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The Adverse Effects of Mobile Phone Radiation on Some Visceral Organs

Laila K. Hanafy, Sawsan H. Karam and Anisa Saleh

Histology Department, Research Institute of Ophthalmology, Giza, Egypt

Abstract: Aim: investigate the effects of mobile phone–emitted radiation on some visceral organs including; heart, lung, liver and kidney. Methods: fifteen rats were assigned to two groups, the 1st group served as control and the 2nd group exposed to mobile phone radiation daily for 4 weeks (1h/day). Results: there was a different degree of damage in these organs subsequent to mobile phone exposure. Conclusion: the results of this study suggested that mobile phone radiation leads to histological changes in the different visceral organs.

Key words: Mobile phone radiation, visceral organs.

INTRODUCTION

The widespread use of mobile phone in recent years has raised the research activities in many countries to determine the effect of the emitted electromagnetic radiation from it.

The mobile phone emitting 900-MH2 electromagnetic radiation, this emitting radiation may be absorbed by various body organs according to the places where they are carried[1,2].

Exposure to electromagnetic radiation from mobile phone can cause detrimental effects on cell function ,chromosomal aberrations and tissue injuries[3,4]. The wide spread expansion of mobile phones has lead to widespread concern for their safety.

A variety of histopathological effects has been postulated to occur because of exposure to EMR including brain, heart, kidney, lens and cornea.

In this study, we investigated the histopathological effects of mobile phone radiation on the heart, lung, liver and kidney tissues.

MATERIAL AND METHODS

Fifteen albino rats were used throughout this study and received appropriate animal care, the animals were divided into two groups (A&B). The first gr. (A) served as control where it composed of 5 rats and the 2nd gr. (B) composed of 10 rats and served as mobile phone group.

The rats of 2nd group were put in cage on were free in motion in their cage, the cage containing opened mobile phone and called intermittently (1h/day for 4 weeks). During the study, all the animals including the control group were fed on a laboratory diet and water ad libitum.

At the end of the study period, the animals were sacrificed under anaesthesia and their heart, lungs, liver and kidney were dissected into small strips.

The specimens were immediately fixed in 4 % formalin solutions for 24 h and embedded in paraffin. Then tissues were sectioned at 5µm, stained with H&E and examined for histopathological changes using light microscope.

RESULTS AND DISCUSSION

Cardiac muscle: light microscopic examination paraffin section of cardiac muscle of control group showed normal muscle fibers with centrally located nuclei on the myocytes (Fig. 1a). The cardiac muscle of exposed rats exhibited congestion of dilated blood vessels and extravasation of RBCs. In addition, disruption of few fibers was observed (Fig. 1b).

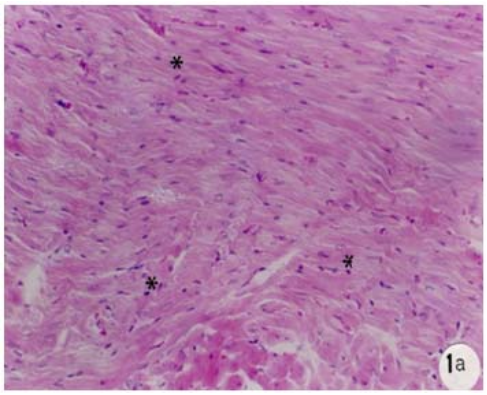

Fig. 1a: Photomicrograph of control rat cardiac muscle. Note normal muscle fibers with centrally located nuclei on the myocytes(*). (H&E. x 250).

Corresponding Author: Sawsan Karam, Histology Department, Research Institute of Ophthalmology, Giza, Egypt. E-mail: sawsanhisto@yahoo.com

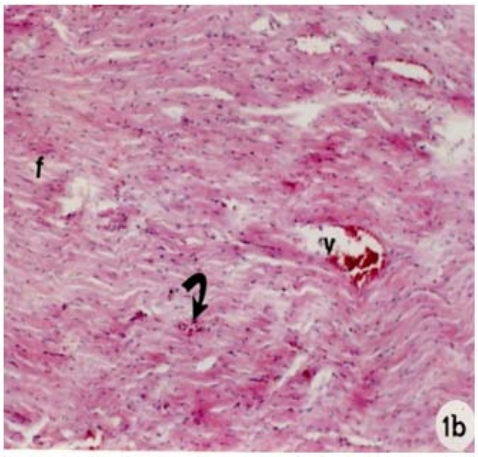

Fig. 1b: Photomicrograph of exposed rat showing cardiac muscle with congestion of dilated blood vessels and extravasation of RBCs (arraw). Note also disarray of few fibers (F). (H &E. x 250).

Lung: histological examination of the lung from the control rats showed normal appearance of alveoli. Alveoli were lined with alveolar epithelium and are separated from one another by the intercellular septa (Fig. 2a). The lung sections from rats exposed to mobile phone revealed severe disruption of interalveolar septa in some cases while mild congestion and extravasation were noted in another one (Fig. 2b).

