

A Review on Electromagnetic Field Radiation Exposure from Mobile Handset on the Central Nervous System (CNS) and affect various parts of Brain

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Abstract

Review Article

The effect of EMF radiation emitted from mobile phone are many health related effect, the exposure to electromagnetic field radiation can penetrate deep into organic tissue and get absorbed producing many harmful effect in human body. Brain is involved in very important functions of the body and EMF might have damaging effect on its different parts. Exposure to EMF radiation has been observed to cause increased free radical production in cellular environment and damage the neurons in the Central nervous system.

Keywords: EMF radiation, Mobile phone, Health effect.

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INTRODUCTION

Electromagnetic Field Radiation

Electromagnetic field (EMF) radiation is photons flow through the space. Each photon contains a certain amount of energy, the amount of energy found in the photons are marker of different types of radiations. The radiation are radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays.

EMF Radiation Sources and Frequency

The source of EMF radiation play vital role in human daily life. The EMF radiation emitted from Mobile phone, Phone tower, Wi-Fi and Am/ Fm tower, Tv tower. The maximum 5 lakh people are daily exposure in phone tower emitted EMF radiation, phone tower operating frequency are 800-2300 MHz. The various numbers of people are also exposure in other sources of EMF radiation i.e. Am/ Fm and Wi-Fi & TV and they have their own frequencies. Mobile phone frequency vary according to the system used mainly the range between 900 MHz -2200 MHz [1]. More than 3 billion people across the world are exposed to EMF radiation emitted by mobile phones.

EMF Radiation and Mobile Phone

The worldwide use of mobile phone has been going sky-high over the past years and the mobile phone technology application have become essential part of personal, business and social life[2].

The radiation emitted from mobile phone are the main exposure of EMF radiation to human being, on this planet every second a person uses a mobile phone, It is estimated that currently 600+ million people worldwide are using mobile phones [3]. The Global system for mobile communications (GSM, 850-900 MHz and 1850-1990 MHz) is the extensive system for mobile telecommunications worldwide [1].

EMF radiation emitted from Mobile Phone Effect

The prolonged exposure of electromagnetic field (EMF) without any protection may produce some adverse effect on human body and affect the various organ of the body [4].

Thermal Effects

The EMF radiation emission produce the heat generation, these heat generation increase the temperature of the body called Thermal effect. While using a cell phone, most of the heating effect occurs at the surface of the head and increase temperature by a fraction of a degree. Chronic effect of EMF may cause to increase in body temperature. In the thermal effect can occur with conversion and absorption of heat by body electromagnetic energy. Increased body temperature is stabilized by higher blood circulation.

Non Thermal Effects

Non-thermal effects induced electromagnetic effects inside the biological cells of the body which is possibly more harmful to the human body causes different disease [5].

EMF Radiation Effects on Health

A group of experts believe that the EMF radiation emitted from mobile handset causes health hazards to human beings. Mobile phone user often complain about burning sensation or heating around the ear, enhance in temperature due to heating a mobile phone is due to dissipation of electrical power and exposure to radio frequency. Chronic Mobile phone user report headache, sleep disturbances, tension, fatigue, dizziness[6]. These are attributed to low level radiation from wireless device. These all symptoms are called electromagnetic hypersensitivity.

Electromagnetic Magnetic Field Radiation effect on Central Nervous System

Electromagnetic field radiation is emitted by many natural and man-made sources that play vital role in human daily life. In fast advancement in the EMF technologies and communications have greatly increased the human populations' exposure to EMFs. Mobile phone is the one of the source of EMFs radiation. On the daily exposure of mobile phone radiation to the human being has disarrangement on whole brain system. The EMFs radiation emitted by mobile phone on the central nervous system have become a particular focus because the mobile phone are near to the head during talking mode and are close

proximity to the brain. The brain is the very important part of the human body which concerned and monitoring the whole body. The long term mobile phone radiation exposure to the brain causes the formation of the cancer inside the head [7]. The Hardell group reported that continuous exposure of mobile phone radiation one hour per day for 10 years or more causes brain tumor risk.

