AP09259923 "Identification of the negative impact of a complex complex of non-ionizing radiation on the human body (on the example of medical personnel)»

Relevance

The rapid and widespread introduction of insufficiently researched technologies (MRI, ultrasound) into medical diagnostic and treatment processes, УЗИis due to the urgent need to combat the pandemic, which causes some caution in terms of individual health not only of patients, but also of medical personnel. The introduction of modern medical diagnostic equipment in specialized institutions of the Karaganda region, the use of various protective systems of ionizingand non-ionizing radiation sources in terms of power and quality, requires an integrated epidemiological and hygienic assessment. Its implementation will allow identifying all external risk factors that contribute to the development of certain pathological processes and syndromes in personnel engaged in setting up and operating such equipment. The study of the structure of the main nosologies during an in-depth medical examination of employees will be based on cytochemical and biochemical, psychophysiological and clinical, and sociological studies to identify risk groups experiencing the greatest adverse effects, confirmed by modern statistical analysis methods. Based on the results, calculated tests for reducing medical and social losses will be presented-technologies for reducing health risks aimed at ensuring the sanitary well - being of personnel.

Objective : to establish the negative effects of non-ionizing radiation exposure from high-tech equipment on the human body at the cellular and subcellular levels to justify preventive programs.

Expected results

Sanitary and hygienic, clinical and laboratory (cytogenetic, biochemical, and immunological) parameters will be evaluated in employees who come into contact with non-ionizing radiation from high-performance diagnostic complexes (MRI, ultrasound). Regularities of disorders in the functioning of psychological stability, cytogenetic immunological status of medical workers in magnetic and electromagnetic fields of a complex spectrum will be established. Predicting and managing occupational risks in MRI, and ultrasoundrooms.

Research Group

Ibraeva L.K. - PhD, Professor of the Department of Internal Diseases NAO " MUK " – project manager, https://orcid.org/0000-0002-9917-0258

Omarkulov B. K. - Candidate of Medical Sciences, Associate Professor, Director of the Institute of Public Health an d Professional HealthNAO "MUK". https://orcid.org/0000-0002-3955-4452

Zharylkasyn Zh. Zh. - Candidate of Medical Sciences, Associate Professor, Head of theresearch Sanitary and hygienic LaboratoryNAO "MUK". https://orcid.org/0000-0001-5432-4842

ГребеневаО. V. - MD, Associate Professor, Chief Researcher of the Sanitary and Hygienic Research LaboratoryNAO "MUK" https://orcid.org/0000-0002-1758-300

Rybalkina D.H. - Doctor of Medicine, Associate Professor of the Department of Internal DiseasesNAO "MUK", https://orcid.org/0000-0002-2041-1259

Bacheva I.V. - PhD, ассоцAssociate Professor of the Department of Internal DiseasesNAO "MUK", https://orcid.org/0000-0002-5576-8637

Shadetova A. Zh. - Candidate of Biological Sciences, leading researcher of the research sanitary and hygienic laboratoryNAO "MUK". https://orcid.org/0000-0003-3029-855X

Rusyaev M. V. - Master's degree, research associate of the Research Sanitary and hygienic Laboratory NAO "MUK". https://orcid.org/0000-0003-3212-4211

Alekseyev A.V. - Master of Medicine, Research Associate of the Sanitary and Hygienic Research Laboratory NAO "MUK". https://orcid.org/0000-0002-8988-3609

Sabirov Zh. B. - Master's Degree in Biology, researcher at the Sanitary and Hygienic Research LaboratoryNAO "MUK". https://orcid.org/0000-0002-9922-3604

List of publications

1. Mamyrbayev, A., Dyussembayeva, N., Ibrayeva, L. et al. Features of malignancy prevalence among children in the Aral Sea Region // Asian Pacific Journal of Cancer Prevention 2016 Dec 1;17(12):5217-5221. doi: 10.22034/APJCP.2016.17.12.5217

2. Sakiev, K., Battakova, S., Namazbaeva, Z., Ibrayeva, L. et al. Neuropsychological state of the population living in the Aral Sea region (zone of ecological crisis) // International Journal of Occupational and Environmental Health 2017 Apr;23(2):87-93. doi: 10.1080/10773525.2018.1425655. Epub 2018 Jan 23

3. Namazbaeva, Z., Battakova, S., Ibrayeva, L. et al. Change in metabolic and cognitive state among people of the Aral zone of ecological disaster // Israel Journal of Ecology and Evolution Online Publication Date: 10 Nov 2018. Volume 64: Issue 1-4, P: 44–55. DOI: https://doi.org/10.1163/22244662-20181035

