



Research Article

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Stratification of Risk Factors for the Development and Progression of Multi-Organ Pathology in Individuals Professionally Associated with Electromagnetic Radiation of Radio Frequency Range

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Abstract

A comprehensive survey involving 113 individuals with direct and prolonged professional exposure to Electromagnetic Radiation of the Radio Frequency Range (EMR-RF) was conducted, taking into account the duration of their exposure (categorized into five groups). The study aimed to evaluate the extent of the detrimental impact of this radiation on various organs and tissues of the body by analyzing the ratio of Antigen-Binding Lymphocytes (ABL) to Tissue Antigens (TA) in these tissues. The findings revealed significant multi-organ disorders in individuals with direct and continuous professional exposure to EMR-RF, with the degree of tissue destruction being influenced by the duration of EMR-RF exposure and the specific characteristics of the affected tissues. The ABL to TA ratio observed in the examined organs could serve as an early criterion for predicting the development of complications and outcomes associated with Multi-Organ Pathology (MOP). Moreover, it could guide the strategic approach to managing these patients.

Keywords: Electromagnetic radiation of radio frequency range (emr-rf), Antigen-binding lymphocytes (abl), Tissue antigens (ta), Degree of destruction, Risk factors for multi-organ pathology (mop)

Introduction

As is well-known, the human body is susceptible to various environmental factors that can lead to functional and, at times, organic damage to organs and tissues [1]. Among the factors influencing the human body, particular emphasis is placed on those capable of exerting prolonged and cumulative effects. Electromagnetic wave exposures fall into this category, particularly the rapidly advancing field of Electromagnetic Radiation of Radio Frequency Range (EMR-RF). According to the majority of researchers, prolonged exposure to EMR-RF can result in a spectrum of effects, ranging from mild

functional disturbances to severe and irreversible disorders in various organs and systems of the body [2-7].

Prolonged and intense exposure to EMR-RF may lead to the development of dystrophy in various organs and tissues [8-12]. The increasing degree of dystrophy contributes to the destruction and necrosis of cells. In the process of degeneration, breakdown products of tissues enter the bloodstream. Acting as molecules or fragments of structural and non-structural proteins, possessing organ specificity, and being "foreign" to the internal environment of



the human body, they acquire the status of Tissue Antigens (TA), triggering an immune reaction aimed at their neutralization and elimination [2-5,13]. In clinical practice, indicators of Antigen-Binding Lymphocytes (ABL) to TA of various organs are used for early prognosis, diagnosis, and assessment of the severity of degenerative and destructive lesions in organs and systems of the body in infectious and non-infectious pathology [3].

As described in existing literature, the areas of EMR-RF application extend to various organs: liver, kidneys, brain tissue, glands of internal secretion (especially adrenal glands and thyroid gland), and multiple segments of the cardiovascular system [3,7,14,15]. Determining the increasing ratio of ABL to TA of target organs under the influence of EMR-RF allows for evaluating the intensity of their damage with exposure to different doses and durations of EMR-RF and developing algorithms for preventive and therapeutic measures for individuals professionally associated with this radiation.

Based on available literary data, which suggests that the norm

for the ABL to TA ratio should not exceed 2%, we collaborated with G.A. Tashpulatova from the Research Institute of SG and PZ of the Ministry of Health of the Republic of Uzbekistan to compile a table for assessing the increasing levels of ABL. We categorized them by degrees of destruction

- 0 degree of destruction-up to 2%
- 1 degree (minimal destruction)-from 2% to 4%
- 2 degrees (moderate destruction)-from 4% to 6%
- 3 degrees (pronounced destruction)-from 6% to 10%
- 4 degrees (severe destruction)-more than 10%

To apply these criteria, we surveyed 113 individuals with direct professional contact with EMR-RF, taking into account their work experience in conditions of exposure to this radiation (5 groups of individuals), and assessed the degree of destructive impact of this radiation on various organs and tissues of the body (Table 1).