EMF Effect on Cellular Structure of Neurons

Exposure to EMF radiation has been observed to cause increased free radical production in cellular environment and damage the neurons in the Central nervous system [8]. The biological tissue inducing changes explained in the term of Thermal or non-thermal mechanism. In non-thermal effect do not raise the body temperature to impair the structure of tissues, their effects can still be seen as an increase in free radical production in tissue [9].

Free radical are reactive molecules induce the conversion of the foods into energy by oxygen. The free radical is an oxidation reaction that occur an oxygen presence. So the oxygen is important for survival, the formation of free radicals cannot be avoided. EMF is one mechanism through the Fenton reaction, suggesting that it promotes free radical activity in cell [10-12].

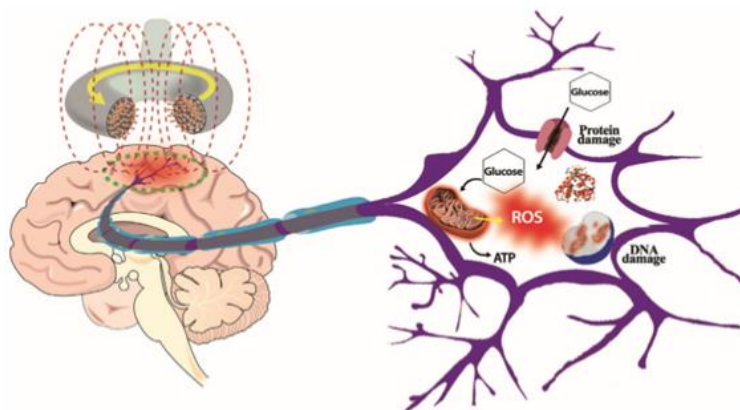


Fig-1: Reactive oxygen species generated by the effect of exposure to EMF damage various cellular structure in neurons of Central Nervous System (CNS)

The Fenton reaction is a catalytic process in which a product of mitochondrial oxidative respiration converts hydrogen peroxide, in to a highly toxic hydroxyl free radical. Some researchers have reported that ROS perform helpful function, a high degree of ROS production cause cellular damage, resulting in rang of disease.

Role of EMF Radiation in Brain Cancer

Cancer is term used to describe at least 200 different diseases, all involving uncontrolled cell growth. The known risk factor that influence risk of cancer are smoking, diet, alcohol contribute to specific type of cancer (eg. smoking is risk factor for lung

cancer, bladder cancer, oral cancer).for many other cancer the risk factor are unknown.

The young children absorb up to 50% more radiation in their brain then adults when they use mobile phones. Absorption rate are grater in children because their ears and skulls are smaller and thinner [13].

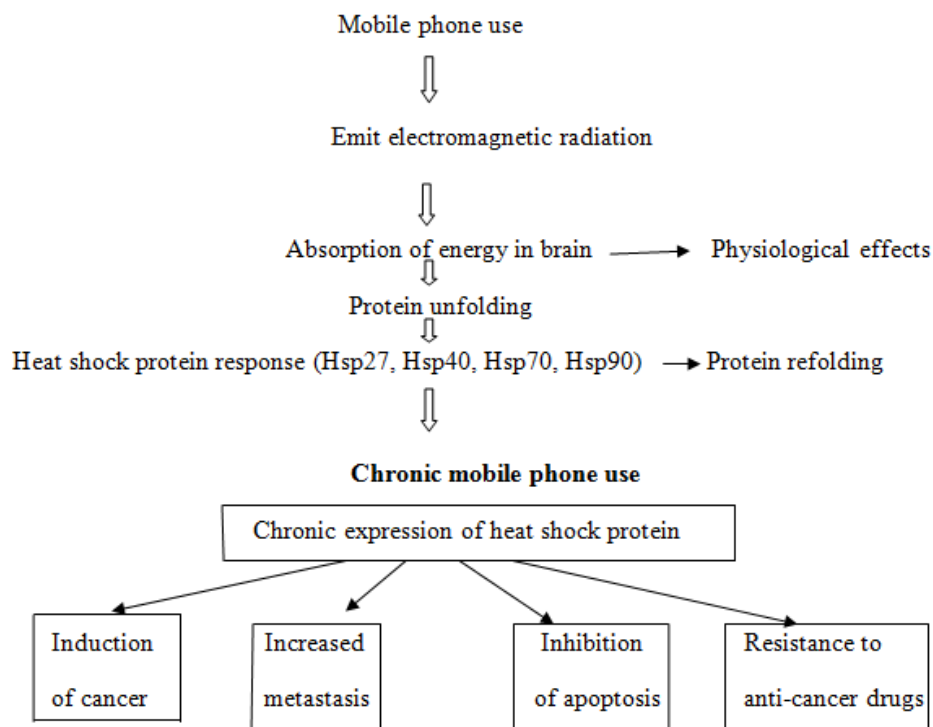
The cancer of the central nervous system (brain and spinal cord) is uncommon. The cause of the brain cancer are unknown ,although the number of study reported that certain occupational chemical exposure, ionization radiation to the scalp is known electromagnetic radiation may obtain a biological effect

