



Effects of Mobile Phone-Derived Electromagnetic Fields on Some Thrombocytopoiesis Parameters in Experimental Animals



Valery Pogorelov M*

Department of industrial and clinical transfusion, Russia

*Corresponding author: Valery M Pogorelov, Department of industrial and clinical transfusion, Moscow, Russia

Submission: 📅 November 29, 2018; Published: 📅 December 06, 2018

Editorial

The electromagnetic radiation radiotelephone, as other sources of electromagnetic fields (EMFs) may have a deleterious effect on human health. In this regard, the effects of EMFs in humans and animals need to be examined as in the clinic and in the experiment. Curcio [1] have been reviewed and discussed the most relevant studies on regarding effects of mobile phone-derived EMFs on human cognition [1]. This mini review allows to conclude that there is a substantial lack of evidence about a negative influence of non-ionizing radiations on attention functioning. Nonetheless, published literature is very heterogeneous under the point of view of methodology (type of signal, exposure time, blinding), dosimetry (accurate evaluation of specific absorption rate or emitted power), and statistical analyses, making arduous a conclusive generalization to everyday life. For example, Thakare & Utane [2] highlighted the effect of EMFs exposure on human health: causes an increase in the production of free radicals, neuronal damage in the central nervous system prenatal and early adult, a significant increase in fetal abnormalities and spontaneous abortions in pregnant, reduces mobility and changes the morphology of isolated sperm cells [2].

Besides, Usman et al. [3], Sani et al. [4] showed that long time exposure of EMFs in experimental animal's might pose detrimental effects to liver, blood cells and their functions; however, there are effects of different frequencies of EMFs on the blood and blood formation in animals' contradictory [3,4]. In early experiments with male rats Trosic et al. [5] noted an increase in the number of circulating red and white blood cells under the influence of EMFs [5]. There was not conclusive evidence on the effects of EMFs on thrombocytopoiesis. Singh et al. [6] linking EMFs effect in rats with reduced oxygen-binding ability of hemoglobin, i.e. hypoxia and not excluding the contribution to it of kidney damage, still assumed that radiation affects blood clotting and affects the bone marrow hematopoiesis animals [6]. Babaei et al. [7] have experimentally demonstrated that the timing of 10-14 days (formation of the liver) and 17-21 days (start of embryonic hematopoiesis) finding pregnant female mice to EMFs (50 Hz), the number of megakaryocytes in the liver of embryos insignificantly ($p=0.10$) decreased [7].

At the same time, Hashem & El-Sharkawy [8], repeatedly (at 4 hours per day) for 30 days EMFs affecting (50 Hz, 2 MT) 6-week healthy mice (Swiss albino), registered leukocytosis with neutrophilia and lymphocytosis, monocytosis as well as a significant increase in red blood cells, hemoglobin concentration, hematocrit value and platelet count [8]. Based on the fluorescence of the stained cells scatterogram new optical platelet count methods, allow considering as normal, immature (reticulated) and giant platelets, to distinguish them from the "noise" or other cells [9]. The ratio of platelets to fluoresce red cell count, the total number of platelets, can be used when calibrating the impedance analyzer, as does not depend on artifacts pipetting or dilution and has a high reproducibility and precision ($CV<5\%$). A new automated method to reliably quantify reticulated platelets (RPs), expressed as the immature platelet fraction (IPF), has been developed utilizing the XE-2100 blood cell counter with upgraded software (Sysmex, Kobe, Japan).

For example, IPF as a percentage of total platelet count has been examined as a diagnostic tool to differentiate aplastic and consumptive thrombocytopenic states [10]. Interestingly, the changes in the morphology of platelets allowed Bessis [11] at the time to connect the appearance in the peripheral blood of platelets with regenerative bone marrow response and forced thrombocytopoiesis [11]. That is what led to the need for their research in the blood of experimental animals. It turned out that the conditions for the implementation of reserves thrombocytopoiesis by RPs in rats or dogs are due to thrombocytopenia (platelet consumption) and increasing the synthesis of thrombopoietin stimulates the production of new platelets [12,13]. The goals of Smith & Thomas [14] study were to establish a reproducible method to quantitate RPs in dogs, to establish a reference interval for RPs percentages in healthy dogs, and to determine whether the percentage of RPs was nonspecifically increased in nonthrombocytopenic dogs with clinical disease [14].

