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Original article

ANALYSIS OF ORGANIZATIONAL MODELS OF DISASTER MEDICINE SERVICE OF THE MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION AT REGIONAL LEVEL*

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Abstract. The results of study and analysis of organizational and functional changes in the Disaster Medicine Service of the Ministry of Health of Russia at the regional level, organizational models of the Disaster Medicine Service functioning in the subjects of the Russian Federation are presented. The study was conducted at the All-Russian Center for Disaster Medicine "Zashchita" (since 2015) and at the Federal Center for Disaster Medicine of the National Medical and Surgical Center named after N.I. Pirogov of the Ministry of Health of Russia.

The purpose of the study is to analyze organizational models of the Disaster Medicine Service functioning at the regional level.

Materials and research methods. The following methods were used in the study: expert evaluation, statistical, analytical, field observation, etc.

The method of expert evaluation was applied through questionnaire survey of experts – Russian experts in the field of disaster medicine and emergency medical care. The questionnaires were filled in twice – questionnaire №1 – in 2015 and questionnaire №2 – in 2019-2020; a total of 529 people took part. Questionnaires № 1 and № 2 included questions and provisions relating to organizational models of the Disaster Medicine Service functioning at the regional level and to organizational and functional changes in the Disaster Medicine Service of the subjects.

Results of the study and their analysis. The results of the research helped to formulate a number of principle statements on further improvement of the Disaster Medicine Service, including development of organizational structure, implementation of its organizational models at the regional level.

Keywords: *departments of emergency consultative medical care, Disaster Medicine Service of the Ministry of Health of Russia, emergency medical care stations, expert evaluation method, medical treatment organizations, organizational and functional changes, organizational models, regional level, territorial centers for disaster medicine, united regional centers of emergency medical care and disaster medicine*

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Оригинальная статья

АНАЛИЗ ОРГАНИЗАЦИОННЫХ МОДЕЛЕЙ ФУНКЦИОНИРОВАНИЯ СЛУЖБЫ МЕДИЦИНЫ КАТАСТРОФ МИНИСТЕРСТВА ЗДРАВООХРАНЕНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ НА РЕГИОНАЛЬНОМ УРОВНЕ*

М.В.Быстров[1]

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Резюме. Представлены результаты научного исследования, посвященного изучению и анализу организационно-функциональных изменений, осуществляемых в Службе медицины катастроф Минздрава России (СМК, Служба) регионального уровня, организационных моделей функционирования СМК в субъектах Российской Федерации (субъекты). Исследование проводилось во Всероссийском центре медицины катастроф «Защита» Минздрава России (с 2015 г.) и Федеральном центре медицины катастроф Национального медико-хирургического Центра им. Н.И.Пирогова Минздрава России (завершение исследования).

* The first article presenting the results of the scientific research — "The results of the study of the organization of medical care to the victims of emergency situations in modern conditions. Report 1". *Meditsina Katastrof* =Disaster Medicine. 2020;1: 28-32

* Данная статья является продолжением статьи «Результаты изучения организации оказания медицинской помощи пострадавшим в чрезвычайных ситуациях в современных условиях. Сообщение 1» // Медицина катастроф. 2020. №1. С. 28–32.

Цель исследования – проанализировать организационные модели функционирования СМК на региональном уровне.
Материалы и методы исследования. При выполнении исследования применялись методы: экспертной оценки, статистический, аналитический, натурного наблюдения и др.
Метод экспертной оценки применялся путём анкетирования экспертов – российских специалистов в области медицины катастроф и экстренной медицинской помощи. Анкетирование проводилось дважды – анкетирование №1 – в 2015 г. и анкетирование №2 – в 2019–2020 гг., в них принимали участие в общей сложности 529 чел. В анкеты №1 и №2 вошли актуальные, по мнению автора, вопросы и положения, имеющие отношение к организационным моделям функционирования СМК на региональном уровне и организационно-функциональным изменениям в СМК субъектов.
Результаты исследования и их анализ. По результатам исследования сформулирован ряд принципиальных положений по вопросам дальнейшего совершенствования деятельности СМК, в том числе по развитию организационной структуры, внедрению организационных моделей функционирования Службы на региональном уровне.

Ключевые слова: *лечебные медицинские организации, метод экспертной оценки, объединенные региональные центры скорой медицинской помощи и медицины катастроф, организационно-функциональные изменения, организационные модели, отделения экстренной консультативной медицинской помощи, региональный уровень, Служба медицины катастроф Минздрава России, станции скорой медицинской помощи, территориальные центры медицины катастроф*

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Study relevance. In the Russian Federation organization and rendering of medical aid to victims in emergency situations are connected with the activities of the All-Russian Disaster Medicine Service and with its most important component — the Disaster Medicine Service of the Ministry of Health of the Russian Federation. The management bodies of the All-Russian Disaster Medicine Service and the Disaster Medicine Service of the Ministry of Health of the Russian Federation must ensure the readiness of healthcare to respond to emergency situations, to provide medical aid, to carry out medical evacuation of victims. A number of scientific works are devoted to the problems of improving the organization and rendering medical aid to the victims in emergencies, to their medical evacuation to medical treatment organizations [1-8]. In recent years the Disaster Medicine Service has been undergoing significant organizational changes, the model of the united regional Center of emergency medical care and disaster medicine is being introduced. In spite of the fact that a number of scientific publications are devoted to the discussion of organizational models of the Disaster Medicine Service functioning at the regional level, from the scientific and methodological point of view these issues seem to be insufficiently elaborated [9-14].

The purpose of the study is to analyze organizational models of the Disaster Medicine Service functioning on the regional level.

Materials and research methods. When conducting the research the following methods were used: expert evaluation, statistical, analytical, field observation, etc. Scientific works and publications in scientific journals on the problem under study, reports on special exercises conducted by the Service of the regional level, reference and analytical materials on the assessment of the state of readiness of the Disaster Medicine Service of the subjects of the Russian Federation were analyzed.

An essential role in the research was played by the method of expert evaluation. There was a survey of experts — Russian experts in the field of disaster medicine and emergency medical care. The questionnaire survey was conducted twice - questionnaire #1 — in 2015; questionnaire #2 — in 2019-2020. Questionnaires #1 and #2 were developed. They included topical questions and provisions related to the system of organization of medical aid to victims of emergencies and the activities of the Disaster Medicine Service in modern conditions. The questions included in the 2015 questionnaire were initially considered by the expert group of the Scientific Council of the All-Russian Center for Disaster Medicine "Zaschita" of the Ministry of Health of Russia and recognized as relevant and significant for scientific research.

242 specialists in the field of disaster medicine and emergency medical care from 51 subjects took part in the survey in 2015.

When preparing questionnaire No.2 we took into account personal experience and experience of our colleagues from All-Russian Center for Disaster Medicine "Zashchita" and territorial centers of disaster medicine / regional centers of emergency medical care and disaster medicine of the subjects. This experience was related to organization of medical aid rendering to victims of emergency situations and reflected personal opinion about organizational and functional changes in the Disaster Medicine Service of the Ministry of Health of Russia on the regional level. Both the established and accepted in the medical community provisions and a number of new but important questions were presented for the expert discussion. It should be noted that the topics of questions in questionnaire No. 2 are in much the same way as those in questionnaire No. 1. It is made deliberately — with the purpose of formulating and expert evaluation of a number of actual and principal provisions, checked up taking into account the time factor. Determining the significance of all

meaningful questions (from 0 — minimum score to 100 — maximum score) in questionnaire № 2 (2019) was mandatory.