4. Babenko, D., Omarkulov, B., Ilya Azizov, Sandle, T., Moraru, D., Chesca, A. Evaluation of sequence based typing methods (SPA and MSLT) for clonal characterization of staphylococcus aureus //(2016) Acta Medica Mediterranea 32(6),2016,1851-1856

5. Mergentay A, Kulov D.B, Bekembayeva G.S, Koikov V, Omarkulov B, Mussabekova S.A. The analysis of working load of general practitioners in the Republic of Kazakhstan //Research Journal of Pharmacy and Technology 12(5), c. 2283-2288

6. Nurlan S. Tabriz, Kuliya Skak, Lazzat T. Kassayeva, Bauyrzhan K. Omarkulov, and Marina A. Grigolashvili Efficacy of the Xpert MTB/RIF Assay in Multidrug-Resista nt Tuberculosis //MICROBIAL DRUG RESISTANCE[a] Mary Ann Liebert, Inc. DOI: 10.1089/mdr.2019.0326

Results achieved

According to the literature, a list of risk factors for medical workers in MRI and ultrasound rooms was determined. The working conditions of medical personnel working on MRI and ultrasound machines are characterized by a complex of harmful factors: a constant magnetic field, increased intensity and severity of work, insufficient natural light, noise.

A literature review on the complex effect of physical fields of various frequencies and modifications is carried out. 130 sources included in international databases were analyzed: 74 in Scopus, 52 in Web of Science, 38 in PubMed, 10 in journals recommended by the Committee for the Control of Education and Science. Also, 17 dissertations and research reports were analyzed. Based on the results of a literary search, an article was published in the publication CCES.

30 medical workers were examined (10 - working in ultrasound rooms, 15 - working in MRI rooms, 5 - in ophthalmologists' offices). Medical workers of MRI and ultrasound rooms in the process of work have contact with 4 sensors (convex for examining the abdominal cavity, small pelvis and retroperitoneal space), microconvex (for transvaginal and transrectal examinations), linear (for examining the breast, thyroid gland, organs musculoskeletal system), vector (for echocardioscopy) with different ultrasound frequencies.

The examined persons were divided into 2 groups: group 1 - medical workers of MRI and ultrasound rooms in contact with physical fields (EMF, PMF and ultrasound), group 2 - without such influence (medical workers of ophthalmological offices).

In the ultrasound rooms, an increase in air temperature (in 91% of cases by 3.70 C higher than the MPL) and noise (in 72.2% of cases by 1.8 dBA above the MPL), a decrease in air humidity (in 82% of cases by 3, 3% below the remote control), air speed (in 100% of cases, 0.05 m / s lower than the remote control), illumination (in 88% of cases, 186.4 lux below the remote control). The EMF level of the non-ionizing part of the spectrum was within the normal

range.

In the MRI rooms, an increase in air temperature (in 35.3% of cases 4.60C higher than the MPL) and noise (in 17.7% of cases, 6.9 dBA above the MPL), a decrease in air humidity (in 38.5% of cases 10% lower than the remote control), air speed (in 100% of cases, 0.04 m / s lower than the remote control). At one workplace (administrator in the regional medical center), the levels of EMF of industrial frequency 50 Hz in terms of the electrical component were 13.1 times higher (up to 93 V / m) and the intensity of EMF in the frequency range 5-2000 Hz in terms of the electrical component was 3 , 8 times (up to 94.1 V / m). In the immediate vicinity of an MRI machine of any power, medical personnel are exposed to an increased risk of exposure to PMF (power of 1.5 T - PMF is 4.5 (36.4 kA / m) and 4 (39.7 mT) times higher than the MRL, power 0, 3 mT - the PMP is 2.3 (18 kA / m) and 1.6 (16 mT) times higher than the MPL).

In the ophthalmological offices, it was revealed: an increase in air temperature (in 100% of cases by 3.20C above the MPL), a decrease in air humidity (in 100% of cases, 7% below the MPL), air velocity (in 100% of cases, by 0.04 m / s below the remote control), the illumination in the "dark rooms" was less than 40 lux, which is due to the specifics of the survey. The EMF level of the non-ionizing part of the spectrum was within the normal range.

The features of the functioning of the body in medical personnel working on MRI and ultrasound devices have been revealed:

In medical personnel working on MRI and ultrasound machines, mild and moderate depression often develop due to factors such as tension in the workplace, night shifts, the reception of a large number of patients per shift, responsibility for the correct diagnosis, a high level of depression is associated with professional "burnout".

