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Electromagnetic hypersensitivity (EHS, microwave syndrome) – Review of mechanisms

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Abstract

Electromagnetic hypersensitivity (EHS), known in the past as “Microwave syndrome”, is a clinical syndrome characterized by the presence of a wide spectrum of non-specific multiple organ symptoms, typically including central nervous system symptoms, that occur following the patient's acute or chronic exposure to electromagnetic fields in the environment or in occupational settings. Numerous studies have shown biological effects at the cellular level of electromagnetic fields (EMF) at magnetic (ELF) and radio-frequency (RF) frequencies in extremely low intensities. Many of the mechanisms described for Multiple Chemical Sensitivity (MCS) apply with modification to EHS. Repeated exposures result in sensitization and consequent enhancement of response. Many hypersensitive patients appear to have impaired detoxification systems that become overloaded by excessive oxidative stress. EMF can induce changes in calcium signaling cascades, significant activation of free radical processes and overproduction of reactive oxygen species (ROS) in living cells as well as altered neurological and cognitive functions and disruption of the blood-brain barrier. Magnetite crystals absorbed from combustion air pollution could have

an important role in brain effects of EMF. Autonomic nervous system effects of EMF could also be expressed as symptoms in the cardiovascular system. Other common effects of EMF include effects on skin, microvasculature, immune and hematologic systems. It is concluded that the mechanisms underlying the symptoms of EHS are biologically plausible and that many organic physiologic responses occur following EMF exposure. Patients can have neurologic, neuro-hormonal and neuro-psychiatric symptoms following exposure to EMF as a consequence of neural damage and over-sensitized neural responses. More relevant diagnostic tests for EHS should be developed. Exposure limits should be lowered to safeguard against biologic effects of EMF. Spread of local and global wireless networks should be decreased, and safer wired networks should be used instead of wireless, to protect susceptible members of the public. Public places should be made accessible for electrohypersensitive individuals.

Section snippets

Background and introduction

Electromagnetic hypersensitivity (EHS), known in the past as “Microwave syndrome”, is a clinical condition characterized by a broad spectrum of non-specific multiple organ systems that typically occur after a person's exposure to electromagnetic fields (EMF) from the environment. Numerous studies have shown biological effects at the cellular level of electromagnetic fields (EMF) at magnetic (ELF) and radio-frequency (RF) frequencies in extremely low intensities. Sensitivity to EMF, a systemic …

Exposure

Exposure to EMF has been described in 2008–9 as between 10 and 15 times higher than the earth's natural magnetic field (Röösli, 2008; Nittby et al., 2009). Specifically around the 1 GHz frequency band, exposures have risen by approximally 10^{18} times natural levels (Bandara and Carpenter, 2018). In 2010, it was estimated that more than 2 billion people use cell phones worldwide (Soffritti, 2010). The electromagnetic fields that people are potentially exposed to are generated by a variety of …

Physiologic evidence of health effects

Several studies cite abnormalities in neuropsychiatric testing in patients who report neuropsychiatric symptoms after exposure. Reeves (2000) reported on 34 US Air Force

personnel who were exposed to RF at intensities greater than permissible exposure limits. The young men reported acute neurologic symptoms after exposure and standardized neuropsychiatric testing indicated that two thirds of the subjects exhibited findings consistent with antisocial personality, mild organic brain syndrome, …

Mechanisms

Many of the mechanisms described for Multiple Chemical Sensitivity (MCS) apply with modification to EHS. Repeated exposures result in sensitization and consequent enhancement of response (Overstreet, 2001; Latremoliere and Woolf, 2009; Molot, 2013; Sage, 2015). Many hypersensitive patients appear to have impaired detoxification systems that become overloaded by excessive oxidative stress (Korkina, 2009; De Luca et al., 2014). Patients can have neurologic, neuro-hormonal and neuro-psychiatric …

Conclusion

In the modern world, exposure to electromagnetic radiation has become inescapable. There are many people who develop adverse health effects as a result of exposure to EMF. This review of the literature included numerous self-reported neurologic and neuropsychiatric symptoms which have a temporal relationship to EMF exposures. Further studies suggest that EMF exposure may be associated with changes in cerebral blood flow which correspond to abnormalities on PET scan of the brain. Some of the …

Declaration of competing interest

The authors declare no conflict of interest. …

Acknowledgements

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