

# ELECTROHYPERSENSITIVITY (EHS)

## Medical overview

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Electromagnetic hypersensitivity (EHS) in occupational and primary health care: A nation-wide survey among general practitioners, occupational physicians and hygienists in the Netherlands

Pauline Slottje<sup>a, b</sup>, Imke van Moorselaar<sup>c</sup>, Rob van Strien<sup>c</sup>, Roel Vermeulen<sup>a, d</sup>, Hans Kromhout<sup>e</sup>, Anke Huss<sup>a, e</sup>  

National survey in the Netherlands among :

- Occupational hygienists
- Occupational physicians
- General practitioners

2016

- About **1/3 of occupational hygienists, occupational physicians and general practitioners have been consulted by one or more EHS subjects**
- Many of these professionals considered a **causal relationship** between EMF and health complaints to some degree **plausible**
- Their approach often included **exposure reduction advice**
- The majority of these professionals felt insufficiently informed about EMF and health

Olle Johansson\*

## **Electrohypersensitivity: a functional impairment due to an inaccessible environment**

The Swedish view provides persons with this impairment a maximal legal protection.

They are not seen as patients, they do not have an overriding medical diagnosis, but **the 'patient' is only the inferior and potentially toxic environment.**



# **Guideline of the Austrian Medical Association (ÖÄK) for the diagnosis and treatment of EMF- related health problems and illnesses (EMF syndrome)**

**Consensus paper of the Austrian Medical Association's EMF  
Working Group (ÖÄK AG-EMF)**

Adopted at the meeting of environmental medicine officers of the Regional Medical Association's and the Austrian Medical Association on 3<sup>rd</sup> March 2012 in Vienna.



In Sweden, EMF syndrome is designated as electrohypersensitivity (EHS), considered a physical impairment and recognized as a **disability**.

With reference to UN Resolution 48/96, Annex, of 20 December 1993 (UN 1993), **local governments grant support to individuals with EHS**.

