Studies of Pulsed 900/1800 MHz RF-Fields on the Permeability of the Blood-Brain Barrier in Rats

Department of Radiation Physics, and Division of Experimental Neurooncology, Department of Neurosurgery; Lund University Hospital, SE-221 85 Lund, SWEDEN

Abstract: No indication of increased brain tumour growth in rats exposed to electromagnetic fields, while increased blood-brain barrier permeability of albumin has been recorded in rats exposed to electromagnetic fields used in wireless communication.

INTRODUCTION

The effects of RF electromagnetic fields upon the blood-brain barrier (BBB) and upon tumour growth in the mammalian brain have been studied since 1980's in our laboratory. We have thus collected an extensive experimental experience in this field. Our studies on the effects of pulse-modulated microwaves at 915 MHz upon brain tumour growth have not disclosed any growth-promoting effects in our rodent models [1]. The same RF electromagnetic fields have been revealed to cause significantly increased leakage of albumin through the BBB of exposed rats as compared to non-exposed animals - in a series of more than one thousand [2]. Follow-up studies have been made with real GSM-900 and GSM-1800 exposures.

EXPOSURE EQUIPMENT

Rectangular coaxial transmission lines in form of TEM-cells as shown if Figure 1 are used for studies on the biological effects of plane wave RF electromagnetic fields exposures up to 1 GHz. Exposures at higher frequencies are performed in an anechoic chamber, which simulates a free-space environment at microwave frequencies. The size of our chamber is chosen such that it can be used for far field exposures at frequencies over 1.5 GHz as well.

RESULTS

The brains were perfused with saline for 3-4 minutes, and thereafter perfusion fixed with 4% formaldehyde for 5-6 minutes. Whole coronal sections of the brains were dehydrated and embedded in paraffin and sectioned at 5 μm. Albumin and fibrinogen were demonstrated immunohistochemically and classified as normal versus pathological leakage. In Figure 2 is shown a normal unexposed brain. After exposure to microwaves albumin leak into the brain tissue and is demonstrated as brown areas around the vessels as shown in Figure 3. The most remarkable observation in our studies is the fact that SAR values lower than 1 mW/kg give rise to a more pronounced albumin leakage than higher SAR values Figure 4. If the reversed situation were at hand, we feel that the risk of
CONCLUSION

We have demonstrated that microwave exposure produces an unequivocal effect on the BBB in Fischer rats. The clinical importance of this finding, however, is disputable. Our method for detection of albumin is extremely sensitive and reveals even minute amounts of albumin leaking through the BBB, so small that they may be harmless to the brain. However, the potential health hazards of the opening the BBB during exposure to wireless communication demands further investigation.

It cannot be excluded that the increased permeability of BBB may promote the development of autoimmune and neuro-degenerative diseases, and we conclude that the suppliers of mobile communication – and our politicians – have an extensive responsibility to support the exploration of these possible risks for the users and the society.

REFERENCES