in target tissue and cell. The different mechanism has been developing by which EMFs radiation from mobile phone could induce cancer in brain.

The EMF radiation with Heat Shock Protein and Cancer

The up regulation of heat shock protein is a normal defense response to cellular stress. However the

chronic expression of heat shock protein promotes oncogenesis, metastasis and resistance to anti-cancer drug. The chronic exposure of the mobile phone radiation increase the expression of heat shock protein which shows directly effect on target tissue or cell and ultimately formation of cancer [14].



The heat shock protein is highly protect, being present in all organisms from bacteria to plant and animal, as an essential mechanism for protection of cells from exposure to high rang of harmful stresses. The heat shock protein not only functions to refold or eliminate misfolded protein, but they also play vital role for cell cycle, cell proliferation, and apoptosis.

Effect of EMF Radiation on Brain Glucose Metabolism

The human brain is sensitive to the effect of EMF radiation from cell phone exposure. The chronic use of the mobile phone (exposure to EMFs radiation) metabolized more glucose in brain tissue on that side of head, where antenna was held than in the tissues on opposite side of the brain [15]. The long term exposure to activated mobile phone significantly increased fasting blood glucose and serum insulin [16]. Increased brain glucose metabolism can cause various changes in brain and ultimately causes much disease in human body.

EMF Radiation Effect on Memory

Exposure of mobile phone radiation results in decreased in memory level. The chronic exposure of

wistar albino rat to electromagnetic radiation (EMFs) may cause disturbance in monoamine neurotransmitters and this cause many adverse effects reported after EMF including memeory loss, learning capacity and increase stress level [6].

DISCUSION

The use of mobile phone is currently one of the fastest growing technological developments. The mobile phone and their base stations produce electromagnetic radiation (EMR).EMR absorbed in body and produces heat but the body's normal thermoregulatory processes carry this heat away. All established health effects of EMR exposure are related to thermal effects. Since EMR from mobile phone can interact with body tissues at level too low to cause any significant heating, no study has shown adverse thermal effects at exposure level below international guideline limits [17]. The vast majority of the reaesch conducted so far has focused mainly on headache, sleep disorders, or allergy like symptoms and cancer. In addition, studies have also shown that mobile phone radiation has a wide range of damaging effects on brain [18]. In fact, the reduced insulin secretion and its action frequently

coexist and this abnormality becomes the prime cause of the increase the blood glucose level [10]. The young children absorb up to 50% more radiation in their brain than adults when they use mobile phones. Absorption rate are greater in children because their ears and skulls are smaller and thinner [13]. Exposure to EMF radiation has been observed to cause increased free radical production in cellular environment and damage the neurons in the Central nervous system [8].

CONCLUSION

It is suggested that long term or excessive use of mobile phones should be avoided. The EMF has potential harmful effects on tissue in human body. The present study it appears pertinent that in order to protect the population living around base stations and user of mobile handset, government of regulatory bodies adopt safety standards, which translate to limit on exposure levels below a certain value and efforts are underway to harmonize the different standards in existence.