Questionnaire #2 survey was conducted from the end of December 2019 to February 2020. The experts filled out the questionnaire online, the Internet program "Yandex Forms" (forms.yandex.ru) was used in the survey. The questionnaire was sent to specialists in different ways: by e-mail, via messengers (WhatsApp, etc.), by official letters to the organization with a link.

287 experts in the field of organization and provision of emergency medical care and disaster medicine from 57 subjects took part in the survey No. 2. Responding to the questions in the questionnaire, the respondents chose one of the possible answers: "yes", "no", "difficult to answer", "other".

The answers of the experts were analyzed taking into account their distribution into groups by their place of work. The following groups of experts were identified: specialists of territorial centers for disaster medicine; specialists of emergency stations and regional centers for emergency medical care and disaster medicine; specialists of medical treatment organizations of the 1st and 2nd levels; specialists of medical treatment organizations of the 3rd level; specialists of federal medical organizations; specialists of other organizations. In the course of the study, expert opinions were analyzed using cross-tabulations.

The results of both questionnaires were statistically processed and analyzed, including the use of a special software named "Statistika".

A total of 529 experts in the field of disaster medicine and emergency medicine took part in surveys #1 and #2.

The statistical significance of the indicators was determined according to the methods generally accepted in statistics. The critical level of significance for testing statistical hypotheses (p) was taken to be 0,05. Statistically significant differences were recorded at p less than 0.05. The methodology used in the dissertation work confirms the reliability of the research results.

While analyzing the organizational model of the united regional center of emergency and disaster medicine both positive sides (advantages) of this model and its probable risks (potential negative sides) were evaluated. Thus, SWOT-analysis has been done.

Results of the research and their analysis. In our article the results of the analysis of the consequences of functional changes in the Disaster Medicine Service and the organizational models of the Disaster Medicine Service operation on the regional level are presented.

As of January 1, 2021 in the Russian Federation there were: 45 territorial centers of the Disaster Medicine Service as independent medical organizations (legal entities); 14 territorial centers of the Disaster Medicine Service within regional, republican, territorial hospitals; 24 territorial centers of the Disaster Medicine Service united with the Emergency Medical Care Stations.

Among the questions presented for expert discussion, of great importance are the questions of validity of development of different organizational models. To the question "What, in your opinion, will uniting in one medical organization (legal entity) a territorial center of disaster medicine, an ambulance station, a department of emergency consultative medical care lead to?", the experts chose one of the proposed options as the answer: 1. Improvement of coordination and interaction of emergency medical services in the region for rapid response and emergency medical care to the population in different modes of operation. 2. Improving the quality and accessibility of emergency medical care in pre-hospital and hospital periods, also for the population living in remote, sparsely populated and hard-to-reach areas. 3. Increasing the level of preparation of medical workers, including in the provision of emergency medical care in emergencies. 4. Creating conditions for organising a unified operational dispatching service and a situation center of regional health care, introduction of new information technologies. 5. Creation of conditions for optimization of work of supporting and auxiliary departments and services. 6. All of the above. 7. Deterioration of the situation with emergency medical care in the region. 8. Difficult to answer. The majority (56.6%) of experts positively assessed the prospects of the united institution, choosing as their answer the option "6. All of the above." In addition, another 11.6% of experts expressed a positive opinion, choosing options 1-5. The possible consequences of the unification of the territorial centers for emergency medicine, ambulance stations and air ambulance were assessed negatively by 18.2%. They indicated that this would lead to a worsening of the situation with the provision of emergency medical care in the region. Thirteen and a half percent (32 people) could not express a distinctive opinion. The greatest share of answers with a negative opinion on the unification issue was revealed in the groups of territorial disaster medicine centers (29.0%) and ambulance stations (19.0%). These groups also revealed a relatively high percentage of the answer option "Difficult to answer" — 11.0% and 28.6%, respectively. Statistical analysis showed that significant differences in group responses depended on the place of work of the expert (Pearson's chi-square — 70.701 at p = 0.0001).

The questions of unification were emphasized once again in the questionnaire No. 2 in 2019-2020.

To the question "Do you agree that the introduction of the organizational model of functioning of the united regional centers for emergency medical care and disaster medicine is expedient in many constituent entities of the Russian Federation. Especially in those regions where the territorial centers of disaster medicine perform mainly organizational and administrative functions and do not have medical forces and means?" the majority (59.9%) of experts answered "yes". A negative answer "no" was given by 17.4; 18.5 found it difficult to answer; "other" was mentioned by 4.2%. The significance of this question — from 0 (minimum score) to 100 (maximum score) — was estimated by the experts as 78.06±28.11.

As already noted, statistical analysis showed significant differences in experts' answers depending on their place of work. The highest number of positive answers (in %) was found in the following groups: Ambulance stations and regional centers for emergency medical care and disaster medicine — 73.9%; medical treatment organizations of the 3rd level and health care management bodies — 84.0; medical treatment organizations of the 1st and 2nd levels — 70.0%. Significantly fewer people supported the implementation of the model of a unified regional center for emergency medical care and disaster medicine in the following groups. Territorial centers of catastrophic medicine — 49.0%; federal medical organizations — 54.5; other medical organizations — 50.0%. Representatives of the group of

territorial centers for disaster medicine dominated among those who indicated "other" (10 out of 12) and "difficult to answer" (27 out of 53) in their answers. They were also the leaders among all expert groups in terms of the relative share of negative answers — 25.5%. This indicator in other groupswas as follows: ambulance stations and regional emergency and disaster medicine centers (7.2%); Level 1 and Level 2 medical treatment organizations (10.0%); Level 3 medical treatment organizations and health care authorities (12.0%); and federal medical organizations (9.1%).

Thus, despite the fact that the majority of experts perceive positively the trend toward unification, there is a significant number of specialists in the field of disaster medicine and emergency medical care who express doubts or negative opinions about the validity and expediency of these organizational measures. Analysis of expert evaluations given in 2019-2020 showed that the greatest reticence and caution regarding the processes of unification of emergency medical organizations is shown by employees of disaster medicine centers. In their explanations for the "other" response option, experts in the field of disaster medicine and emergency medicine indicated the following. They believed that this reorganization and the disappearance of territorial centers of catastrophe medicine as independent organizations can lead to a weakening of the role of the service of disaster medicine, "dilution" and relegation to the background of the functions of disaster medicine in the united centers, to the reduction of efficiency in making managerial decisions in emergency situations.

The following positive results (advantages) can be achieved if the unification process is properly organized:

- concentration and management of the main medical forces and means in the region in the prehospital period and carrying out medical evacuation in various modes of operation;
- creation of optimal conditions: for implementation of modern organizational and information technologies, development of a unified operative-dispatching service, unified information space; for implementation of a monitoring system for emergency medical assistance and medical evacuation; for better coordination of emergency medicine services, ambulance services, emergency consultative medical assistance department (sanitary aviation);
- formation of conditions for improving the level of training of medical workers, including on the issues of emergency medical aid in emergency situations;
- optimization of the activities of supporting departments and services;
- optimal organization of procurement activities in a united institution, etc. [9].

In practice there are clear positive results of the functioning of the joint institution in the Chuvash Republic, where the process of unification took place step-by-step, starting in 2013, as well as in the Tula Region and the Republic of Crimea.

