A Technical Report on the Effect of Electromagnetic Radiation from a Mobile Phone on Mice Organs

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To The Editor: Exposure to electromagnetic radiation (EMR) from mobile phones can cause detrimental effects on cell function, chromosomal aberrations, and tissue injuries [1-6]. The rapid expansion of mobile phones has lead to widespread concern for their safety. We examined the histopathological effects of direct exposure to this EMR from mobile phones in adult male Swiss albino mice. The animals were obtained from the biotechnology center, Tripoli, Libya, weighing from 25-30 grams, aged 10-12 weeks. The experiments were approved by state authorities and fol¬lowed guidelines of Egyptian law for animal protection.

Mice were fed standard diets and water ad libitum. Plastic cages (diameter 45 cm by 11 cm height) were designed for this work. The roof of the cage was designed to receive the mobile phone from a distance of about 10 cm from the cage floor [7]. EMR was emitted from the Nokia 1112 device with a dimension of 104×44×17 in connection with Libyan network (Misurata, Libya). The distance between phone and mice was about 10 cm. The GSM mobile phones operate with microwave carrier frequencies in the GHz range (850–1900 MHz) [8-10].

Mice were divided into three groups. Group one was the control group (n=5) with mice unexposed to the mobile phone. Group two (n=5) were mice exposed for 1 hour every day for ten days while the cell phone was in answering state. Group three mice (n=5) were exposed for 12 hours per day while the cell phone was in standby state. Small pieces of liver, kidney and spleen were fixed in 10% buffered formalin for histological examination. These tissues were dehydrated in ethanol, embedded in paraffin wax, and stained with hematoxylin and eosin. Examination of liver sections of group two showed that the interlobular areas of all examined sections were rich in inflammatory cellular infiltration (Fig. 1B), in comparison to the control group (Fig. 1A). Also, the hepatocytes appeared vacuolated and contained denser nuclei (Fig. 1B). Liver sections of group three showed more intensive inflammatory response around the central vein (Figure 1C). Hepatocytes were swollen and their cytoplasm appeared to be highly vacuolated..

All of the renal tissue sections of group two showed more mononuclear leukocytic infiltration between the renal tubules in addition to dilation of some tubules (Fig. 2B), in comparison to the control group (Fig. 2A). Also, some glomeruli were atrophied and some kidney tubules were vacuolated (Fig. 2B). Group three renal tissue sections appeared with some congested glomeruli, some vacuolated renal tubules, and some inflamed areas in between the kidney tubules (Fig. 2C).

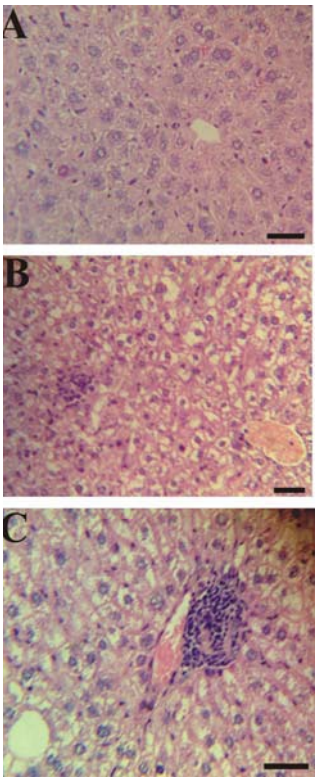

Figure 1

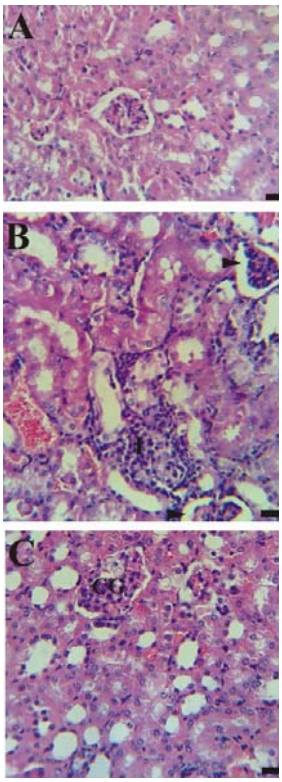

Figure 2

Figure 1. Light micrograph of the liver sections. A Control liver with central vein and surrounding hepatocytes, sinusoids lined with Kupffer cells. B EMR exposed group for 1h with interlobular inflammatory cellular infiltrations and hepatocytic vacuolation. C EMR exposed group for 12h with inflammatory cellular infiltration around the hepatic vein and hepatocytic vacuolation. Sections stained with hematoxylin and eosin, Bar ¨T 25 µm

Figure 2. Light micrograph of the kidney sections. A Control kidney with normal glomeruli and renal tubules. B EMR exposed group for 1h with some atrophied glomeruli, leukocytic infiltrations between the kidney tubules and vacuolation of some tubules. C EMR exposed group for 12h with congested glomeruli and few leukocytic infiltrations. Sections stained with hematoxylin and eosin, Bar ¨T 20 µm

Splenic tissue sections of group two revealed enlarged white pulp with increased sinusoidal spaces (Fig. 3B), when compared to the control group (Fig. 3A). Some white pulp of group three tissue sections appeared to be

fused (Fig. 3C). This disorganization was due to hyperplasia of the lymphoid tissue.

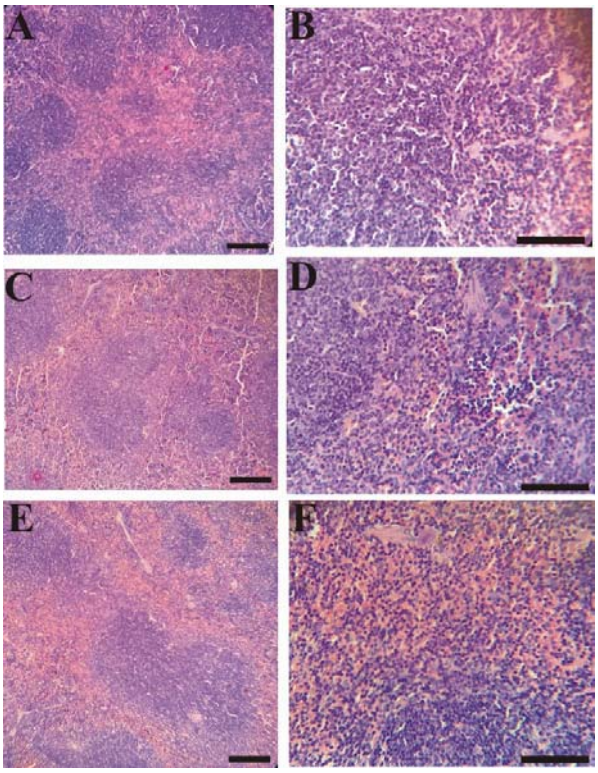

Figure 3. Light micrograph of the spleen sections. A Control spleen with normal white and red pulps. B EMR exposed group for 1h with enlarged white pulps and dilated sinusoids. C EMR exposed group for 12h with fused white pulps, dilated sinusoids and hyperplasia of splenic cells. Sections stained with hematoxylin and eosin, Bar ¨T 20 µm for A, C and E. Bar ¨T 50 µm for B, D and F.

In summary, repeated exposure to the electromagnetic radiation (EMR) emitted from mobile phones is able to induce hepatic, renal and splenic tissue damage. The degree of damage increased with time of exposure to EMR. Previously similar tissue changes have been described using lower frequency EMR [9, 11-13]. However our study was the first to expose the mobile phone itself to the animals. Extended investigations are required to establish the hazards of exposure to the EMR from mobile phones on humans.

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