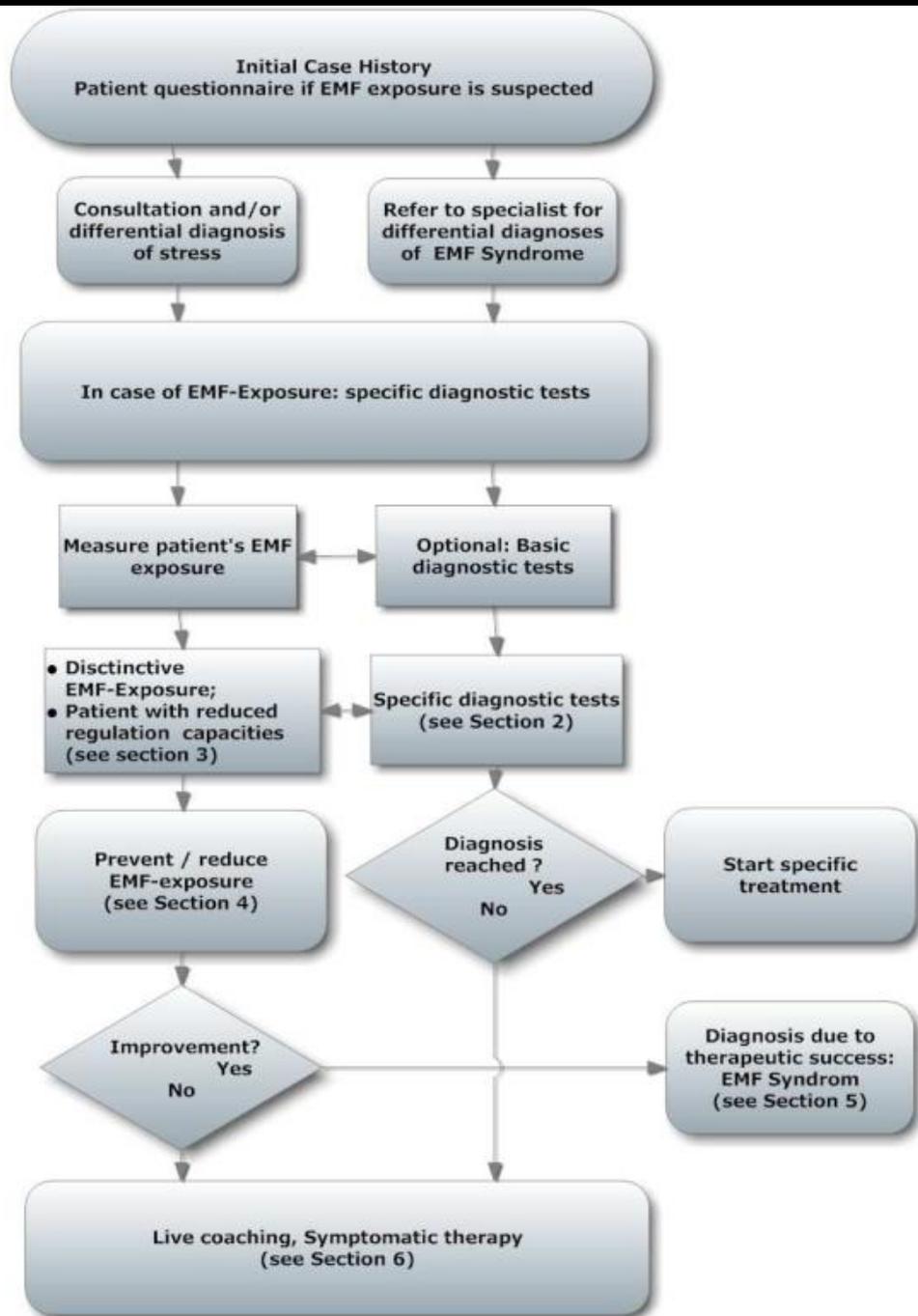


Employees with EHS have a right to support from their employers so as to enable them to work despite this impairment.

Some hospitals in Sweden provide rooms with low EMF exposure.

## Diagnosis and treatment:

1. History of health problems and EMF exposure
2. Examination and findings
3. Measurement of EMF exposure
4. Prevention or reduction of EMF exposure
5. Diagnosis
6. Treatment



## **Patient questionnaire:**

- a) List of symptoms
- b) Variation of health problems depending on time and location
- c) Assessment of EMF exposure

## **Cardiovascular system:**

### **Basic diagnostic tests**

Blood pressure and heart rate (in all cases resting heart rate in the morning while still in bed), including self-monitoring, possibly several times a day, e.g. at different places and with journaling of subjective well-being for a week.

### **Specific diagnostic tests**

- 24-hour blood pressure monitoring (absence of night-time decline)
- 24-hour ECG (heart rhythm diagnosis)
- 24-hour heart rate variability HRV (autonomous nervous system diagnosis)

## Laboratory tests

### Basic diagnostic tests

\* Early morning urine:

Adrenaline

Noradrenaline

Noradrenaline/adrenaline quotient

Dopamine

Serotonin

\* Early morning urine:

6-OH melatonin sulphate

\* Saliva

Cortisol (8 am, 12 am and 8 pm)

\* Blood:

Blood count & differential blood count

Fasting blood glucose & postprandial blood glucose

HBA<sub>1c</sub>

TSH

## Blood tests:

Homocysteine

Intracellular ATP

Intracellular glutathione (redox balance)

Malondialdehyde (lipid peroxidation)

8-hydroxydeoxyguanosine (DNA oxidation)

Interferon-gamma (IFN $\gamma$ )

Interleukin-1 (IL-1)

Interleukin-6 (IL-6)

Interleukin-10 (IL-10)

Tumour necrosis factor alpha (TNF $\alpha$ )

NF-kappaB

Vitamin B<sub>2</sub> (FAD and riboflavin)

Vitamin B<sub>6</sub> (whole blood)

Vitamin D

Ubichinon (Q 10)

Selenium (whole blood)

Zinc (whole blood)

Magnesium (whole blood)