A blood samples stained with Thiazole Orange (TO) and a phycoerythrin-labeled monoclonal antibody to platelet CD61, then

analyzed by flow cytometry. The coefficients of variation were 7.8% to 15.6% (intra-assay precision) and 6.1% to 19.5% (inter-assay precision). The reference interval for RPs in the healthy control group was 0-4.3% (0-12,095/microL). No significant differences were found in the mean percentage of RPs or absolute concentration of RPs between control and affected dogs. These studies demonstrate a reliable, noninvasive diagnostic assay for measurement of RPs in whole blood and provide a baseline for assessment of the clinical utility of the assay. So, it was experimentally found that the frequency of RPs-sensitive, having an advantage over other platelet parameters thrombocytopoiesis control test animals. In experiments with non-ionizing radiation, in contrast to the above items, Singh et al. [6] taking blood from retro-orbital area male rats for 30 days animals receiving distilled water treated with EMFs (50Hz, 51.2mkL/36.2ICB) revealed thrombocytosis, thus confirming the powerful impact of electromagnetic waves on the blood [6].

In our experiments in rats was not thrombocytopenia also; conversely, in the blood samples of the irradiated animals demonstrated an increase in total number of platelets, and at a decreased proportion of immature platelets were positively correlated with count platelet at all points of the study [15]. Therefore, we cannot assume that the EMFs in the frequency ranges given us radio waves activates thrombocytopoiesis rats. However, it should be borne in mind that RPs circulate in peripheral blood for 24-36h [16], whereas we evaluated their content on days 12 and 28 of the experiment. At the same time, it is known that in rat's experimental thrombocytosis does not occur due to the activation of thrombocytopoiesis: after splenectomy, for example, the number of platelets in the blood of animals increases due to the redistribution of these cells [17].

Perhaps in our case, the rats exposed to EMFs had platelet exit from the depot: a significant ($p < 0.05$) weight loss of the spleen. According to Bentfeld et al. [18] platelets secrete lysosomal enzymes in the early stages of thrombus formation: the reaction product is determined in a diffuse form in almost all platelets [18]. Polasek [19] concluded that acid phosphatase is associated with procoagulant platelet activity [19]. From the results of our experiment, it follows that the proportion of platelets containing acid phosphatase in the blood of rats at the end of radiation did not depend on the exposure time and significantly ($p < 0.05$) increased compared with the control: from $12.0 \pm 1.3\%$ to $13.0 \pm 1.2\%$ versus $8.0 \pm 0.7\%$. However, in our case, this may not be related to the EMFs, but is a consequence of the methodological features of the study: the decapitation procedure itself increases the hemostatic activity of the spleen of platelets and accelerates blood coagulation.

Thus, the results obtained in experiments showed that the radiotelephone of electromagnetic radiation (selected EMF ranges) do not affect thrombocytopoiesis: RPs in animals' blood decreases when the total number of circulating platelets increases. In this regard it is important that in acute blood loss in experimental animals [20], as well as in plateletpheresis in humans

[21], thrombocytopenia (real or relative) is accompanied by an increase in RPs. In contrast, γ -irradiation of rats in the experiment, apparently differing fundamentally from non-ionizing radiation of a radiotelephone, suppresses the formation of platelets in the bone marrow and their hemostatic activity in peripheral blood: the total number of platelets, the number of RPs, and the activity of acid phosphatase in the cells fall [22,23].