The slower rate of aging, the average values of biological age and a higher assessment of all spheres of quality of life according to the WHOQOL-BREF questionnaire contributed to a higher physical performance of medical workers with MRI and ultrasound devices than in ophthalmological offices, which may be a consequence of the intermittent effect of low EMF values and are characterized by as a stimulating beneficial effect on the human body with strict observance of safety requirements for performing labor operations.

The revealed lower average values of attention, verbal short-term memory for words and visual short-term memory for numbers in medical workers with MRI and ultrasound machines than in workers of ophthalmological offices indicate a high intensity of the impact of risk factors on their psycho-functional activity, leading to fatigue.

The productivity of mental work and its accuracy among medical workers of MRI and ultrasound devices turned out to be lower than among workers of ophthalmological offices, which indicates not only a lower volume of information processing, but also its lower quality.

In 11% of the surveyed, an increase in the level of CRP was observed, which is probably associated with acute inflammatory processes at the time of the study.

Evaluation of physical examination showed that medical workers with MRI and ultrasound machines were more likely to complain of numbness, paresthesia in the fingers, muscle weakness, dizziness, convulsions, problems with the cardiovascular system (1.5 times); benign formations (2 times), changes in the visual system (3 times). This was confirmed by epidemiological data on morbidity and medical attention.

In the general group of medical workers, when assessing HRV, the indices of vagal activity SDNN, RMSSD, HF are reduced in comparison with the population level. When comparing both groups, in medical workers of MRI and ultrasound devices, these indicators were 1.5-2 times lower than in workers of ophthalmological offices, which can probably be due to the tension in the regulation of the cardiovascular system with satisfactory reserves as a result of the influence of external factors.

Studies of the karyotype did not reveal cytogenetic abnormalities.

As part of this research work, for conducting a sociological survey of medical personnel working on MRI and ultrasound machines, a specially developed "Questionnaire for the study

of the impact of non-ionizing radiation on the health of medical personnel", which includes 38 questions, for the following blocks under study: passport part (gender, nationality, education, place of work, position, specialization of the respondents); block of socio-economic factors (housing conditions, lifestyle, bad habits); block of social and hygienic factors (subjective assessment of working conditions and factors of the labor process, assessment of the work and rest regime of the respondents); block of medical and social factors (subjective assessment of one's own health, the presence of chronic diseases). Also, according to the short version of the WHOQOL-BREF questionnaire, the quality of life was assessed.

Medical personnel working on MRI and ultrasound machines subjectively notes the presence of factors that significantly affect their performance: EMF of various frequencies (66.7%), noise (56.7%), PMF (43.3%), work at night time (43.3%), suboptimal air temperature (23.3%), impaired air exchange / insufficient lighting (20%), exposure to various disinfectants (chlorine or alcohol) at the workplace (73.3%).

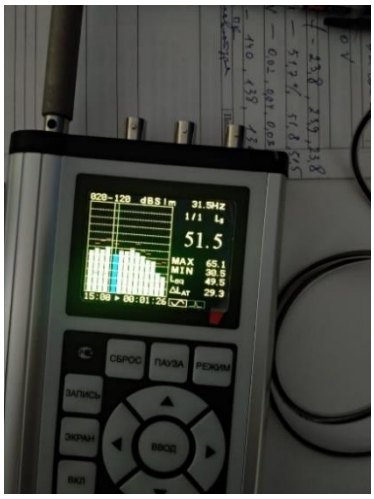
The most frequent complaints in comparison with the control group among medical personnel working on MRI and ultrasound machines were: flickering black spots / blurred vision (40%), pain in the eyes / lacrimation (24%), anxiety / panic attack (32%) , heart palpitations (32%), nausea / sweating (20%).

Publication

Ibrayeva L.K., Grebeneva O.V., Shadetova A.Zh., Rybalkina D.Kh., Minbayeva L.S., Bacheva I.V., Alekseyev A.V. Effect of Non-ionizing Radiation on the Health of Medical Staff of Magnetic Resonance Tomography Offices// Journal of Clinical Medicine of Kazakhstan.- 2021.- №18(4). – P. 16-22.