Examination of other section from the same group showed severe thickening of alveolar walls, which were infiltrated by inflammatory cells and extravasated RBCs (Fig. 2c).

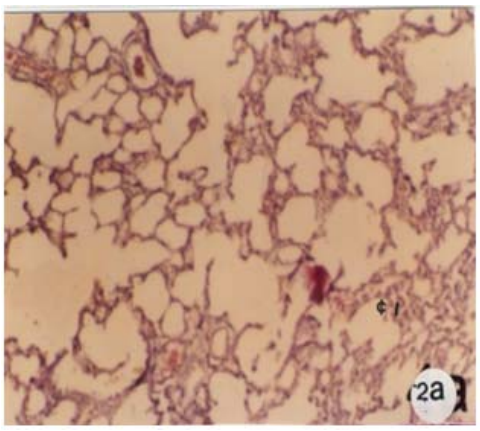

Fig. 2a: Photomicrograph of control rat lung. Alveoli are lined with alveolar epithelium and are separated from one another by the intercellular septa («). (H&E. x 250).

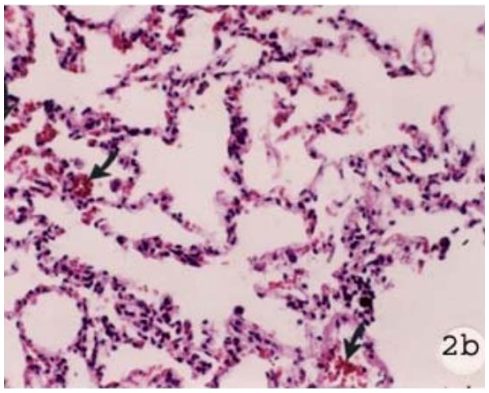

Fig. 2b: Photomicrograph of exposed rat lung showing severe disruption of interalveolar septa. Note mild congestion and extravasation (arraws). (H&E. x 250).

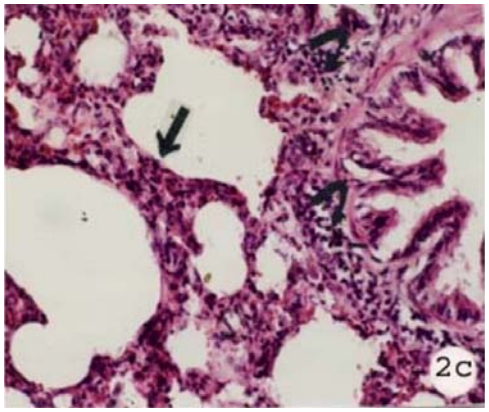

Fig. 2c: Photomicrograph of another exposed rat lung showed severe thickening of alveolar walls(large arraw) inflammatory cells (small arraw) (H&E. x 250).

Liver: sections of control liver (gr.A) showed central vein with radiating cords of liver cells (Fig. 3a). These cells had vesicular nuclei and granular cytoplasm. Sinusoids were evident between the cords. In the section from the exposed group, although the hepatic cytoarchitecture was almost normal, liver sections exhibited congestion of the sinusoids and the central vein (Fig. 3b).

Kidney: histological examination of the kidney from control group kidney showed normal appearance of glomeruli tubules and interstitial tissues (Fig. 4a). However, the kidney sections from the exposed group revealed extravasation of blood cells between the tubules together with signs of atrophy of few glomeruli (Fig. 4b).

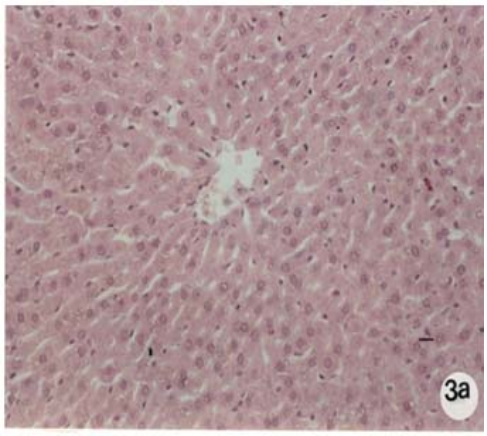

Fig. 3a: Photomicrograph of control rat liver showing central vein with radiating cords of liver cells and sinusoids were evident between these cords. (H&E. x 250).

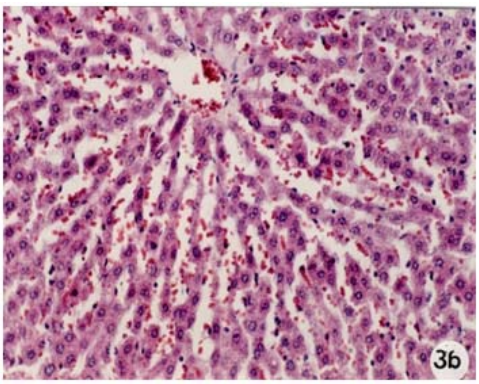

Fig. 3b: Photomicrograph of exposed rat liver. The hepatic cytoarchitecture is almost normal, Note, congestion of sinusoids and central vein. (H&E. x 250).