Considering the positive aspects (advantages) of the organizational model of the unified regional center for emergency medical care and disaster medicine, it is necessary to mention certain risks (probable "weaknesses") of the unified institution model, which can be divided into 3 main groups:

1. Risks and difficulties resulting from the necessity to perform a significant amount of organizational and technical work.

2. Risks of a decrease in the efficiency of managerial decision-making as a result of a significant consolidation of the organization.

3. Risks of domination of some directions of activities to the detriment of other main directions. Some respected and honored specialists in disaster medicine express concerns, that in some regions the "disaster medicine" voice in the work of united centers can significantly weaken because of the domination of everyday work on rendering emergency medical aid [9].

The experts supported the expediency of preserving and further developing the organizational model of territorial disaster medicine centers to a greater extent than in the two above-mentioned questions. To the question "Do you agree with the fact that in a number of subjects of the Russian Federation it is expedient to preserve territorial centers of disaster medicine, including those performing the functions of interregional centers of disaster medicine?" the great majority (78.4%) of experts answered "yes". 10.5 found it difficult to answer; 7.6 expressed a negative opinion (answer "no"); 3.5% chose "other". According to the experts' assessment, the significance of question #25 was 83.84±24.88. Statistical processing of the results of the questionnaire showed significant differences in the answers in the groups depending on the place of work (Pearson's chi-square - 32.578 at p=0.005). In all groups the majority of experts gave a positive answer, the most supporters of preserving the model of territorial centers of disaster medicine were in the groups of territorial centers of disaster medicine (83,4%) and medical treatment organizations of the 1st and 2nd levels (85,0%). Slightly less were in the groups of emergency stations and regional centers for emergency and disaster medicine (75.4%) and treatment medical organizations of the 3rd level and health care authorities (76.0%); the least were in the group of federal medical organizations (54.5%). The share of negative answers was greater (10.1%) in the group of emergency medical care workers and in the group of employees of leading regional medical treatment institutions of the 3rd level and health care management bodies of the subjects (12.0%). It is noteworthy that a certain part of experts who disagreed on the question of the advisability of maintaining the model of territorial disaster medicine centers in some regions, as well as who indicated "other" in their answers, were employees of disaster medicine centers — 10 of 22 and 6 of 10 people, respectively. The option "Difficult to answer" (in %) was more frequently encountered in the group uniting representatives of federal medical centers, including departmental, military medical institutions and scientific organizations — 36.4%. In this group, the same percentage of the "Difficult to answer" response option was also found in the previous question regarding the implementation of the unified center model. This situation can be explained by the focus of the employees of these organizations on solving problems at the federal level, and to a lesser extent by involvement in problems at the regional level.

We share the opinion of the majority of experts and consider it reasonable and expedient to keep the model of territorial centers for disaster medicine in a number of regions.

We believe that in the conditions of our country other organizational models of functioning of the Disaster Medicine Service, ambulance and sanitary aviation, including mixed ones, are also possible. A number of provisions

on possible variants of organizing the activity of emergency medical services at the level of the region are formulated and presented for discussion to the experts in questionnaire №2.

To the question "Do you agree that solving medical evacuation issues, taking into account the principles of optimal routing at medical district level, necessitates the creation/increase of evacuation forces and means at this level? And this can be accomplished within the framework of the following organizational models: creation and functioning of regional centers of emergency medical care and disaster medicine at the level of medical districts of subdivisions; creation and functioning of stations of emergency medical care with a similar area of responsibility as the multidisciplinary medical center of the 2nd level (within the medical district with sub-stations of emergency medical care in districts, working in a single information space and under functional "supervision" of regional centers). In any of these variants a clear organizational-functional integration and single information space of the emergency medical aid, Disaster Medicine Service, sanitary aviation and medical medical organizations are obligatory?". The majority (77.0%) of specialists answered "yes" and supported these provisions. Negative answers were given by 4.6%, 15.3% found it difficult to answer, and 3.1% indicated "otherwise". Significance of this question was estimated by experts as 80.47±24.45. The highest rate of positive answers was noted in the groups of medical treatment organizations of the 1st and 2nd levels (85.0%); emergency medical aid stations and regional centers of emergency medical aid and disaster medicine (84.1%); medical treatment organizations of the 3rd level and health authorities (84.0%). This indicator is somewhat lower in the groups of disaster medicine centers (72.4%) and federal medical organizations (68.2%). This question caused the greatest "difficulties in answering" for representatives of disaster medicine centers (23 people) and emergency medical services (9 people). In relative terms (as a percentage of the total number of answers in a particular group), it was in the group of federal medical organizations (27.3%). The differences between the groups are not statistically significant (Pearson's chi-square - 12.509 at p=0.640). We share the opinion of the majority of experts and consider reasonable the variant of the organizational model of functioning of emergency medical care, disaster medicine and sanitary aviation in a number of regions, taking into account the peculiarities of formation of medical districts.

The structure of the regional centers of emergency medical aid and disaster medicine must correspond to the tasks assigned to this institution, contribute to its functioning and development of its activities.

Conclusion

The analysis of the activity of the territorial centers of disaster medicine in the subjects of the Russian Federation testifies that if the work is properly organized, positive results can be achieved with different organizational models: the territorial center of disaster medicine(independent medical organization) — Sverdlovsk region, Chechen Republic, Khanty-Mansi Autonomous Area, Khabarovsk territory etc.; territorial center of disaster medicine (as a part of leading regional hospitals) — Rostov region, Republic of Tatarstan

The results of expert evaluation of provisions on organizational models of emergency medical care functioning at the regional level confirm the necessity of weighted, thoughtful approach to the choice of organizational model of emergency medical care in the region. This model should take into account territorial peculiarities of healthcare and exclude administrative "pushing and imposing" of one of the models.

It is fundamentally important that in any organizational model the tasks and powers of the territorial center of disaster medicine as a body of everyday management of the Disaster Medicine Service on the regional level and its functionality in the field of "disaster medicine" must be fully solved.

Taking into account the experts' opinions, the following organizational models of the Disaster Medicine Service seem to be the most promising: the model of the territorial center for disaster medicine with the emergency consultative medical aid department (sanitary aviation) in in it and the model of the united regional center of the emergency and disaster medicine or the regional center for disaster medicine and emergency medical aid.

In any variant a clear functional integration and creation of a single information space are mandatory.

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Original article

ON THE ISSUE OF SPECIAL EXERCISES IN THE COUNTERTERRORISM SYSTEM INVOLVING SPECIALISTS OF HEALTH CARE MANAGEMENT BODIES, MEDICAL FORMATIONS AND ORGANIZATIONS

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Abstract. *The objectives of the study* are to analyze the experience of exercises conducted in the counter-terrorism system by specialists of the regional Disaster Medicine Service, to identify key organizational issues of preparation and implementation of exercises; to develop proposals for their improvement in the subject of elimination of medical and sanitary consequences of terrorist acts committed with the use of conventional means of destruction.
Materials and research methods. Sources of information and materials studied: normative and methodological documents regulating the procedures of organizing and conducting military training in the field of healthcare; materials of trainings performed by specialists from regional EMC on the subject of organizing the liquidation of medical and sanitary consequences of terrorist acts; data from expert evaluation maps on the subject of the study; scientific papers and publications on technologies of training and exercises involving specialists from healthcare management bodies, medical units and organizations.
The following scientific methods were used in the research: content analysis method, expert assessment method, statistical method, logical and informational modeling, and analytical method.
*Results of research and their analysis***.** The results of the study of basic organizational issues of preparing and conducting special exercises (command-staff exercise, staff training, tactical and special exercises) conducted in the regions with the participation of specialists of public health authorities, medical formations and organizations within the framework of counter-terrorism are presented. Sound proposals were made to improve the technology of preparing and conducting special exercises and communicating their results to medical specialists.
The results of the study showed that almost all the experts (98.0%) were in full agreement with the need, in order to maintain and increase the preparedness of health care authorities, medical organizations, including emergency medical care and the Disaster Medicine Service, to conduct regional trainings on the subject of medical support of the population during terrorist acts. And only 2.0% of the experts had difficulty in formulating a specific conclusion on this issue.

