Libyan International Medical University

Faculty of Basic Medical Science

Effect of serotonin on migraine

Submitted by: Fatma Elzhraa Ali Zobi, 3nd year medical student, Faculty of Basic Medical Science, Libyan International Medical University

Supervisor: Dr. Ghanem Altuwati, tutor in Libyan international medical university.

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Abstract:
Serotonin is a chemical necessary for communication between nerve cells. It can cause narrowing of blood vessels throughout the body. it is not known exactly if serotonin affects these directly, or if it has an overall role in coordinating the nervous system. When serotonin or estrogen levels change, the result for some is a migraine. A migraine can cause severe throbbing pain or a pulsing sensation, usually on just one side of the head. Not all headaches represent migraines, and migraine is not the only condition that can cause severe and debilitating headaches Migraine attacks can cause significant pain for hours to days and can be so severe that the pain is disabling.
In this report, I will illustrate three different studies with their opinions.

Introduction:
Migraine headache is a result of specific changes within the brain. It is the most frequent neurological disorder in the adult population worldwide, affecting up to 12% of the general population and more frequent in women (approximately 25%).It causes severe head pain that is often accompanied by sensitivity to light, sound, or smells. It is the result of specific physiologic changes that occur within the brain and lead to the characteristic pain and associated symptoms of a migraine. The pain of a migraine is often described as throbbing or pounding and it may be made worse with physical exertion.. Serotonin is a chemical that has a wide variety of functions in the human body. It is sometimes called the happy chemical, because it contributes to wellbeing and happiness. The scientific name for serotonin is 5-hydroxytryptamine, or 5-HT. It is mainly found in the brain, bowels, and blood platelets. As the precursor for melatonin, it helps regulate the body's sleep-wake cycles and the internal clock. It is thought to play a role in appetite, the emotions, and motor, cognitive, and autonomic functions. It appears to play a key role in maintaining mood balance. Low serotonin levels have been linked to depression.(2)

Discussion:
I collected three different studies about the relation between the serotonin and migraine.

1- Of the many factors that have been implicated in the pathophysiology of migraine, none seems to have a better claim than serotonin (5-hydroxytryptamine, 5-HT). The evidence for this is: 5-HT concentrations in blood increase during the prodromal (aura) phase and subsequently, decrease to subnormal levels in the headache phase; migraine attacks may be triggered, in susceptible, subjects, by reserpine which depletes body serotonin; migraine attacks may be triggered, in susceptible subjects, by reserpine which depletes body serotonin; migraine attacks may be relieved by intravenous injection of 5-HT; medications known to affect 5-HT concentrations have been shown to be efficacious in both aborting (agonists of 5-HT1 receptors) and preventing (antagonists of 5-HT2 receptors) migraine attacks. Since most of 5-HT in blood is stored in the platelets, attention of many investigators focused on the platelet function

abnormalities. The positive findings provoked some of them to hypothesise that migraine is a primarily platelet disorder.

Advances in the understanding of the role of 5-HT in migraine and the pharmacology of this amine have now resulted in the development of a highly selective 5-HT1 -like receptor agonist which selectively constricts cranial blood vessels and inhibits neurogenically-mediated plasma protein extravasation in the dura mater.(1)

2- Older theories about migraines suggested that symptoms were possibly due to fluctuations in blood flow to the brain. Now many headache researchers realize that changes in blood flow and blood vessels do not initiate the pain, but may contribute to it. Today, it is widely understood that chemical compounds and hormones, such as serotonin and estrogen, often play a role in pain sensitivity for migraine sufferers. One aspect of migraine pain theory explains that migraine pain happens due to waves of activity by groups of excitable brain cells. These trigger chemicals, such as serotonin, to narrow blood vessels. When serotonin or estrogen levels change, the result for some is a migraine. Serotonin levels may affect both sexes, while fluctuating estrogen levels affect women only. For women, estrogen levels naturally vary over the life cycle, with increases during fertile years and decreases afterwards. Women of childbearing age also experience monthly changes in estrogen levels. Migraines in women are often associated with these fluctuating hormone levels and may explain why women are more likely to have migraines than men. Some research suggests that when estrogen levels rise and then fall, contractions in blood vessels may be set off. This leads to throbbing pain. Other data suggest that lower levels of estrogen make facial and scalp nerves more sensitive to pain.(2)

3- New study results enlighten the dual role of serotonin in migraine pain. While triggering pain via peripheral nerve endings, serotonin has the opposite effect in the central nervous system. The researchers suggest that in migraine patients, this inhibitory control in the central nervous system may be weakened, 'opening the gates' for peripheral pain signals In a study recently published in Neuropharmacology, an international group of scientists based at the University of Eastern Finland and led by Professor Rashid Giniatullin convincingly explained the mysteries of serotonin in migraine. The team found that serotonin induces a massive activation of peripheral nerve endings, which play a key role in triggering migraine pain. Analyzing the pattern of this activation, they found that serotonin induced remarkably robust and persistent spiking activity in individual trigeminal nerve fibers. This explains not only the immediate pain-inducing but also the prolonged sensitizing effect of serotonin. Using specific agonists and antagonists of serotonin Professor Giniatullin's team demonstrated the key role in neuronal firing of the only known ligand-gated serotonin receptor, the 5-HT3 receptor. Apart from its direct activation of nociceptors, this receptor also activates the release of another migraine trigger, the neuropeptide CGRP, meaning that serotonin action is amplified via CGRP to initiate the long-lasting migraine events. An

important aspect of the study was the identification of the source of endogenous serotonin in meninges: granules of resident mast cells contain serotonin, the release of which may contribute to the symptoms of migraine. Finally, the researchers also identified the reason for the previously unexplained dual effect of serotonin. In the central nervous system, serotonin blocked trigeminal nerve projections via the same 5-HT3 receptors that activate pain in the peripheral system. Thus, peripheral serotonin evokes powerful pro-nociceptive effects but it has the opposite effect in the central nervous system.(3)

Conclusion:
In this report, I compared between the three different studies of the relation between serotonin and migraine and they were similar to each other that serotonin is necessary for the communication between the nerve cells, which cause narrowing of the cranial blood vessels so, when it is decreased, it leads to migraine.

References:

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