Table 1: Degree of Destruction of Some Organs and Tissues (in %) Depending on the Duration of Exposure to EMF-EMR (n=113).

Investigated Organs	1 st Group n=20 Experience up to 5 years % (Degree)	2 nd Group n=24 Experience 6-10 years % (Degree)	3 rd Group n=22 Experience 11-20 years % (Degree)	4 th Group n=29 Experience 21-30 years % (Degree)	5 th Group n=18 Experience more than 30 years % (Degree)
Liver	0.85±0.53 (0)	2.4±0.32 (1)	4.3±0.43 (2)	5.2±0.27 (2)	6.8±0.37 (3)
Brain	0.8±0.47 (0)	2.3±0.33 (1)	5.0±0.31 (2)	6.4±0.29 (3)	8.2±0.44 (3)
Kidneys	0.85±0.44 (0)	1.4±0.38 (0)	2.4±0.37 (1)	3.3±0.35 (1)	4.8±0.38 (2)
Adrenal Glands	0.75±0.51 (0)	2.6±0.43 (1)	3.2±0.39 (1)	5.2±0.27 (2)	7.0±0.53 (3)
Myocardium	3.40±0.35 (1)	3.53±0.29 (1)	5.9±0.45 (2)	9.1±0.32 (3)	9.3±0.52 (3)

Note*: The degree of organ and tissue destruction is indicated in parentheses, taking into account the gradation of the increasing level of ASL to TA of the specified organs and tissues: 0 degree of destruction-up to 2%; 1 degree (minimal destruction) - from 2% - to 4%; 2 degrees (moderate destruction)-from 4% to 6%; 3 degrees (pronounced destruction)-from 6% to 10%; 4 degrees (severe destruction)-more than 10%.

Table 2: Comparative Characteristics of Biochemical Indicators of Blood Erythrocytes in Examined Individuals under the Influence of EMF-EMR (n=74).

Groups	Phos. Ar Act. (cond. units)	MDA (mol/mgHb)	SOD (U/mgHb)	Catalase (mmol/mgHb)	RDE Index (U)	Lactate (IU/g Hb)
Control n=9	0.56±0.01	1.64±0.09	2.41±0.33	3.47±0.41	2.63±0.03	3.51±0.12
Group I n=12	0.58±0.06	1.69±0.12	2.55±0.18	4.06±0.24	2.44±0.17	3.54±0.23
Group II n=10	0.64±0.07	1.74±0.11	2.33±0.14	3.94±0.21	2.01±0.18*	3.96±0.23
Group III n=12	0.67±0.06*	2.36±0.14*	2.01±0.12	3.03±0.21	1.98±0.14*	4.54±0.33*
Group IV n=10	0.69±0.07*	2.94±0.24*	1.73±0.14*	3.41±0.34	1.76±0.15*	4.93±0.33*
Group V n=11	0.73±0.04*	4.51±0.31*	1.66±0.12*	3.76±0.24	1.49±0.13*	5.27±0.41*
Group VI n=10	0.74±0.02*	4.93±0.27*	1.61±0.14*	3.98±0.31	1.51±0.04*	5.84±0.23*

Note*: Significance of differences in indicators compared to the control. Cond. Units: Phos. Ar - Phospholipase-Ar; RDE-Red Blood Cell Deformability Index.

The data indicates that an increase in professional experience involving direct exposure to EMR-RF corresponds to a progression in the degree of destructive changes observed in various organs and tissues among the affected individuals. In light of this, we also

analyzed various clinical, laboratory, and biochemical indicators in the surveyed individuals to assess the extent of the impact on the body due to direct and continuous exposure to EMR-RF (Table 2).

Moreover, we assessed the condition of the cardiovascular system in this patient group based on essential protocol parameters, including the nature of metabolic processes in the myocardium, blood oxygen saturation levels, exertional and resting dyspnea, blood pressure levels, and ECG indicators, among others.