Key words: *command-staff exercises, conventional means of destruction, counterterrorism system, Disaster Medicine Service, emergencies, emergency medical care, medical formations, medical organizations, public health authorities, regional centers for emergency medical care and disaster medicine, special exercises, staff training, tactical-special exercises, territorial disaster medicine centers, terrorist acts*

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Оригинальная статья

К ВОПРОСУ О ПРОВЕДЕНИИ В СИСТЕМЕ ПРОТИВОДЕЙСТВИЯ ТЕРРОРИЗМУ СПЕЦИАЛЬНЫХ УЧЕНИЙ С УЧАСТИЕМ СПЕЦИАЛИСТОВ ОРГАНОВ УПРАВЛЕНИЯ ЗДРАВООХРАНЕНИЕМ, МЕДИЦИНСКИХ ФОРМИРОВАНИЙ И ОРГАНИЗАЦИЙ

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Резюме.*Цели исследования* – изучить и проанализировать опыт специальных учений, проведенных в системе противодействия терроризму специалистами Службы медицины катастроф (СМК) регионов; определить ключевые организационные вопросы подготовки и проведения таких учений; разработать предложения по совершенствованию проведения специальных учений применительно к тематике ликвидации медико-санитарных последствий терактов, совершенных с использованием обычных средств поражения.
Материалы и методы исследования. Источники информации и материалы, подвергнутые изучению: нормативные и методические документы, регламентирующие порядок подготовки и проведения учений в сфере здравоохранения; материалы учений, проведенных специалистами СМК регионов по тематике организации ликвидации медико-санитарных последствий терактов; данные карт экспертной оценки по теме исследования; научные работы и публикации, посвященные технологиям подготовки и проведения специальных учений с участием специалистов органов управления здравоохранением, медицинских формирований и организаций.
При выполнении исследования применялись следующие научные методы: метод контент-анализа, метод экспертной оценки, статистический метод, логическое и информационное моделирование, аналитический метод.

Результаты исследования и их анализ. Представлены результаты исследования базовых организационных вопросов подготовки и проведения специальных учений (командно-штабное учение, штабная тренировка, тактико-специальное учение), проводимых в регионах с участием специалистов органов управления здравоохранением, медицинских формирований и организаций в рамках противодействия терроризму. Внесены обоснованные предложения по совершенствованию технологий подготовки и проведения специальных учений и доведения их результатов до медицинских специалистов.
Результаты исследования показали, что практически все эксперты (98,0%) были полностью согласны с необходимостью – в целях поддержания и повышения готовности органов управления здравоохранением, лечебных и других медицинских организаций, в том числе учреждений и формирований скорой медицинской помощи и Службы медицины катастроф – проводить в регионах учения по тематике медицинского обеспечения населения при террористических актах с использованием обычных средств поражения. И только 2,0% экспертов испытывали затруднения при формулировании конкретного заключения по данному вопросу.

Ключевые слова: *командно-штабные учения, медицинские организации, медицинские формирования, обычные средства поражения, органы управления здравоохранением, региональные центры скорой медицинской помощи и медицины катастроф, система противодействия терроризму, скорая медицинская помощь, Служба медицины катастроф, специальные учения, тактико-специальные учения, территориальные центры медицины катастроф, террористические акты, чрезвычайные ситуации, штабные тренировки*

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The highest form of preparation of health care for response to natural and man-made emergencies, accompanied by medical and sanitary consequences, are special exercises (command-staff exercises, staff training, tactical and special exercises). Such exercises are held with the participation of specialists of health care management bodies, medical formations and organizations of emergency medical care and Disaster Medicine Service, medical treatment organizations and other medical institutions [1-3].

At special exercises a set of management tasks and therapeutic and evacuation measures in application to a specific case are practiced. This contributes to maintaining and improving the readiness of medical organizations to work in an emergency situation [1, 4].

Hence there is the need to investigate the problems of preparing and conducting special exercises in the system of counter-terrorism using the method of retrospective analysis.

Such exercises are conducted in the regions, as a rule, comprehensively, often — under the direction of anti-terrorist commissions and their headquarters. Relevant medical specialists, public health forces and means are invited to participate in them. However, as experience shows, it is expedient to hold such exercises and trainings in the system of regional healthcare separately — only on the problems of liquidation of medical and sanitary consequences of terrorist acts [5, 6].

The purpose of the study is to determine the key organizational technologies for the preparation of the exercises, to develop proposals for their improvement as applied to the problems of liquidation of medical and sanitary consequences of terrorist acts committed with the use of conventional means of destruction* on the basis of the experience of special exercises performed by specialists of the Disaster Medicine Service.

Materials and methods of research. Sources of information and materials on the subject of the research were: normative and methodological documents; materials of trainings conducted by specialists of the Regional Disaster Medicine Service; data of expert evaluation maps on the subject of the research; scientific works and publications on the technologies of preparing and conducting the trainings.

The following research methods were used: content analysis method, expert assessment method, statistical method, logical and information modeling, analytical method.

Results of the study and their analysis. The study showed that practically all the experts (98.0%) agree with the necessity of conducting medical trainings in the regions. Only 2.0% of the experts have difficulty in formulating their conclusions on this matter.

The results of the study highlighted the need to study organizational issues of preparing and conducting special exercises in the health care system of the subjects of the Russian Federation.

First, it was necessary to determine the optimal frequency of special exercises. It was found that such exercises should be conducted within a municipality

* Conventional means of destruction are weapons that are based on the use of explosives and incendiary mixtures — artillery, missile and aviation ammunition, small arms, mines, incendiary ammunition and flammable mixtures, as well as bladed weapons and non-standard (improvised) explosive devices

once every six months — 68.3% of the experts. 29.8% of the experts were in favor of having exercises once a year, and 2.9% of them thought it was optimal to have such exercises once every 2 years.

With this in mind, we examined the frequency with which similar exercises were conducted between 1999 and 2005 by regions where terrorist attacks occurred during this period. Why does the study cover this period of time? In the years indicated, there was high terrorist activity on the territory of the Russian Federation associated with counterterrorist operations in the North Caucasus.

It turned out that the most infrequent exercises were conducted in 1999-2001. In the first 4 years (1999-2003) only 38.5% were conducted, and in the remaining 3 years (2003-2005) 61.5% of the exercises were conducted. At the same time, according to data from the territorial Disaster Medicine Centers, from 1999 to 2001 there were no exercises at all in the Republic of Ingushetia, the Kabardino-Balkarian Republic, or the Moscow Region. If we consider that during these 3 years 47.3% of terrorist acts were committed on the territory of Southern Federal District subjects, such situation cannot be considered satisfactory. All the more so because during these years the sociopolitical situation in this federal district was the most acute.

