

STUDIES ON THE POSSIBLE EFFECTS OF HIGH POWER MICROWAVES ON THE CENTRAL NERVOUS SYSTEM

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In several studies biological effects of electromagnetic field exposure have been reported. The majority of these studies have been performed at levels of exposure that could produce substantial heating. In this study we have focused on the possible effects of nonthermalizing, high power microwave (HPM) pulses. Adult male rats were anaesthetised and placed in an anechoic chamber. Additional experiments with female pregnant rats (gestation days 7-14) were performed in order to detect possible teratological changes. A horn antenna was used as a transmit-antenna, which generates the electromagnetic fields (EMF), inside the chamber. The anaesthetised rats were placed at a distance from the antenna where the incoming wave was approximately that of far field. The antenna were feed by a radio frequency (RF) power generator, which delivers 1.6 GHz pulses with pulse duration of 0.55 microseconds and a magnitude of 10 kW. The spacing between the pulses was 3.3 ms. With this duty cycle ($1.667 \cdot 10^{-4}$) the average power fed to the antenna was 0.821 W. At the exposure area the electrical field strength during the pulses was equal to 1783 V/m, which gives a power density in the pulses of 8435 W/m^2 . The average power density is then 1.41 W/m^2 (0.141 mW/cm^2). The rats were exposed for 1-15 minutes. After a survival of 1 - 10 days the animals were killed and the was rapidly dissected out and fresh frozen on dry ice. Brains from sham-exposed rats were used as controls. Rat pups were killed at (gestration day 18). Cryostat sections from these specimens were incubated with antibodies to tenascin, neuropilin 1 and 2, VEGF, MAP-2, GFAP, Bcl-2, Cox-1 and Cox-2 or with relevant complimentary oligoprobes for in situ hybridization histochemistry. The sections will be finally examined in the light microscope. Some sections will also be analysed for the presence of DNA fragmentation, typical for apoptotic cells. In some of the exposed rats, and in two control rats, the function of the BBB was assessed with intravenous injections of horseradish peroxidase (HRP; type II, 200mg/kg bw; Sigma, Sweden). The HRP was allowed to circulate for 15 minutes after the HPM exposure. The vascular system of the rats were then perfused with phosphate buffered saline followed by 2% glutaraldehyde. Sections from several regions of the brain and the spinal cord were prepared with a cryostate and the HRP was visualized using Hanker's histochemical technique. The sections were examined in the light microscope. HRP could be detected associated to blood vessel walls and outside the blood vessel walls in regions lacking the BBB, e. g. the area postrema. However, no evidence for a disruption of the BBB could be detected in the rats exposed to HPM. Further experiments are on their way.