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PERSPECTIVES

# Excessive Exposure to Radiofrequency Electromagnetic Fields May Cause the Development of Electrohypersensitivity

David O. Carpenter, MD

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**E**lectrohypersensitivity (EHS) is a syndrome that consists of some combination of excessive fatigue, headache, weakness, memory impairment, tinnitus, dizziness, irritability, sleep disturbances, loss of appetite, and a general feeling of ill health that occurs in some individuals and is attributed to exposure to electromagnetic fields (EMFs), most commonly to radiofrequency (RF) EMFs. There has been considerable doubt that the syndrome is real because a number of laboratory studies done with individuals who report they suffer from EHS have concluded that such individuals are unable to distinguish when fields were or were not applied under controlled conditions.<sup>1,2</sup> However, Rea et al<sup>3</sup> reported that some but not all persons who reported themselves to be electrosensitive reacted to exposure but not to sham. McCarty et al<sup>4</sup> reported that a physician suffering from EHS reported headaches, muscle twitching, and skipped heartbeats occurring in the presence of a 60-Hz field in a statistically significant manner more often than in a sham control. The World Health Organization<sup>5</sup> has acknowledged that a significant number of individuals report such symptoms but questions whether they are indeed caused by EMF exposure. Indeed, most medical personnel when seeing a patient with the symptoms of EHS will refer them to psychological or psychiatric care. Despite this skepticism, there are increasing reports of the incidence of EHS and of individuals with severe disabilities caused by the

ubiquitous presence of cell phones, cell towers, WiFi, smart meters, radio and television transmission towers, and other forms of RF radiation.

Questions about the existence of EHS go back to the days of the Cold War and differing concepts related to the effects of RF radiation. In most Western countries, it has been assumed that there are no biological effects of EMFs other than those mediated via tissue heating. In contrast, in Soviet countries, there were many early reports of behavioral effects occurring at much lower intensities than those that cause tissue heating. The symptoms reported included headache, fatigue, difficulty in concentration, depression, emotional instability, and irritability (reviewed by Silverman<sup>6</sup>). Soviet exposure standards were much more stringent than those in Western countries. Although the reported effects and low exposure standards were discounted by most Western scientists, some researchers such as Frey<sup>7</sup>—as early as 1965—concluded from his own and other studies that there were nonthermal effects, particularly on nervous tissue and heart muscle, that could be observed at very low intensities. Important factors were peak power density, carrier frequency, and modulation.<sup>8</sup>

Between 1953 and 1975, the Soviets irradiated the chancery building of the US embassy in Moscow with a microwave beam with an intensity of 5  $\mu$ W, and in 1975 to 1976 they increased the intensity to 18  $\mu$ W. A health study of embassy employees did not find elevated mortality, but it did note more depression, irritability, difficulty in concentrating, and memory loss.<sup>9</sup> These symptoms were attributed to anxiety by most governmental authorities, however, rather than microwave exposure.

The symptoms of EHS are similar to those of a number of other syndromes, including fibromyalgia, multiple chemical sensitivity, chronic fatigue syndrome, Gulf War illness, and others. These are sometimes collectively identified as “idiopathic environmental intolerance” or “medically unexplained symptoms.” They have in common complaints of fatigue, weakness, headaches, difficulty concentrating, multiple aches and pains, difficulty with sleep, and often

difficulties with balance and vertigo. Although the triggering events vary for each of these syndromes, many people suffer from more than 1.<sup>10,11</sup> Although all of these syndromes have initially been ascribed to psychological factors,<sup>12</sup> there is increasing evidence that those alone do not explain the diseases.<sup>13</sup> The critical question is why some develop these sensitivities whereas others do not, and whether there are specific triggers that are responsible.

The report by Lamech<sup>14</sup> raises the possibility that excessive exposure to RF, perhaps to some specific characteristic of the RF waveforms associated with smart meters, triggers the development of EHS. As stated in this paper,

... since the beginning of installation of wireless smart meters in the state of Victoria, people from various regional and metropolitan areas, of all ages and during all seasons have started to report symptoms from exposure to the meters' radiofrequency fields ... only 8% of cases stated that they had suffered from EHS prior to exposure to smart meters, which suggests that when it comes to wireless meters, the threshold for symptom development appears to be significantly lower compared to that for other wireless devices.

Smart meters use atypical, short, and very intense pulses of RF microwaves whose biological effects have not been carefully examined. The average RF intensity over periods of time coming from a smart meter is not as great as that from a cell phone held to the head (Table 1 in Carpenter<sup>15</sup>), and like other point sources of RF, falls off rapidly with distance. Milham and Morgan<sup>16</sup> have described high frequency voltage transients as "dirty electricity" and have implicated these rather than the 60 Hz magnetic fields in some adverse health effects. It is possible that some feature of the smart meter emissions related to these brief but very intense RF pulses increases the likelihood of triggering EHS in susceptible individuals.