The results of the examined parameters were meticulously reviewed to identify the most informative ones, forming the foundation for the criteria table for the development of Multi-Organ Pathology (MOP) and determining the patient management strategy based on the degree of MOP (Table 3).

Table 3: Criteria for Predicting the Development of Multi-Organ Pathology in Individuals with Direct and Continuous Exposure to EMR-RF.

Criteria for MOP Development	1 point	2 points	3 points
Work Experience with EMR-RF	Less than 10 years	10-25 years	More than 25 years
Antigen-Binding Lymphocytes (ABL) to Tissue Antigens of Various Target Organs (including liver, brain, myocardium, etc.)	2% to 6%	6% to 10%	More than 10%
Integrated Indicator of Malondialdehyde (MDA) to Superoxide Dismutase (SOD) + Catalase Ratio ($N < 1$) (N - Normal Range)	1.0 to 1.2	1.3 to 1.55	≥ 1.55
Degree of Metabolic Disturbance in the Myocardium	Insignificant	Moderate	Severe
Dyspnea	During Stress Test	With Light Exertion	At Rest
Elevation of Leukocyte Intoxication Index (LII) (N: 0.3-1.5)	1.5 to 2.0	2.0 to 3.0	More than 3.0

Assessment Categories for MOP Development

- Stage 0 (Latent): 1-4 points-Risk group for MOP development, recommended periodic monitoring, and scheduled examination 1-2 times a year.
- Stage 1 (Transitory): 5-10 points-Mild degree of MOP-recommended periodic monitoring, scheduled examination twice a year, and outpatient or sanatorium-resort treatment.
- Stage 2 (Recurrent): 11-20 points-Moderate degree of MOP-recommended periodic monitoring, scheduled examination, and inpatient treatment in the therapy or professional pathology department.
- Stage 3 (Permanently Stable): 21-30 points-Severe degree of MOP-recommended examination and inpatient treatment in the department of professional pathology, with temporary suspension from professional activity, periodic monitoring, and assessment of professional suitability through Vocational and Technical Expertise Committee (VTEK).
- Stage 4 (Permanently Progressive): More than 30 points-Severe degree of MOP-recommended urgent examination and inpatient treatment in the department of professional pathology, with suspension from professional activity, periodic monitoring, and assessment of professional suitability through VTEK.

This proposed scoring method for MOP can be used to forecast and assess the severity of multi-organ pathology or the development of complications in various organs and systems of individuals at professional risk due to direct and continuous exposure to EMR-RF, guiding the management approach for these patients.

Conclusions

It has been observed that individuals with direct and continuous professional exposure to Electromagnetic Radiation of the

Radio Frequency Range (EMR-RF) exhibit pronounced multi-organ disorders affecting various organs and systems of the body. The degree of tissue destruction is influenced by the duration of EMR-RF exposure and the characteristics of the affected tissues. The ratio of Antigen-Binding Lymphocytes (ABL) to Tissue Antigens (TA) in the examined organs can serve as an early criterion for predicting the development of complications and outcomes of Multi-Organ Pathology (MOP). Additionally, it aids in choosing the management tactics for these patients.

Key Points

- Individuals with direct and continuous exposure to EMR-RF experience significant multi-organ disorders.
- The duration of EMR-RF exposure and tissue-specific characteristics influences the extent of tissue destruction.
- ABL to TA ratio in examined organs is an early predictor for complications and outcomes of MOP.
- The findings contribute to selecting appropriate management strategies for individuals professionally exposed to EMR-RF.

These conclusions underscore the importance of early diagnosis, monitoring, and developing individualized treatment approaches for individuals exposed to EMR-RF in their professional activities. The study results provide a foundation for further clinical research and the formulation of effective health management strategies for this occupational group.

Acknowledgement

None.

Conflict of Interest

None.

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