Is the Electrohypersensitive Patient’s Headache a Variant of the Migraine Disease Mediated by TRPA1 Receptors?

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Abstract:
According to the French Agency for Food, Environmental and Occupational Health & Safety, electromagnetic hypersensitivity affects more than 3 million people in France, and headaches are a very frequent cause of complaint in electrohypersensitive patients, to the point of dominating the clinical picture. These headaches share characteristics with migraine pathology, and clinical improvement with anti-migraine therapy has led us to consider that the headache in the electrohypersensitive patient may be a variant of the migraine disease mediated by the TRPA1 receptor, which if confirmed, would offer effective therapeutic possibilities to relieve the electrohypersensitive patient.

Introduction:
Electromagnetic hypersensitivity is an environmental pathology that affects three to five percent of the population in France (1). In two-thirds of cases, women are affected by the disease by the age of 40. Clinical signs are dominated by neurological disorders; more precisely by headaches in 98% of cases attributed to the presence of a source of non-ionising electromagnetic fields (2). The interrogation of patients sometimes also includes the triggering of headache with odours that can go as far as a symptomatology that establishes the diagnosis of multiple chemical sensitivity confirmed by the QEESI (The Quick Environmental Exposure and Sensitivity Inventory) test (3).

Hypothesis:
The clinical presentation of these patients very closely resembles to the one of patients suffering from migraine triggered by odour or light (4). Having also noted the improvement in symptomatology with the use of a triptan or a prophylactic treatment for migraine, and after a review of the literature, we hypothesized that electrohypersensitive patient’s headache is a variant of migraine disease in which the trigger is non-ionizing electromagnetic fields and the TRPA1 receptor is a key element in the process that may explain the findings.

It has been established that non-ionizing electromagnetic fields cause an increase in the concentration of intracellular free radicals in the human cell at sub-thermal thresholds (5,6). The mechanism of this increase, although debated, seems to be through the activation of...
voltage gate calcium channels (VGCCs)(7,8). This increase in free radicals at the level of nociceptive neurons and in particular the trigeminal nerve one’s would activate the Transient Receptor Potential A1 (TRPA1) (9) which causes the neuron to secrete CGRP Calcitonin Gene Related Peptide (CGRP)(10) and inflammatory molecules such as substance p and neurokinin as well as the release of histamine (11). The CGRP will lead to arterial cerebral vasodilatation in the cerebral dura mater without action on the venous system, resulting in a migraine (12). In fact depending on the individual this is described as a brain fog and can go as far as a real migraine with vomiting and the whole typical procession.

TRPA1 belongs to the family of TRP (transient receptor potential) receptors (13) which are designed to detect changes in the surrounding environment. TRPA1 is directly sensitive to chemicals, particularly chlorine and wood smoke, as well as wasabi and menthol. It is also sensitive to cold and is activated by free radicals. This explains why at the cutaneous (14), pulmonary, oropharyngeal, digestive and urinary level it can be directly activated, reflecting the chemical sensitivity of patients who breathe smoke and have chest pain by releasing CGRP and inflammatory and painful substances. At the oropharyngeal level, the trigeminal nerve leads the information directly to the brain and triggers the “migraine” (15). In addition, when pulmonary TRPA1 receptors are activated they can cause heart rhythm disturbances (16,17,18).

Activation of TRPA1 and other receptors leads to a phenomenon of central sensitization which will result in an increasingly explosive reaction for a given stimulus, and in particular will facilitate the triggering of the reaction by different stimuli: light noise smell touch non ionizing electromagnetic fields and vibration creating what is known as a central sensitization syndrome (19,20,21).

It is even possible by repeatedly exposing rats to acrolein, a TRPA1 receptor agonist, to create a chronic migraine state, which is blocked by a pre-treatment with valproic acid, and whose effects are attenuated by sumatriptan (22).

Conclusion:
Thus, if our hypothesis is confirmed, since electrohypersensitivity headaches would be a variant of the migraine disease, this would finally give us a practical basis for work and offer effective therapeutic possibilities to relieve the electrohypersensitive patient.

Conflicts of Interest:
The authors declare no conflict of interest.

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