MRS monitoring of the effects of mobile phone use on the brain

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INTRODUCTION

Mobile phones have revolutionized communications throughout the world and become incontestably a mainstream utility. The possible health consequences resulting from the interaction of radiofrequency (RF) fields involved in mobile phone use and the human body tissues is disputed in the literature (1,2) and debate continues within the scientific community especially concerning brain tumor induction. Due to the close proximity of the mobile phone device to the head, the brain is exposed to relatively high specific absorption rates (SAR), and almost 80% of the power of the microwave radiations cross the brain and is absorbed by the head of the user (3). This study was designed to take advantage of the possibility of observing early effects of the use of mobile phones on the brain of long term extensive users by magnetic resonance spectroscopy (MRS). Spectra of the most exposed brain regions were compared between users and nonusers and between the exposed and contralateral brain regions to monitor metabolite changes.

METHODS

Two groups of subjects were recruited for this study: a group of 21 mobile phone users (age range = 20-54 years; average, 36.3 years) and a control group of 15 subjects having never used a mobile phone (age range = 20-50 years; average, 32.1 years). Mobile phone users had been using their mobile phone for a period of 2 to 10 years (average, 5.5 years) for estimated daily periods ranging between 1 to 4 hours. Proton magnetic resonance spectra were obtained at 1.5 T from 2 x 2 x 2 cm^3 voxels located close to the two areas most irradiated by the antenna of the mobile phone: the temporal lobe on the side where the mobile phone is usually held by the user and the pontobulbar area (Figure 1). As a control, spectra were recorded in a voxel in the contralateral left temporal lobe. The excitation was performed using the GE PROBE protocol using the PRESS pulse sequence with the following acquisition parameters: TR = 1500 ms; TE = 30 ms; number of acquisitions = 192; spectral width = 2000 Hz; number of points = 1024; total acquisition time per voxel = 6.6 min. Quantitation of NAA, Cho, Cr and mI metabolites was performed using the LCModel software. Metabolite ratios were compared between the mobile phone users and the nonusers and between the left and right temporal voxels using Student's t tests with a threshold value of $p < 0.05$ for statistical significance.

RESULTS

Average values of the NAA/Cr, Cho/Cr and mI/Cr metabolite ratios for the mobile phone users and for the control subjects are presented in Table 1. All metabolite ratios were practically identical between mobile phone users and nonusers and no statistically significant changes could be calculated in the right temporal and pontobulbar areas. In addition, the comparison between the exposed right temporal area and the contralateral left temporal area for the 21 mobile phone users did not show any statistically significant difference for any metabolite ratio.

Table 1: MRS metabolite ratios for mobile phone users and nonusers

Brain region	Metabolite ratio	Mobile phone users (n = 21)	Nonusers (n = 15)
Left temporal lobe	NAA/Cr	1.27 ± 0.12	1.24 ± 0.10
	Cho/Cr	0.26 ± 0.04	0.23 ± 0.05
	mI/Cr	0.83 ± 0.14	0.81 ± 0.12
Right temporal lobe	NAA/Cr	1.29 ± 0.15	1.32 ± 0.14
	Cho/Cr	0.25 ± 0.05	0.22 ± 0.06
	mI/Cr	0.80 ± 0.15	0.78 ± 0.13
Pontobulbar region	NAA/Cr	2.01 ± 0.32	2.00 ± 0.42
	Cho/Cr	0.54 ± 0.08	0.56 ± 0.10
	mI/Cr	1.23 ± 0.27	1.30 ± 0.30

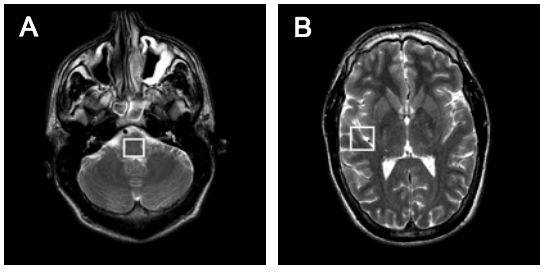

Figure 1. MR images of the brain showing the location of the regions of interest (ROIs, 2 x 2 x 2 cm^3) selected for the ^1H MRS experiments in the (A) pontobulbar region and (B) right temporal lobe.

DISCUSSION

The present results do not demonstrate changes in the MRS-detectable metabolite levels for extensive mobile phone users relative to nonusers or between the exposed brain region and its contralateral region. It remains possible that such effects exist in a very low proportion of users as has been reported in some epidemiological cancer studies or that the effects are below the detection level of the MRS technique.

References

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