The number of exercises conducted in different regions on the topic of the elimination of the medical and sanitary consequences of terrorist acts varied greatly. For example, during the period under study, 87 exercises were conducted in Moscow, 39 in Stavropol Krai, and 22 in Astrakhan Oblast. At the same time, in the Kabardino-Balkarian Republic, the Moscow Region, and the Republic of North Ossetia-Alania, 2, 3, and 7 such exercises were conducted, respectively. One cannot agree that there was no need for more intensive training of health care authorities and medical organizations in these regions to deal with the consequences of terrorist attacks.

The study established that the foci of the medical and sanitary consequences of terrorist acts committed with the use of conventional weapons and explosive devices are, as a rule, local in nature. In view of this, it was necessary to specify the scale of the exercises and the number of medical forces and facilities involved in the exercises.

It was determined that these exercises should involve health care management bodies, medical organizations (medical treatment organizations, trauma centers, the regional center for emergency medical care and disaster medicine, the station, substation or department of emergency medical care, the territorial center for disaster medicine, etc.). This is especially true in cities where there are facilities with a high risk of terrorist attacks on them or where major events are held.

There are convincing arguments to support this conclusion. During the period under study, 93.8% of terrorist attacks were committed in large cities in crowded places. The trend of committing terrorist attacks in cities is stable not only in Russia, but also in other countries [4, 7, 8].

The study of this issue using the method of expert assessment yielded the following results. 46.8% of experts believed that it is necessary to conduct exercises with the medical organization that is planned to be involved in the elimination of the medical and sanitary consequences of terrorist acts, as well as with the entire healthcare system of the municipality. 32.3% of the experts were in favor of conducting exercises with relevant organizations of a medical district (intermunicipal entity or major city). 20.9% of experts were in favor of conducting exercises on a regional healthcare scale.

The results of the study allow us to formulate the following recommendation. Initially, it is advisable to conduct exercises on the scale of medical organizations located on the territory of one municipality. Then the scale of the exercise can be enlarged: the number of victims, the number of medical institutions involved in the elimination of medical and sanitary consequences of the terrorist attack increased; the medical and tactical situation and conditions of management activities complicated, and the exercise should be then conducted within the medical district, within a major city or region. In doing so, the exercise scenario should be based on the need to perform a maximum amount of medical evacuation and management activities.

The recommendation concerning the scale of a special exercise is fully consistent with the results of our earlier study [7].

In performing the study, it was necessary to identify the main developer — the organization specialists who should prepare the necessary materials for conducting a special exercise and the official who will manage these exercises.

The analysis of experts' opinions on this issue showed that 57.1% of experts believe that the main developers of materials should be specialists of regional emergency and disaster medicine centers and territorial disaster medicine centers. 35.3% of experts believe that such materials should be developed by specialists of executive authorities in the sphere of public health protection. And 7.6% gave preference to specialists from other government agencies, including those in the regional anti-terrorist commission, territorial bodies of the Federal Security Service and the Russian Ministry of Emergency Situations.

The study of the experience of real exercises during the period under study showed that the main developers of such exercises in 60.4% of cases were specialists of territorial disaster medicine centers. In 3.3% of cases they were developed by specialists of regional healthcare authorities; in 8.6% — by specialists of municipal healthcare authorities. In 26.7%

of cases the developers were the heads of medical treatment organizations; in 0.5% of cases — the specialists of ambulance stations and in 0.5% of cases — other medical specialists. When preparing and conducting the exercises, the specialists of the territorial centers for disaster medicine provided methodological assistance to the heads and developers of the exercise materials.

As for the question of who should be the head of the exercises, the experts' opinions were distributed as follows. Most of all (41.8%) experts gave preference to the head of regional healthcare. 28.2% preferred the head of the regional center for emergency medical care and disaster medicine; 20.9% preferred the deputy head of regional health care. 9.1% of the experts indicated other medical specialists, including those from the regional anti-terrorist commission, the territorial bodies of the Federal Security Service and the Russian Ministry of Emergency Situations.

Other results were obtained when studying the experience of the conducted exercises. It turned out that the leaders of the exercises were: in 32.3% of the exercises — the directors of territorial centers for disaster medicine; in 17.7% — the heads of medical treatment organizations; in 16.7% — the heads of healthcare authorities of the subjects; in 15.6% — their deputies; in 15.1% — the heads of healthcare authorities of municipalities; and in 2.6% of the exercises, other officials.

The heads of regional health authorities need to lead medical counterterrorism exercises more frequently. It is possible that the lack of participation in the exercises by heads of health care authorities had a negative impact on the quality of the exercises and reduced the degree of their effectiveness.

The results of the study speak for themselves. The leader of special exercises held on a municipal scale can be the head of a regional center for emergency medical care and disaster medicine or a territorial center for disaster medicine, or the deputy head of regional health care. The head of the exercises held on the scale of a medical district, a large city or a region is the head of regional health care, and the head of the headquarters of the exercises is the head of the regional center for emergency medical care and disaster medicine or the territorial center for disaster medicine.

An important aspect of the preparation and conduct of exercises is the ability of regional medical authorities and heads of medical institutions to organize and to conduct such exercises.

Experts' opinions on this issue were distributed as follows. 49.5% of experts believe that health authorities are fully prepared to perform the above task. 30.1% expressed the opinion that health authorities are partially ready, while 20.4% of experts found it difficult to assess their readiness.

The presented results of the study can contribute to the development of measures for the organization of targeted professional training of relevant medical specialists. This will help to improve the quality of the exercises and achieve better preparedness of regional level health care to deal with the medical and sanitary consequences of terrorist attacks.

The results of the study also point to the need for more active, systematic and specific work on the training of specialists of health care management bodies and managerial staff.

According to experts, the main reasons for the failure of special exercises are: low level of professional training (34,5%); imperfect training programs (31,2%); insufficient methodological support (14,8%); lack of a standard list of training scenarios (17,2%); lack of participation of managerial specialists, shortage of trained medical specialists, turnover of medical staff (2,3%).

The study of exercise scenarios showed that the topics of the exercises were, as a rule, the same — in 80.2% of cases the topics of the exercises and the issues to be solved were the same. Often it was not possible to create a complex multivariant medical-tactical situation.

Specialists from the territorial organizations of the Ministry of Emergency Situations, the Federal Security Service, the Ministry of Internal Affairs of Russia, and other organizations and services, with which to interact during terrorist attacks, should be invited to the special exercise [8-10]. The main purpose of their participation is to understand the tasks that they will have to solve in the interests of organizing medical assistance and medical evacuation of the victims.

The study examined the extent to which these specialists participate in special exercises. It was found that such specialists are invited as participants in regional exercises in 91.8% of cases.

However, the share of specialists from different departments turned out to be different. Most often specialists from the territorial organizations of the Russian Ministry for Emergency Situations (37.4%), the Russian Ministry of the Interior (25.2%), the Russian Federal Security Service (23.1%) participate in the exercises. Much less often are specialists of the Federal Guard Service (4.9%), Rospotrebnadzor (2.5%), and other organizations and services (6.9%).

An important measure in the implementation of the results of the exercises is the order and completeness of their communication to the participants of the exercises and the relevant medical specialists. Emphasis should be placed on those results, which wold help to improve the preparedness of the health care system to respond to terrorist attacks.