Differential lipid profile

Dominique Belpomme, Christine Campagnac and Philippe Irigaray\*

# Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder

Rev Environ Health 2015; 30(4): 251–271

- 1216 prospectively investigated, clinically and biologically, consecutive EHS and/or MCS-self reported cases
- Preliminary data, based on 727 evaluable of 839 enrolled cases:
  - 521 (71.6%) were diagnosed with EHS,
  - 52 (7.2%) with MCS,
  - and 154 (21.2%) with both EHS and MCS
- 2/3 patients with EHS and/or MCS female
- mean age: 47 y

Near 40% had an increase in **histaminemia** - indicating a chronic inflammatory response

Oxidative stress: **Nitrotyrosin**, a marker of both peroxynitrite (ONOO<sup>o-</sup>) production and opening of the blood-brain barrier (BBB), was increased in 28% of the cases.

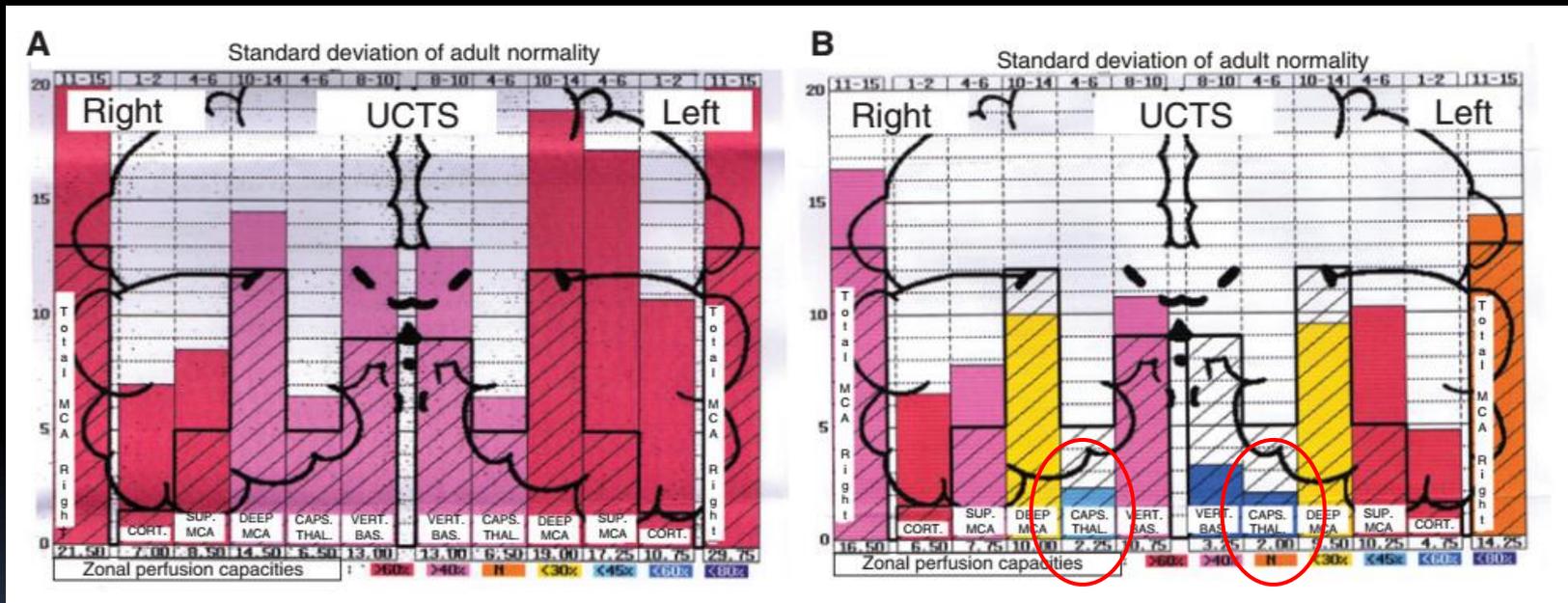
**Protein S100B**, another marker of BBB opening was increased in 15%.

**Circulating autoantibodies against O-myelin** were detected in 23%, indicating EHS and MCS may be associated with an autoimmune response.