Photo report

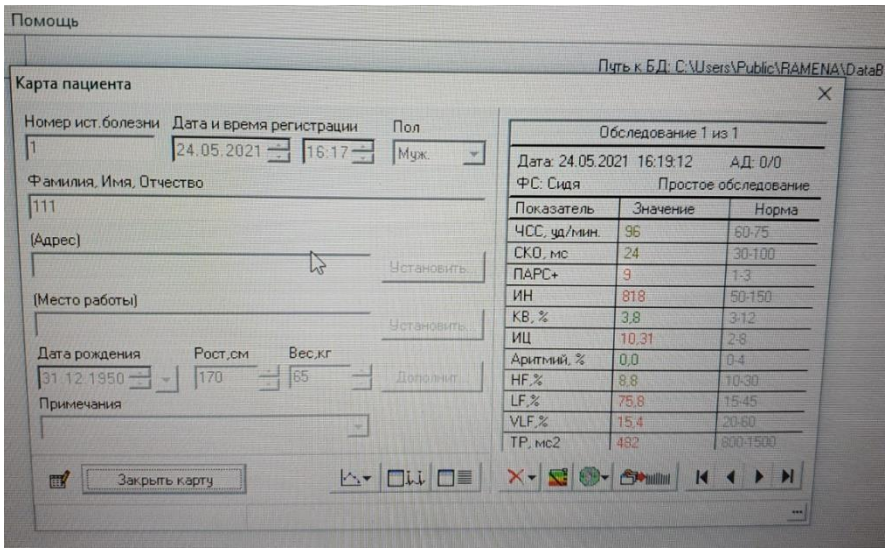


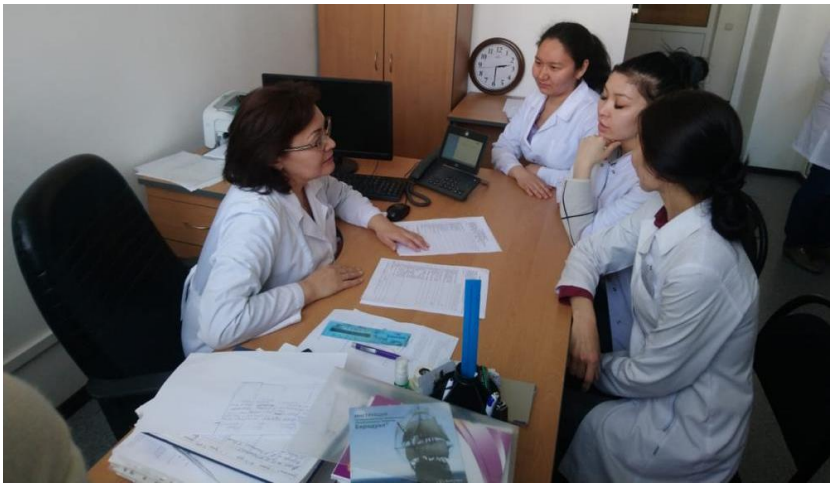



166094
604
ИПМ-101
ИЗМ
КОНТ
ВЫКЛ
РЕЖИМ РАБОТЫ
200
2000
ПРЕДЕЛЫ ИЗМЕРЕНИЯ мВ
ИЗМЕРИТЕЛЬ НАПРЯЖЕННОСТИ ПОЛЯ МАЛОГАБАРИТНЫЙ
166094


СТ - 01
F(м)=0.010 кВ
F(t)=0.009 кВ
5 - Potencial
Измеритель напряженности электростатического поля
1 2 3
4 5 6
7 8 9


ВЕ-метр АТ-003
Измеритель параметров ЭМП трехкомпонентный


Помощь
Путь к БД: C:\Users\Public\RAMENA\DataB
Карта пациента
Номер ист.болезни
1
Дата и время регистрации
24.05.2021
16:17
Пол
Муж.
Фамилия, Имя, Отчество
111
(Адрес)
Установить...
(Место работы)
Установить...
Дата рождения
31.12.1950
Рост,см
170
Вес,кг
65
Дополнит...
Примечания
Закрыть карту
Обследование 1 из 1
Дата: 24.05.2021 16:19:12
АД: 0/0
ФС: Сидя
Простое обследование
Показатель
Значение
Норма
ЧСС, уд/мин.
96
60-75
СКО, мс
24
30-100
ПАРС+
9
1-3
ИН
818
50-150
КВ, %
3,8
3-12
ИЦ
10,31
2-8
Аритмий, %
0,0
0-4
HF,%
8,8
10-30
LF,%
75,8
15-45
VLF,%
15,4
20-60
TP, мс2
482
800-1500





Information for potential users

The target consumers will be researchers from biological laboratories and university departments, developers of modern diagnostic systems, specialists from regional health departments and sanitary supervision organizations. Predicting and managing the carcinogenic and non-carcinogenic risks of occupational - determined diseases of the cardiovascular and nervous systems, neoplasms and reproductive disorders in health workers will have a significant impact on preventing the loss of years of life. An information bank of data on the quantitative and qualitative parameters of harmful environmental factors, predicting their impact on the health of medical personnel exposed to a complex complex of non-ionizing radiation with noise-vibration, microclimatic and light factors at the workplace, can be transferred (on commercial terms) to create large databases for further scientific research.