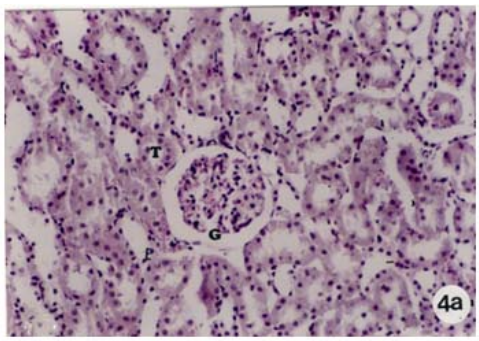

Fig. 4a: Photomicrograph of control rat kidney showing normal appearance of glomeruli(G) tubules (T) and interstitial tissues. (H&E. x 250).

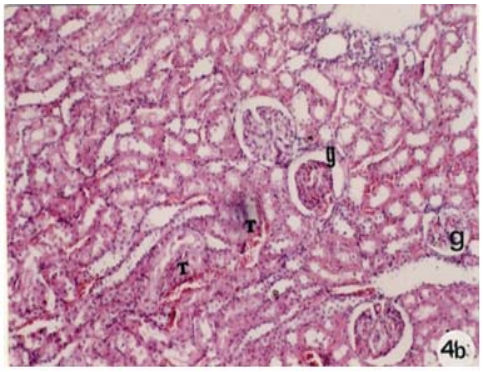

Fig. 4b: Photomicrograph of exposed rat kidney showing extravasation of blood cells between the tubules (T). Note, signs of atrophy of few glomeruli (g). (H&E. x 250).

Discussion: The increased use of MP by the public is associated with aware of contradictory reports about the possible health hazards due to the exposure of the users to electromagnetic radiation (EMR). This study aimed to investigate the histological effects of exposure to MP on some tissues.

In past studies, the disruption of oxidant / antioxidant balance in various tissues exposed to MP has been shown in experimental studies[5,6,7].

In biological systems affected by EMR, the mechanisms of tissues damage were thought to involve reactive oxygen species (ROS). With excessive free radical production and the resulting consumption of antioxidant, endogenous defense mechanisms could become insufficient. These free radicals lead to damage of large cellular molecules such as lipids, proteins and nucleic acid[8].

Recent studies have shown an increasingly important role for oxidative stress in the pathogenesis of a number of pathological entities including inflammation[9], AIDS[10], atherosclerosis[11], multiple sclerosis[12] and carcinogenesis[13].

Atilli lihan *et al*.[14] proved the MP oxidative damage biochemically by increasing the level of malondialdehyde (MDA, an index of lipid peroxidation), and nitric oxide (No, a marker of oxidative stress). In addition the level of super oxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GP) which are indicative of antioxidant status (which are free radical scavengers) were reduced. The cytotoxicity of free radical is related to the ability of these molecules to the oxidize cell constituents particularly lipids and/or nucleic acids.

The destruction of the cell membrane (which its main constituents is lipid) showed in the study most probably as a result of lipid peroxidation caused by

mobile phone electromagnetic wave. Also, in the present study, the extravasated blood elements was appeared. This may be explained as a result of disruption of the blood capillaries walls.

In agreement with our study, MP induced heart tissues damage, these damage may be due to the MP are used in close proximity to the heart, therefore, EMR emitting MP may be absorbed by the heart[1]. Lung, related effects of MP use have not yet been elucidated. In the current study, there was disruption of the interaliveolar septa in addition to inflammatory cellular infiltration, extravasations of blood cells and congestion of blood vessels. In addition, company *et al*.[15], suggested that the lipid peroxidation cause significant increase in both renal and hepatic function testis.

Previously, it was reported that the mobile phone electromagnetic radiation may be mainly absorbed by the kidney because they are often carried in belts[2], they reported that the mobile phone induced renal impairment in rats and using of melatonin (as antioxidant) may exhibit a protective effect against this impairment.

Similarly, Ozguner *et al*.[7] found that the mobile phone radiation caused renal tubular injury and by using melatonin and caffeic acid phenethyl ester (CAFE) prevent this injury by reducing oxidative stress and protect kidney from oxidative damage induced by mobile phone radiation.

In consonant with present study, Al-Glaib *et al*.[16] supported the biochemical results of company *et al*.[15] and was in accordance to the current study. They described interlobular inflammatory infiltration and hepatic vacuolation leucocytic infiltration between the tubules in the liver, in addition to dilatation of some tubules was seen in kidney tissue.

In conclusion, this study was a trial to correlate and explain the past biochemical changes of MP and the histopathological changes of some tissues investigated in this research.

Due to the hazardous effects of mobile phone, we suggest more studies on other tissues and try natural protective drugs to avoid these dangers.

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