It turned out that in the regions different methods are used for this purpose. This occurs during working meetings devoted to parsing and summarizing the results of the exercises (61.0%), is reflected in the materials of exercise reports (21.9%), and in the content of normative and methodological documents being developed (17.1%).

The majority (62.4%) of experts pointed to the need to develop an improved method of communicating the results of the exercises to medical specialists. It would be advisable to use analytical letters and briefs more often. Such documents would present data in comparison with the results of other similar exercises, as well as include methodological recommendations.

Conclusion

At the present time, when terrorist activity in our country and in some states bordering Russia remains high, it is necessary to pay more attention to healthcare preparedness to respond to emergency situations caused by terrorist acts and to eliminate their medico-sanitary consequences.

Long-term experience of work on life saving and health preservation of victims in extreme situations and the results of this research show that the main and the most effective form of maintaining and increasing the level of preparedness are special exercises. At such exercises, on the one hand, the level of knowledge, practical skills and competencies are tested, and on the other hand, the training of medical specialists is carried out.

The research results show that when preparing and conducting such exercises in the regions an important role belongs to heads and relevant specialists of health care management bodies, regional centers of emergency medical care and disaster medicine and territorial centers of disaster medicine and medical treatment organizations. Their professional training in this direction largely determines the quality and effectiveness of special exercises held. The study has shown that the level of training of the mentioned medical specialists needs further improvement.

Therefore, the forms and methods of their training require a thorough revision.

It is advisable to correct both the Unified postgraduate programs of doctors' training in the medicine of catastrophes (organization of medical aid to the population in emergency situations), and the specific curricula of the cycles of thematic improvement.

Since the elimination of the consequences of terrorist acts is carried out with the involvement of forces and means under the jurisdiction of various federal and regional bodies of executive power, in order to improve the operational interaction it is necessary to practice the invitation of specialists of these structures for their adequate participation in special exercises.

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Original article

EXPERIENCE OF APPLYING TELEMEDICINE TECHNOLOGIES IN THE WORK OF VORONEZH REGIONAL CLINICAL CENTER FOR DISASTER MEDICINE

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Abstract. *The purpose of the study* is to determine the role of telecommunication technologies in increasing the efficiency of Voronezh Regional Clinical Center for Disaster Medicine.
Materials and methods of research. The data contained in analytical reports and other documentation of the Center for 2018-2020 in terms of identifying patterns of their change with the introduction of telecommunications technologies were analyzed.
Results of the study and their analysis. Introduction of telemedicine technologies in the work of the Center resulted in increase of volume of rendering of medical care by its specialists. The neurosurgeons were the most demanded specialists, who performed telemedical consultations, which is mostly related to the necessity of performing consultations for the doctors of trauma centers of the II and III levels, engaged in treatment of victims of car accidents.
Voronezh Regional Clinical Center for Disaster Medicine plans to further expand the use of telecommunication technologies not only in treating victims of road accidents, but also victims of other man-made and natural emergencies.

Key words: *pediatric field hospital, teleconsultations, telemedicine, Voronezh Regional Center of Disaster Medicine*

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Оригинальная статья

ОПЫТ ПРИМЕНЕНИЯ ТЕЛЕМЕДИЦИНСКИХ ТЕХНОЛОГИЙ В РАБОТЕ ВОРОНЕЖСКОГО ОБЛАСТНОГО КЛИНИЧЕСКОГО ЦЕНТРА МЕДИЦИНЫ КАТАСТРОФ

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Резюме. *Цель исследования* – определить роль телекоммуникационных технологий в повышении эффективности работы Воронежского областного клинического центра медицины катастроф (ТЦМК, Центр).
Материалы и методы исследования. Проанализированы данные, содержащиеся в аналитических справках и другой документации о работе Центра в 2018–2020 гг., в плане выявления закономерностей их изменения в результате внедрения телекоммуникационных технологий.
Результаты исследования и их анализ. Внедрение телемедицинских технологий в работу ТЦМК привело к увеличению объема оказания его специалистами регламентируемой медицинской помощи. Наиболее востребованными специалистами, проводившими телемедицинские консультации, были врачи-нейрохирурги, что в значительной степени связано с необходимостью проведения консультаций для врачей травмоцентров II и III уровня, занимающихся лечением пострадавших в дорожно-транспортных происшествиях (ДТП).
В планах работы Воронежского областного клинического центра медицины катастроф – дальнейшее расширение использования телекоммуникационных технологий не только при лечении пострадавших в ДТП, но и в других чрезвычайных ситуациях (ЧС) техногенного и природного характера.

Ключевые слова: *Воронежский областной клинический центр медицины катастроф, дорожно-транспортные происшествия, Полевой педиатрический госпиталь ВЦМК «Защита», пострадавшие, телемедицинские консультации, телемедицинские технологии, чрезвычайные ситуации*

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Since the late 1970s the number of man-made and natural disasters in the world has been steadily growing. For example, in a UN report (October 2020), the Office for Disaster Risk Reduction stated that 7,346 large-scale natural disasters occurred between 2000 and 2019. As a result, 4.2 billion people were affected, costing the global economy about $2.97 trillion [1]. In the Russian Federation 150 man-made emergencies on average occur annually, in which hundreds of people die [2, 3].

In an interview with TASS at the end of 2020, EMERCOM Minister E.N. Zinichev said: "This year, the number of emergencies in our country has increased by 29% compared to last year. At the same time we managed to significantly reduce the number of casualties and fatalities while increasing the number of rescued" [4].

According to the minister, this was possible due to the introduction of information technologies, which makes it possible to predict and to prevent emergencies [4].

While carrying out rescue work in an emergency area, the organization of medical support for victims is of great importance [5-7].

The world experience of introducing telecommunication technologies in the organization of medical support to the population of hard-to-reach areas suggests the importance of this resource in the organization of medical support in various emergency situations [8].

Elimination of medical and sanitary consequences of any emergency situation requires a prompt response from the relevant services to make the right medical and tactical decision and to attract external consultants to strengthen the work of field medical hospitals [9].

The modern level of development of information and communication systems allows a remote dialogue between employees of services of extreme medicine in real time [10].

On August 27, 2001, the concept of development of telemedical technologies in Russia was approved. In accordance with the concept, information support for the work of the units and institutions of the All-Russian Disaster Medicine Service, including consultative support for medical teams in emergency situations, reached a higher level [11].

At present in the field of emergency medicine telemedicine technologies are used in the following ways: rapid transmission of information about the nature and peculiarities of an emergency situation in order to make an objective decision on the specifics of medical and evacuation measures; consultations with leading clinicians to provide medical assistance to rescue workers and doctors working in the foci of an emergency situation; coordination and interaction of specialists from different departments, including those from different countries, on the liquidation of medical and sanitary consequences of emergency situations.

The first telemedical consultations in an emergency situation were performed in 1997 in the framework of the activities of the Disaster Medicine Service of the Russian Ministry of Health during the liquidation of the consequences of the plane crash on a residential area in Irkutsk. The telemedicine consultation was conducted by the Center for Children's Telemedicine. Specialists from the Moscow Research Institute of Pediatrics and Children's Surgery conducted the consultations. The expedience of the newly created Children's Telemedical Center for conducting telemedical consultations by the staff of the leading Children's Research Institute was due to a large number of injured children. There was a children's boarding school at the center of the emergency situation — 14 children died in the plane crash [12].