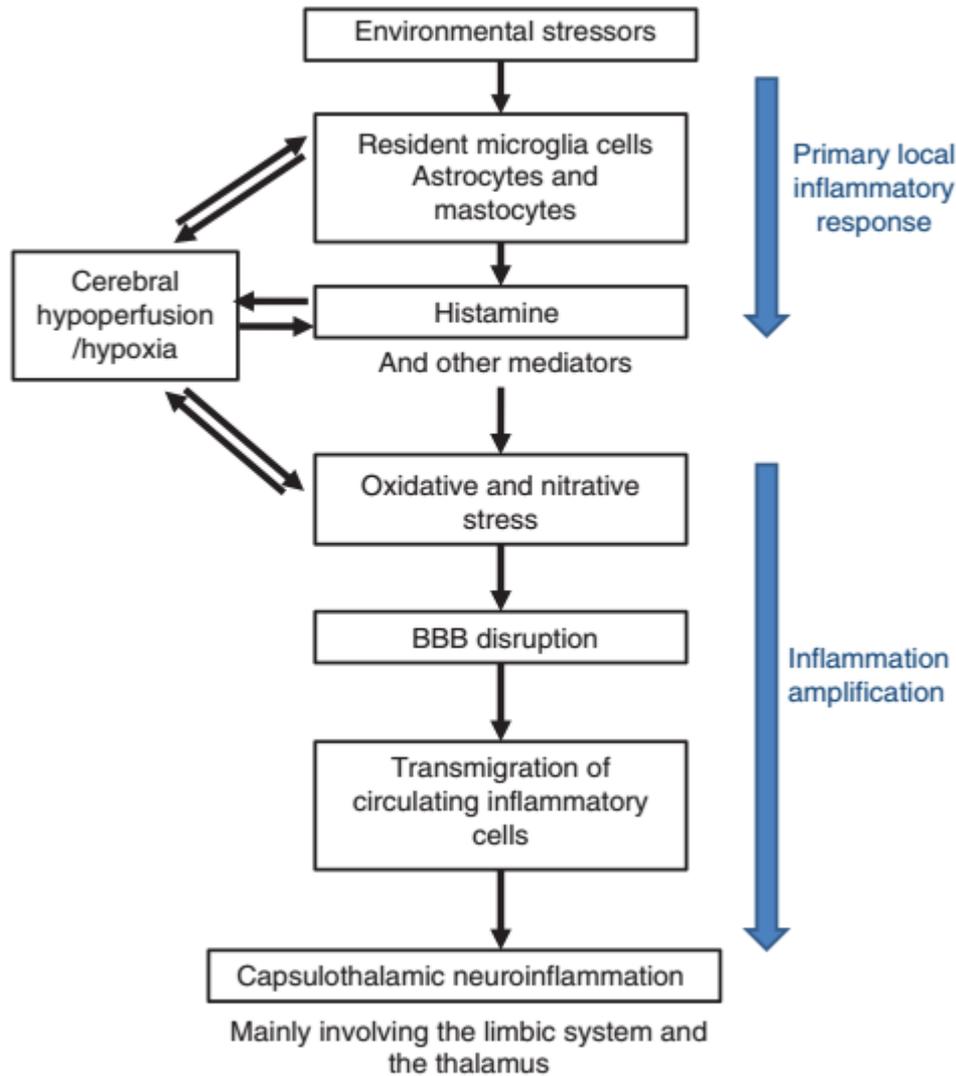
Increased **Hsp27** and/or **Hsp70 chaperone proteins** in 33% of the patients.

As most patients reported chronic insomnia and fatigue, we determined the **24 h urine 6-hydroxymelatonin sulfate (6-OHMS)/creatinin ratio** and found it was decreased (<0.8) in all investigated cases.

We serially measured the **brain blood flow (BBF) in the temporal lobes** of each case with pulsed cerebral ultrasound computed tomography. Both disorders were associated with **hypoperfusion in the capsulothalamic area**, suggesting that the inflammatory process involve the limbic system and the thalamus.



