understanding the patho-physiology of migraine.

Headache is one of the man's most common affection the frequency of disabling headache is explain in part by rich nerve supply to head (including efferent nerve fibers from trigeminal, glossopharyngeal, vagus and upper three cervical nerve). And in part psychological implication of head pain, causing anxiety about even modest headache, head pain can be result of either intra or extra cranial disease in the distribution of any of above nerves⁽¹²⁾.

The first possible explanation is that migraineurs have brain structural differences compared with healthy people due to their genetic background⁽¹²⁻¹⁴⁾.

Anatomical changes underlying increases in cortical thickness may include an increase number and/or density of neuronal and/or glial cells in certain part of the cortex [fig. 1,3]. this focal dysplasia may render the cortex more excitable, one of the leading hypo theses in migraine patho physiology is indeed that the brain of migraineurs are hyper excitability⁽¹⁵⁻¹⁷⁾.

The hypo thesis of hyper excitable brain in migraine is supported by fact that preventing treatment using drugs likely to reduce the cortical excitability are beneficial in migraine with or without aura. independent from etiological nature of the cortical thickness increase in migraineurs, it is worth noting that the anatomical modification that we described were present both in migraine, substrate for these clinical entities⁽¹⁸⁾.

So, understanding the patho physiology of migraine is an essential step in design of drugs at preventing and treating migraine effectively⁽¹⁹⁾.

The result indicates that there is thickening of pre and post central cortex in patient with headache [fig. 1]. And from review of literature, at seem that the article concentrates on post central cortex and specifically on somatosensory area⁽¹²⁾, [table 1, fig. 2 and 3].

Dr. Hidjikhani and Collages⁽¹²⁾ said that there was

no difference in cortical thickness in pre central cortex in patient with headache. but in my research, there is changes in pre central cortex. And these changes can be explained according to the hypo thesis of rich nerve supply to head⁽¹¹⁾. And increase number and/or density of neuronal cells⁽¹⁶⁾ in addition to hyper excitable of brain in migraineurs patients.

US study have found the cortex are brain is thickening in people who have migraine compared to those who do not the research don't know whether the difference causes the migraine or having migraine over the years has led to the difference in brain structure.

Reported headache attack may lead to or to be the result of these structural changes in the brain said Hadjikhani in a prepared treatment, she said that most of those people had been suffering from headache since childhood .so long term overstimulation of the sensory field in the cortex could explain these changes.

Using MRI, researchers had already discovered there were structural differences between brain of people with headache and people without headache or the other hand, it could also be that their brain structure changed progressively for some other reason and this led to the headache.

However, regardless of the cause the result show that the sensory areas of the brain are important components in headache. this explain why patient with headache often also have other pain disorder such as back pain, jaw pain, and other sensory⁽³⁾. Problems, where the skin becomes so sensitive that even a gentle breeze can be painful [Hadjikhani]⁽¹²⁾.

Other studies have also revealed the cortex of people who have certain condition is different, for instance people with multiple sclerosis and Alzheimer disease have thinner cortex. The area become thicker with extensive learning and motor training⁽¹¹⁾.

Recommendation:

1. Early diagnosis and treating causes of headache in order to preventing a complication and side effect like weakness of memory.
2. Using complimentary medication which content drug and certain behavior training exercises which related to relaxation and preventing tension, stress, anxiety with continues using physical exercises to increase the ability of person in order avoiding the

result of damage or injury to cortical area of brain.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from Al-Farahidi University Ethical committee

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