A new stage in the development of telemedicine within the framework of the All-Russian Disaster Medicine Service began in April 2001, when the Field Pediatric Hospital of the All-Russian Center for Disaster Medicine "Zaschita" was set up in Gudermessky District of the Chechen Republic. In 2001, more than 34,000 outpatients were treated in the hospital, and 2,847 inpatients were treated. Since the healthcare system of the Chechen Republic was destroyed in the early 2000s, the Field Pediatric Hospital replaced the Republican Hospital. Many specialized medical care activities were carried out on its basis [9].

Telemedical consultations were widely used in the work of the hospital. The activity peaked in 2002, when a total of 64 telemedicine consultations were performed on 54 patients, 10 patients being consulted twice. Teleconsultations were performed for 16 clinical areas. Most of the consultations (36) were performed for different traumas and orthopedic disorders — there were 13 patients with orthopedic pathology only. A plastic surgeon consulted 9 patients, a trauma surgeon — 5 patients, and a neurosurgeon — 4 patients. A combustiologist consulted two patients with deep extensive burns. The therapists consulted 19 patients, including a cardiologist for four patients, a medical geneticist for four children with congenital pathologies, and a hematologist for three patients.

The telemedicine consultations resulted not only in the determination and clarification of treatment tactics, but also the medical evacuation of some patients to other medical treatment organizations (four to Moscow, two to Makhachkala, and two to Stavropol).

In an interview (2004), the head of the hospital said: "Equipment with modern diagnostic and therapeutic apparatus is a distinctive feature of our hospital... Children with severe burns were admitted to the hospital. It was possible to save them only by applying modern methods of treatment ... Masha and Ruslan, ten years old, are especially remembered. Their overall treatment plan was coordinated with the head of the Children's Burn Center at Moscow Hospital No. 9, Lyudmila Budkevich, using satellite telemedicine technology... As a result, the young patients returned home practically healthy" [13].

Telemedicine consultations were especially important when physicians "were confronted with a particularly severe course of diseases and traumas or with rare and

little-known congenital diseases. For example, a child is brought in with a suspected blood disorder. There is no hematologist among our doctors. In the hospital you can make an ultrasound, X-ray, general and biochemical blood tests. We collected as much objective information as possible, prepared a package of documents digitally and sent it all for consultation via e-mail. Most often — to the Moscow Research Institute of Pediatrics and Pediatric Surgery" [13].

Doctors at the hospital not only received consultations from leading specialists, but also "often coordinated the transfer of a child to a specialized department. The most complicated ones were sent to Moscow — to the Children's City Hospital No. 9, the Russian Children's Clinical Hospital, and other medical institutions" [13].

High efficiency of using telemedicine technology not only to address some issues of treatment tactics, but also for further hospitalization of patients should be noted.

In recent years, the Voronezh region has paid a lot of attention to the development of telemedicine technologies and their implementation in health care. According to the director of the Medical Information and Analytical Center in Voronezh, "by May 2020, the healthcare department of the Voronezh region had connected 32 regional hospitals, 11 municipal hospitals, and 9 specialized healthcare organizations to the telemedicine consultation system; in total, there are 144 units in the region that have the telemedicine consultation system" [14]. [14]. Since the beginning of the COVID-19 pandemic, the workload of the regional center for telemedicine has increased manifold. According to its head, "since mid-April 2020, the number of consultations via our center with doctors from district hospitals and city medical organizations has more than tripled" [14].

In the Voronezh region, the system of emergency medical care is also undergoing changes, including those associated with the introduction of the latest digital technologies — especially in various emergencies.

The Voronezh Regional Clinical Center of Disaster Medicine (hereinafter referred to as the Center) is a medical organization of a special type. It consists of 3 departments: emergency consultative medical care, medical evacuation, anesthesiology and resuscitation. Such a structure of the Center's medical unit fully meets the tasks it performs. "Narrow" specialists provide specialized emergency medical care; resuscitation physicians provide medical evacuation of patients requiring resuscitation support during transportation (if necessary, they perform anesthesiology aid during operations). 24 hours a day the ambulance doctors provide medical aid to the victims of road accidents in the area of responsibility of the emergency center on the highway M-4 "Don" and ensure interaction with the rescue service — structural subdivision of the institution "Civil defense, population protection and fire safety of the Voronezh region".

The aim of the research is to define the role of telecommunication technologies in increasing the performance efficiency of the Voronezh Regional Clinical Center of Disaster Medicine.

Materials and methods of the research. The data contained in the analytical reports and other documentation of the Center for 2018-2020 were analyzed in terms of identifying patterns of their change with the introduction of telecommunication technologies in the work of the Center.

Results of the study and their analysis. Table 1 presents the main indicators of the Center's work in 2018-2020.

As can be seen from the analysis of data on the work of the Center in 2018-2020, in these years there was a tendency to increase the volume of specialized emergency and ambulance medical care to the population of the Voronezh region. Thus, in 2020 the number of patients who received medical care, taking into account remote telephone consultations, increased by 12.7% compared to 2019. The increase was due to the growth: the number of remote telemedicine consultations — by 53 (9.2%); the number of outreaches by ambulance vehicles — by 624 (31.0%); the number of evacuations — by 1401 (123%).

Data on the provision of medical care by specialists of the Center and by regional medical treatment organizations to patients in district hospitals in 2018-2020.

Resuscitation specialists accounted for the largest proportion (50.4%) of the total number of specialists who performed sanitary tasks in 2020. This is due to an increase in the number of patients, mainly COVID-19 patients, who required resuscitation support during medical evacuations — compared to 2019, the number of visits increased by 6.8%. For the same reason, emergency physicians performed 699 missions in 2020. Endoscopy physicians were very active — they made 174 missions in 2020.

A large number of surgeries were performed by specialists of the Center and regional medical treatment organizations in district hospitals in 2018-2020 (Table 3). (Table 3).

As can be seen from the data in Table 3, the number of surgeries performed by all surgeons in 2020 decreased by 61 compared to 2019. This was due to a decrease in the number of vascular surgeries — vascular surgeons operated on 116 fewer patients in 2020 than in 2019. At the same time, more (by 38) general surgeries were performed. This was due to surgical manipulations in patients with acute gastrointestinal bleeding during therapeutic fibrogastroduodenoscopies. Decrease of operative activity can be related to restrictive measures in connection with the COVID-19 pandemic.

Of all the medical teams at the Center, the neurosurgical team was the most in demand. Its specialists took an active part in providing medical aid to the victims of traffic accidents (Table 4).

As we can see from Table 4, in 2020 the volume of neurosurgical care increased due to the increase of telemedicine consultations (by 53). The total number of consulted patients increased by 47 (5.2%).

Telemedicine consultations for II and III level trauma center physicians are extensively introduced into the Center's practice (Table 5).

The data in Table 5 show the growing demand for telemedicine consultations by neurosurgeons. This seems to be due to the increased attention to solving the problem of medical care for victims of road accidents. These accidents are accompanied by a large number of lethal outcomes as a consequence of craniocerebral injuries.

Thus, the use of telemedicine technology has enabled neurosurgeons to make real-time decisions about the need to travel to regional hospitals to provide emergency medical care to patients or to conduct remote telemedical consultations. For example, in 2020 there were 955 requests to neurosurgeons from district hospitals in Voronezh Oblast

Таблица 1 / Table No. 1

Основные показатели работы ТЦМК в 2018–2020 гг.