UCTS exploring the global centimetric ultrasound pulsatility in the two temporal lobes of a normal subject (A) and in a EHS self-reporting patient (B). Measurements are expressed in Pulsometric index (PI).



## Proposed hypothetic EHS/MCS common pathogenic model

based on EHS/MCS induced:

- neuroinflammation,
- cerebral hypoperfusion,
- histamine release,
- oxidative/nitrosative stress
- BBB disruption

- 
- Our data strongly suggest that EHS and MCS can be objectively characterized and routinely diagnosed by commercially available simple tests.
  - Both disorders appear to involve inflammation-related hyper-histaminemia, oxidative stress, autoimmune response, capsulothalamic hypoperfusion and BBB opening, **and a deficit in melatonin metabolic availability; suggesting a risk of chronic neurodegenerative disease.**
  - The common co-occurrence of EHS and MCS strongly suggests a common pathological mechanism.

# Electromagnetic Hypersensitivity: Evidence for a Novel Neurological Syndrome

David E. McCarty,<sup>1</sup> Simona Carrubba,<sup>1</sup> Andrew L. Chesson, Jr.,<sup>1</sup> Clifton Frilot, II,<sup>2</sup> Eduardo Gonzalez-Toledo,<sup>3</sup> and Andrew A. Marino<sup>1</sup>

*International Journal of Neuroscience*, 121, 670–676, 2011

The subject, a female physician self-diagnosed with EMF hypersensitivity, was exposed to an average (over the head) 60-Hz electric field of 300 V/m (comparable with typical environmental-strength EMFs) during controlled provocation and behavioral studies.

In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ( $p < .05$ ).

**The symptoms were caused primarily by field transitions (off-on, on-off) rather than the presence of the field**, as assessed by comparing the frequency and severity of the effects of pulsed and continuous fields in relation to sham exposure.

# Hypothesis on how to measure electromagnetic hypersensitivity

Andreas Tuengler<sup>1</sup> & Lebrecht von Klitzing<sup>2</sup>

*Electromagnetic Biology and Medicine*, 2013; 32(3): 281–290

Simultaneous recordings of:

- heart rate variability,
- microcirculation and
- electric skin potentials

are used for classification of EHS

HRV, electric skin potentials and microcirculation are influenced in EHS patients under exposure within some minutes and remain so after exposure for some minutes up to 1 h

# Electromagnetic hypersensitivity: Fact or fiction? ☆

Stephen J. Genuis <sup>a,\*</sup>, Christopher T. Lipp <sup>b</sup>

Science of the Total Environment 414 (2012) 103–112

Common reported signs and symptoms associated with electromagnetic hypersensitivity (EHS) [Havas, 2006; Johansson, 2006]

Headache

Thought processing difficulties

Memory impairment

Heart palpitations

Sleep disorders

General malaise

Blurred vision

Weakness

Dizziness

Chest discomfort

Muscle pain

Tinnitus

Fatigue

Nausea

Night sweats

Restless legs

Paresthesias

## Sensitivity related illness (SRI)

SRI describes a **pathophysiological response to bioaccumulation of foreign materials** originating from various potential sources: such as toxic chemicals, surgical implants, infections, dental materials, and radioactive compounds.

The mechanism by which the body becomes hyper-reactive or hyper-sensitized to electromagnetic energy may start with a totally unrelated toxicant insult or multiple insults in the form of foreign exposures.

After a threshold of bioaccumulation is achieved, **an individual's immune system loses the normal adaptive responses** with immune tolerance and becomes **sensitized** to exposures from seemingly insignificant and unrelated environmental stimuli.



De Luca et al. (2010) discovered that people who suffer from EHS may have **various defects in genes involved in toxicant elimination within their body.**

These genes are responsible for producing antioxidant/detoxification enzymes such as glutathione-S-transferases, superoxide dismutase, catalase, N-acetyl transferases, cytochrome 450 enzymes and others (Wormhoudt et al., 1999).



