A study of neurotoxic biomarkers, c-fos and GFAP after acute exposure to GSM radiation at 900MHz in the picrotoxin model of rat brains.

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Medical/biological study (experimental study)

Aim of study (acc. to author)

To study a time-course description of effects after acute microwave exposure in the rat brain by measuring 1) the neuronal activation using the c-fos expression and 2) glial reactivity as an indicator of parallel neuronal damage in seizure-related rat model.

Background/further details:

Rats were made seizure-prone by injection of a subconvulsive dose of the GABA antagonist picrotoxin. 72 adult male rats were divided into 12 groups: 1) picrotoxin treated (to induce seizure proneness), exposed for 2 h and investigated after 90 min., 2) picrotoxin treated, sham-exposed for 2 h and investigated after 90 min., 3) no picrotoxin administration, exposed for 2 h and investigated after 90 min., 4) no picrotoxin administration, sham-exposed for 2 h and investigated after 90 min., 5) picrotoxin treated, exposed for 2 h and investigated after 24 h, 6) picrotoxin treated, sham-exposed for 2 h and investigated after 24 h, 7) no picrotoxin administration, exposed for 2 h and investigated after 24 h, 8) no picrotoxin administration, sham-exposed for 2 h and investigated after 24 h, 9) picrotoxin treated, exposed for 2 h and investigated after three days, 10) picrotoxin treated, sham-exposed for 2 h and investigated after three days, 11) no picrotoxin administration, exposed for 2 h and investigated after three days, 12) no picrotoxin administration, sham-exposed for 2 h and investigated after three days.

Endpoint

- effects on the neurological system: clinical signs of seizure or jerks; c-fos and GFAP expression in the brain

Exposure

- 900 MHz, microwaves
- PW pulsed wave, mobile communications, digital mobile phone, GSM
- co-exposure

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Parameters</th>
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<tbody>
<tr>
<td>Exposure 1: 900 MHz</td>
<td>power: 1 W (output power)</td>
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<tr>
<td>Modulation type: pulsed</td>
<td>power: 192.67 mW maximum (178.37 - 192.67 mW mean absorbed power with PT)</td>
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<tr>
<td>Exposure duration: continuous for 2 h</td>
<td>power: 202.33 mW maximum (189.41 - 202.33 mW mean absorbed power without PT)</td>
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<tr>
<td></td>
<td>SAR: 1.44 W/kg mean (brain) (1.32 - 1.44 W/kg with PT)</td>
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<tr>
<td></td>
<td>SAR: 1.38 W/kg mean (brain) (1.35 - 1.38 W/kg without PT)</td>
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<tr>
<td></td>
<td>SAR: 1.62 W/kg peak value (1 g) (1.48 - 1.62 W/kg in the brain with PT)</td>
</tr>
<tr>
<td></td>
<td>SAR: 1.55 W/kg peak value (1 g) (1.52 - 1.55 W/kg in the brain without PT)</td>
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<tr>
<td></td>
<td>SAR: 0.81 W/kg mean (whole body) (0.74 - 0.81 W/kg with PT)</td>
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<tr>
<td></td>
<td>SAR: 0.78 W/kg mean (whole body) (0.76 - 0.78 W/kg without PT)</td>
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<tr>
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<td>SAR: 4.47 W/kg peak value (1 g) (4.09 - 4.47 W/kg in the body with PT)</td>
</tr>
<tr>
<td></td>
<td>SAR: 4.28 W/kg peak value (1 g) (4.19 - 4.28 W/kg in the body without PT)</td>
</tr>
</tbody>
</table>

Exposed system:

animal
rat/Sprague-Dawley
whole body

Methods

Endpoint/measurement parameters/methodology

- molecular biosynthesis: c-fos expression (in cortical structures (neocortex including somatosensory areas such as motor cortex and parietal somatosensory cortex; paleocortex including olfactory areas such as piriform cortex and primary sensory and integrative entorhinal cortex) and subcortical structures (hippocampal areas: dentate gyrus, CA1, CA3)) and GFAP expression (only after three days) in the brain (immunohistochemistry; microscopy)
Main outcome of study (acc. to author)
The data revealed that c-fos expression and glial markers were triggered by the combined stress of non-thermal mobile phone exposure and the toxic effect of picrotoxin on cerebral tissues:
90 minutes after exposure high levels of c-fos expression were recorded in the neocortex and paleocortex along with low hippocampus activation in picrotoxin treated animals. Most brain areas, except the piriform cortex, showed important increases in neuronal activation 24 h after exposure and picrotoxin administration. Three days after picrotoxin treatment, exposure effects were still apparent in the neocortex, and the hippocampal structures (dentate gyrus and CA3), but a significant decrease in activity was found in the palaeocortex structures (piriform cortex and entorhinal cortex). During this time, glial reactivity increased in brain regions of irradiated, picrotoxin-treated animals.
The findings suggest the need for further examination of the effects of mobile telephone exposure on epileptic patients.

Study character: medical/biological study, experimental study, full/main study, blind study

Study funded by
- Xunta de Galicia, Spain
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