References

- Curcio G (2018) Exposure to mobile phone-emitted electromagnetic fields and human attention: No evidence of a causal relationship. *Frontiers in Public Health* 6(42): 1-12.
- Thakare NS, Utane AS (2018) Effect of exposure of high frequency electromagnetic field on human health: A review. *Int J of Adv Res Electron Commun Engineer (IJARECE)* 7(1): 45-49.
- Usman AD, Wan AWF, Kadir MZA, Mokhtar M, Ariffin R (2012) Microwave effect of 0.9 GHZ and 1.8 GHZ CW frequencies exposed to unrestrained swiss albino mice. *Progress in Electromagnetics Research B* 36: 69-87.
- Sani A, Labaran MM, Dayyabu B (2018) Effects of electromagnetic radiation of mobile phones on hematological and biochemical parameters in male albino rats. *Eur Exp Biol* 8(2): 1-5.
- Trosic I, Matausic PM, Radalj Z, Prilic I (1999) Animal study on electromagnetic field biological potency. *Arh Hig Rada Toksikol* 50(1): 5-11.
- Singh M, Garbyal RS, Singh KP, Singh UP (2003) Effect Of 50-Hz-Powerline-Exposed Water on Hematological Parameters in Rats. *Electromagnetic Biology and Medicine* 22(1): 75-83.
- Babaei S, Bayat P, Rafiei M (2009) Population in NMRI mice fetus exposed to electromagnetic field. *Iranian Red Crescent Med J (IRCJM)* 11(3): 271-276.
- Hashem MA, El Sharkawy NI (2009) Hemato-biochemical and immunotoxicological effects of low electromagnetic field and its interaction with lead acetate in mice. *Iraqi J Veterinary Sci* 23(1): 105-114.
- Harrison P (2000) Progress in the assessment of platelet function. *Br J Haematol* 111(3): 733-744.
- Briggs C, Kunka S, Hart D, Oguni S, Machin SJ (2004) Assessment of an immature platelet fraction (IPF) in peripheral thrombocytopenia. *Br J Haematol* 126(1): 93-99.
- Bessis M (1972) *Living blood cells and their ultrastructure*. Springer-Verlag, Berlin, Germany, p. 210.
- Pankraz A, Ledieu D, Pralet D, Provencher BA (2008) Detection of reticulated platelets in whole blood of rats using flow cytometry. *Ex Toxic Pathol* 60(6): 443-448.
- Pankraz A, Bauer N, Moritz A (2009) Comparison of flow cytometry with the Sysmex XT2000iV automated analyzer for the detection of reticulated platelets in dogs. *Vet Clin Pathol* 38(1): 30-38.
- Smith R, Thomas JS (2002) Quantitation of reticulated platelets in healthy dogs and in nonthrombocytopenic dogs with clinical disease. *Vet Clin Pathol* 31(1): 26-32.
- Pogorelov VM, Ivanova LA, Fesenko MA, Dvernik VN, Vasileva EA et al. (2013) Effects of electromagnetic fields exposure of adult male rats on some thrombocytopoiesis parameters: An initial study. *Russian Open Sci Bull* 195: 94-104.
- Ault KA, Rinder HM, Mitchell J, Carmody MB, Vary CP et al. (1992) The significance of platelets with increased RNA content (reticulated platelets). A measure of the rate of thrombopoiesis. *Am J Clin Pathol* 98(6): 637-646.

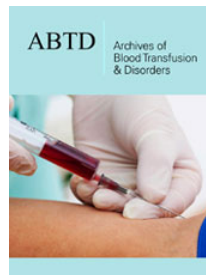
17. Kuo YR, Yang KD, Yang MY, Huang MN, Lin CW, et al. (2002) Reactive thrombocytosis alone does not affect the patency of microvascular anastomosis in the splenectomy rat. *Plast Reconstr Surg* 110(3): 812-817.
18. Bentfeld ME, Bainton DF (1975) Cytochemical localization of lysosomal enzymes in rat megakaryocytes and platelets. *J Clin Invest* 56(6): 1635-1649.
19. Polasek J (2009) Platelet lysosomal acid phosphatase enzyme activity as a marker of platelet procoagulant activity. *Blood Transfus* 7(2): 155-156.
20. Ingram M, Coopersmith A (1969) Reticulated platelets following acute blood loss. *Br J Haematol* 17(3): 225-229.
21. Pogorelov VM (2018) Immature platelet fraction as a thrombopoietic index in donor's plateletpheresis. *J Blood Disord Symptoms & Treat* 2(2): 1-15.
22. Soliman MS, El Shamy E, Tawfik SS (2005) Flow cytometric analysis of platelets changes in rats after whole body gamma irradiation. *Egypt J Rad Sci Appl* 18(1): 147-159.
23. Hafez MN, El Gawish MA, Mohamed FA, Hussien FM (2006) Physiological and histological studies on glucan as modulator of hazardous effects in rats treated with cyclophosphamide and exposed to γ -radiation. *Egypt J Hosp Med* 23(1): 333-352.



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