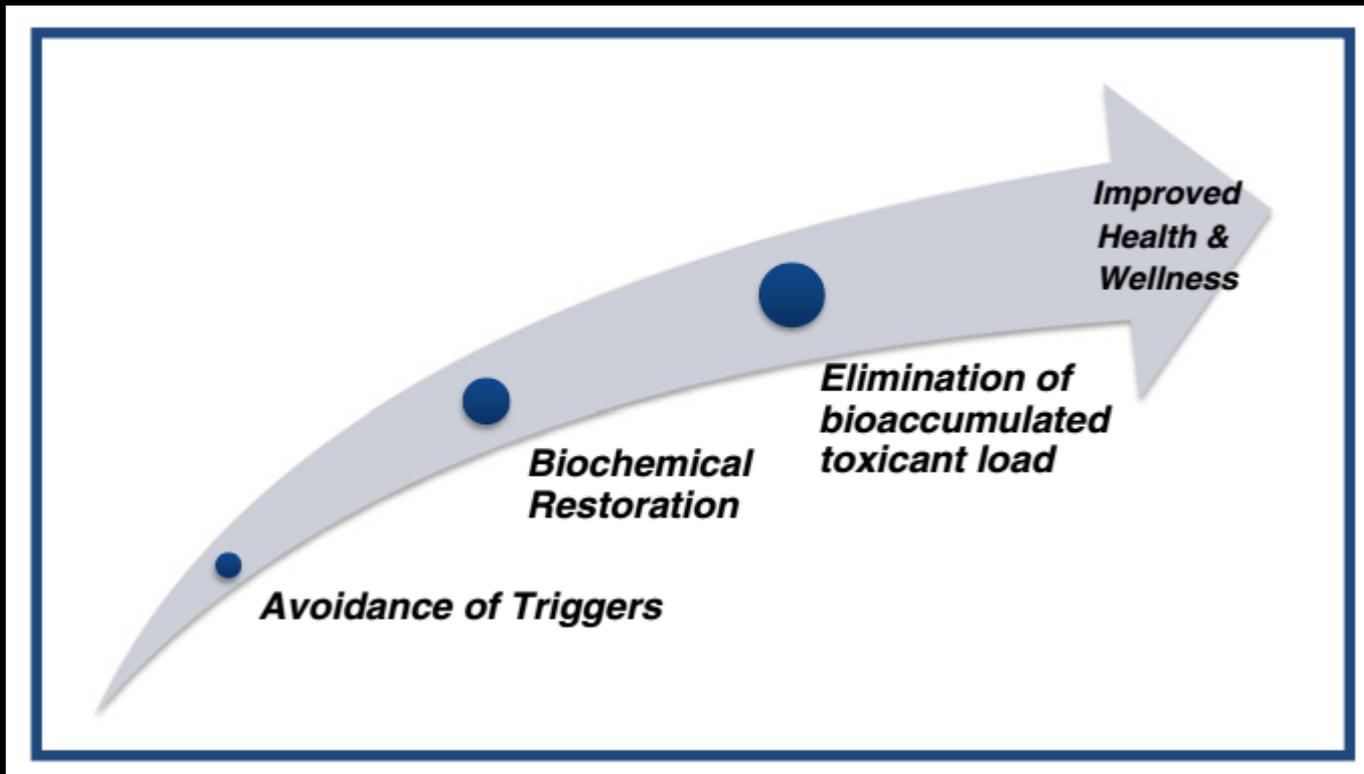
As a result these people may have **impaired detoxification mechanisms** resulting in a predisposition to toxicant bioaccumulation.

## Catecholamine dysregulation

Disruption and dysregulation of catecholamine physiology in response to adverse EMR (Buchner and Eger, 2011).

Reported to **affect regulation of endocrine systems** including adrenal gland function (Marino et al., 1977)  
Recent research highlights a dose–response relationship which occurs well below established limits for technical radiofrequency radiation exposure.

With ongoing exposure – such as living in close proximity to a cell phone base station – this pathophysiological reaction may involve a protracted alteration of norepinephrine, epinephrine, dopamine and phenylethylamine biology.



Intervention approach to manage sensitivity related illness