REFERENCES

- Behari J. Biological responses of mobile phone frequency exposure. 2010.
- Al-Khlaiwi T, Meo SA. Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population. Saudi medical journal. 2004;25(6):732-6.
- Saikhedkar N, Bhatnagar M, Jain A, Sukhwai P, Sharma C, Jaiswal N. Effects of mobile phone radiation (900 MHz radiofrequency) on structure and functions of rat brain. Neurological research. 2014 Dec 1;36(12):1072-9.
- Omura Y, Losco M. Electro-magnetic fields in the home environment (color tv, computer monitor, microwave oven, cellular phone, etc) as potential contributing factors for the induction of oncogen c-fos ab1, oncogen c-fos ab2, integrin $\alpha 5 \beta 1$ and development of cancer, as well as effects of microwave on amino acid composition of food and living human brain. Acupuncture & electrotherapeutics research. 1993 Jan 1;18(1):33-73.
- Friedman J, Kraus S, Hauptman Y, Schiff Y, Seger R. Mechanism of short-term ERK activation by electromagnetic fields at mobile phone frequencies. Biochemical Journal. 2007 Aug 1;405(3):559-68.
- Ezz HA, Khadrawy YA, Ahmed NA, Radwan NM, El Bakry MM. The effect of pulsed electromagnetic radiation from mobile phone on the levels of monoamine neurotransmitters in four different areas of rat brain. Eur Rev Med Pharmacol Sci. 2013 Jul 1;17(13):1782-8.
- Schüz J, Jacobsen R, Olsen JH, Boice Jr JD, McLaughlin JK, Johansen C. Cellular telephone use and cancer risk: update of a nationwide Danish cohort. Journal of the National Cancer Institute. 2006 Dec 6;98(23):1707-13.
- Kivrak EG, Altunkaynak BZ, Alkan I, Yurt KK, Kocaman A, Onger ME. Effects of 900-MHz radiation on the hippocampus and cerebellum of adult rats and attenuation of such effects by folic acid and Boswellia sacra. Journal of Microscopy and Ultrastructure. 2017 Dec 1;5(4):216-24.
- Challis LJ. Mechanisms for interaction between RF fields and biological tissue. Bioelectromagnetics. 2005;26(S7):S98-106.
- Volkow ND, Tomasi D, Wang GJ, Vaska P, Fowler JS, Telang F, Alexoff D, Logan J, Wong C. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. Jama. 2011 Feb 23;305(8):808-13.
- Lai H, Singh NP. Magnetic-field-induced DNA strand breaks in brain cells of the rat. Environmental health perspectives. 2004 May;112(6):687-94.
- Aydin B, Akar A. Effects of a 900-MHz electromagnetic field on oxidative stress parameters in rat lymphoid organs, polymorphonuclear leukocytes and plasma. Archives of medical research. 2011 May 1;42(4):261-7.
- Gandhi OP, Lazzi G, Furse CM. Electromagnetic absorption in the human head and neck for mobile telephones at 835 and 1900 MHz. IEEE transactions on microwave theory and techniques. 1996 Oct;44(10):1884-97.
- French PW, Penny R, Laurence JA, McKenzie DR. Mobile phones, heat shock proteins and cancer. Differentiation. 2001 Jun 1;67(4-5):93-7.
- Volkow ND, Tomasi D, Wang GJ, Vaska P, Fowler JS, Telang F, Alexoff D, Logan J, Wong C. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. Jama. 2011 Feb 23;305(8):808-13.
- Meo S, Ruberaan K. Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile phones on fasting blood glucose. International journal of occupational medicine and environmental health. 2013 Apr 1;26(2):235-41.
- Ilhan A, Gurel A, Armutcu F, Kamisli S, Iraz M, Akyol O, Ozen S. Ginkgo biloba prevents mobile phone-induced oxidative stress in rat brain. Clinica chimica acta. 2004 Feb 1;340(1-2):153-62.
- Derias EM, Stefanis P, Drakeley A, Gazvani R, Lewis-Jones DI. Growing concern over the safety of using mobile phones and male fertility. Archives of andrology. 2006;52(1):9-14.