In the specific case of EHS, there is a long history of development of symptoms of EHS after an acute but excessive exposure to RF. Williams and Webb<sup>17</sup> in 1980 reported effects of 2 airmen exposed to high levels of RF radiation from a radar beam. After an immediate sensation of heat, they later developed nausea, lightheadedness, and extreme apprehension with poor appetite and photosensitivity. Forman et al<sup>18</sup> in 1982 reported on 2 men who were accidentally and acutely exposed to microwave radiation. Both exhibited symptoms of headaches, insomnia, irritability, and emotional lability, even after a 12-month follow-up. Both also developed hypertension several months after exposure. Schilling<sup>19</sup> in 1997 reported on 3 men accidentally exposed to 785 MHz RF radiation. All experienced immediate sensations of heating, followed by pain, headache, numbness and parasthesias, malaise, diarrhea, and skin erythema. The first man, age 44, experienced lassitude, lack of stamina, drowsiness and chronic headache. The symptoms gradually improved over 3 years follow-up, but he still had chronic headaches at 3 years. The second man, age 47, also had

lassitude, lack of stamina, drowsiness, and chronic left-side frontoparietal headache, which was made worse by exposure to sun or heating. The symptoms improved somewhat over 3-year follow-up but the headaches remained. The third man had a lower exposure and his symptoms almost disappeared after 18 months. Schilling<sup>20</sup> in 2000 reported on 6 antenna engineers exposed in 2 separate incidents. All experienced acute headache, parathesia, diarrhea, malaise, and lassitude. Four of the men showed no improvement in symptoms after follow-up for 3 or 4 years, with headache, loss of stamina, severe malaise, and lassitude being the major symptoms.

This author has also had opportunity to review the exposure and medical history of some individuals whose history is similar to that of the radar operators. RG, age 38, was a technical expert at repair of RF generating equipment who prior to an accidental RF exposure in 2011 was healthy. He had been called to repair equipment in a room with 15 radios broadcasting at 1900 MHz. After 1 to 2 hours of work within the facility, he began to feel hot and developed a headache, dizziness, and nausea. He left the room and was taken to a hospital, where he was found to have mild burns on his face, head, and neck. It was subsequently determined that although all of the equipment was supposed to have been turned off, 6 of the transmitters were on. He was directly in front of 3 of them. He had been exposed to concentrated RF for the whole period he was in the room. No measurements were taken of the RF intensity.

RG was taken to an emergency room where he was found to have burns of his eyes, headache and palpitations, and dizziness when looking down, which were accompanied by fatigue and malaise. One month later he still suffered from constant headache, dizziness, photosensitivity, nausea, confusion, and difficulty with cognition. His gait was unsteady and he was easily disoriented. He continued to have problems with mood and photophobia; was more irritable; was less spontaneous; had decreased sex drive; had continued nausea, which was resulting in weight loss; and had continued memory problems. One year later, he reported depression, sleep disturbances, and difficulty with thought processing, and the nausea was less frequent but more severe. His mood was withdrawn.

RG came to my office 2 years and 2 months after his exposure. He had the appearance of being a pale and chronically ill white male. His affect was of someone depressed and lacking spontaneity. He complained of constant headaches; confusion and memory loss; lower-back, hip, and stomach pain; nausea; weight loss; vertigo; and constant anxiety and depression. He has severe mood swings. His memory was very poor initially and he would forget a lot. His memory had improved with time, but he still had difficulty reading because he became confused, could not comprehend, and found it difficult to focus. Thus, an acute excessive exposure to RF radiation led to a syndrome of adverse health effects that continued essentially unabated for more than 2 years, and it has all of the characteristics of EHS.

JJ is a 41-year-old man who contacted me about his EHS. He also was healthy prior to a near electrocution event while working at home. Upon contacting a live wire he froze and lost consciousness for approximately 30 seconds, but he did not suffer from cardiac problems. He went to the hospital with a very bad headache, but he was not found to have other abnormalities. Subsequently he was fatigued, had severe photophobia, and had very severe headaches, which he had never had before. Four years later, he has constant dizziness, frequent headaches, vertigo, and nausea. The symptoms are greatly increased when he is in the presence of EMFs, particularly RF. Unfortunately, his job requires him to be almost continuously exposed to RF. Again it appears that an acute exposure caused an increased sensitivity to EMFs that has not gone away over a period of several years. This case is unusual in that the exposure was to electric current, but the long-term effect was the development of typical EHS.

There is some indication that an excessive acute exposure may also be the trigger for other of the idiopathic environmental intolerance syndromes. For example, in the case of multiple chemical sensitivity, there is often a report that some particularly intense chemical exposure triggered an intolerance to chemicals that had not been previously apparent.<sup>21,22</sup>

The number of individuals who suffer from EHS is unknown but has been estimated to be as high as 3% of the US population<sup>23</sup> and 5% of the Swiss population.<sup>24</sup> However, because these numbers come primarily from self-reports, they are of questionable accuracy. The study by Rea et al<sup>13</sup> indicates that some individuals who report being electrosensitive are able to distinguish applied RF fields, although others are not, which suggests that many who believe they have EHS are attributing their symptoms to the wrong source. On the other hand, many people who may in fact be suffering from the “medically unexplained symptoms” may never have considered magnetic fields or RF radiation as a contributing cause, which would result in an underrepresentation of the frequency of the syndrome. Hallberg and Oberfeld<sup>25</sup> have plotted self-reported rates of EHS over time and suggest that rates are dramatically increasing, presumably reflecting increased exposure to the overall population, as well as greater awareness of the possible associations with EMFs.

The report by Lamech<sup>14</sup> is valuable for several reasons. It provides support for the possibility that a sudden increase in RF exposure—in this case from smart meters—results in the development of EHS. This observation is consistent with the reports mentioned above and suggests that the syndrome can be triggered in susceptible individuals by an unusual or intense exposure to EMFs and perhaps to electric current. The Lamech report also raises the important question of what characteristics of smart meters, compared with other sources of RF, may be responsible for provoking EHS. Clearly, much more work needs to be done to understand the basic mechanisms responsible for this syndrome. However, this report adds to the developing evidence that EHS is a real disease, that a significant number of people suffer from EHS,

and that—beyond taking steps to reduce EMF exposure—we have very limited knowledge of how to prevent and treat the disease.

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