Key performance indicators of the territorial disaster medicine center in 2018-2020

Показатель / Indicator	2018	2019	2020
1. Количество обращений об оказании скорой и скорой специализированной медицинской помощи, в т.ч. о проведении медицинской эвакуации, абс. Number of requests for emergency and specialised emergency medical care, including medical evacuation, abs.	3258	4114	4636
1.1. в т.ч. обращений о проведении медицинской эвакуации больных Covid-19 of which requests for medical evacuation of patients Covid-19	–	–	1698
2. Оказана медицинская помощь, чел., всего, из них: Medical care provided, people, total, of which:	3258	4114	4636
2.1. медицинская эвакуация больных Covid-19 medical evacuation of patients with Covid-19	–	–	1698
2.2. консультации по телефону / consultations by phone	780	1263	837
2.3. телемедицинские консультации / telemedicine consultations	536	577	630
2.4. выезды специалистов на санитарном автотранспорте visits of specialists by sanitary vehicles	1951	2014	2638
2.4.1. в том числе для эвакуации больных Covid-19 of which for evacuation of patients Covid-19	–	–	1167
2.5. количество вылетов санитарной авиации, абс. number of air ambulance flights, abs.	291	263	166
3. Количество операций, выполненных специалистами Центра в ЛМО области, абс. / Number of surgeries performed by specialists of the center in regional medical treatment organisations, abs.	448	451	390
4. Количество оперативных пособий, выполненных специалистами Центра в ЛМО области (фиброэзофагогастродуоденоскопии, бронхоскопии, колоноскопии), абс. Number of surgical procedures performed by specialists of the center in regional medical treatment organisations (fibroesophagogastroduodenoscopy, bronchoscopy, colonoscopy), abs.	219	212 (179 гастродуоденоскопий; 33 бронхоскопии) / 212 (179 gastroduodenoscopies; 33 bronchoscopies)	174 (4 бронхоскопии; 2 колоноскопии) 174 (4 bronchoscopies; 2 colonoscopies)
5. Число эвакуированных, чел., из них: / Number of evacuees, people, of them:	1148	1139	2540
5.1. - с острой хирургической патологией / with acute surgical pathology	550	503	338
5.2. - с терапевтической патологией / with therapeutic pathology	517	552	445
5.3. - с Covid-19 / with Covid-19	–	–	1698
5.4. - детей / children	70	64	44
5.5. - с акушерской и гинекологической патологией - with obstetric and gynecological pathology	11	20	15
6. Доставлено в экстренном порядке компонентов крови в ЛМО области, л, из них: Blood components urgently delivered to regional medical treatment organisations, l, of which:	40,8	55,5	45,1
- эритроцитарная масса / red blood cell mass	17,3	28,0	20,6
- свежезамороженная плазма / fresh frozen plasma	23,5	27,5	24,5

Таблица 2 / Table No. 2

Количество выездов специалистов ТЦМК и областных ЛМО в районные больницы в 2018–2020 гг., абс./ %

Number of trips by specialists of the territorial disaster medicine center and regional medical treatment organisations to the regional hospitals in 2018-2020, abs.

Специалисты / Specialists	2018	2019	2020
Анестезиологи-реаниматологи ТЦМК / Anesthesiologists-resuscitators of the territorial disaster medicine center	832/46,5	962/43,6	**1337/50,4**
Нейрохирурги ТЦМК, ВОДКБ* /Neurosurgeons of center and VRCCH*	130/5,8	171/7,8	**163/6,1**
Хирурги, кроме нейрохирургов – все областные ЛМО / Surgeons other than neurosurgeons of regional medical treatment organisations	606/26,8	436/19,8	**226/8,5**
- в т.ч. общие хирурги / including general surgeons	167/7,4	112/5,1	**77/2,9**
Другие специалисты / Other specialists	474/20.0	636/28,8	**928/35**
Всего / Total	2242/100,0	2205/100,0	**2654/100,0**

* ВОДКБ – Воронежская областная детская клиническая больница /* VRCCH – Voronezh Regional Children's Clinical Hospital

for emergency consultative medical care. In 163 cases (17.1%) neurosurgeons visited patients, and 137 patients were operated on in 84% of the visits. The number of telemedicine consultations was 630 (66% of the total number of visits). The presented data testify the high efficiency of applying the telemedical technologies in the work of the Center providing the emergency specialized neurosurgical aid to the population of the Voronezh region.

Conclusion

1. The introduction of telemedical technologies in the work of the Center resulted in the increase of volume of rendering medical care by the specialists of the Center.

2. The neurosurgeons were the most demanded specialists, who performed telemedicine consultations, which is mostly related to the necessity of consultations for II and III level trauma centers doctors, involved in the treatment of the victims of traffic accidents.

Таблица 3/ Table No. 3

Количество операций, выполненных в районных больницах хирургами ТЦМК и областных ЛМО в 2018–2020 гг., абс.

Number of surgeries performed by specialists of the territorial disaste medicine center and regional medical treatment organisations in the regional hospitals, abs.

Показатель / Indicator	2018	2019	2020
Выполнено операций, всего, из них: Number of surgeries, total, of which:	448	451	**390**
• нейрохирургами / by neurosurgeons	116	127	**137**
• другими хирургами, всего, из них: by other surgeons, total, of which:	332	324	**253**
- общими хирургами - by general surgeons	96	70	**118**
- травматологами - by traumatologists	26	5	**8**
- сосудистыми хирургами - by vascular surgeons	186	235	**119**
- челюстно-лицевыми хирургами - by maxillofacial surgeons	5	3	**3**
- торакальными хирургами - by thoracic surgeons	7	4	**3**
- отоларингологами - by otolaryngologists	10	2	**1**
- урологами / by urologists	–	3	**0**
- акушерами-гинекологами - by obstetricians-gynecologists	2	2	**1**

Таблица 4 / Table No. 4

Характеристика работы специалистов нейрохирургической бригады ТЦМК в 2018–2020 гг.

Characteristics of the work of specialists of the neurosurgical team of the territorial disaster medicine center in 2018-2020

Показатель / Indicator	2018	2019	2020
Количество выездов, абс. / Number of trips, abs.	130	172	**163**
Количество выполненных операций, абс./ Number of surgeries performed, abs.	116	127	**137**
Количество консультаций по телефону, абс. / Number of phone consultations, abs.	156	331	**325**
Количество телемедицинских консультаций, абс. / Number of telemedicine consultations, abs.	536	577	**630**
Число проконсультированных пациентов, чел. / Number of persons consulted, people	822	908	**955**

Таблица 5 / Table No. 5

Количество экстренных ТМК, выполненных нейрохирургами Центра для врачей травмоцентров II и III уровня в 2018–2020 гг.

Number of emergency telemedicine consultations given by the Center's neurosurgeons for Level II and Level III trauma center doctors in 2018-2020

Лечебная медицинская организация, для врачей которой проведена экстренная ТМК Medical treatment organisation, for doctors of which an emergency telemedicine consultation was given	Количество телемедицинских консультаций, абс. Number of telemedicine consultations, abs.		
	2018	2019	2020
Борисоглебская районная больница (РБ) / Borisoglebskaya District Hospital	101	74	**146**
Павловская РБ / Pavlovskaya District Hospital	110	158	**139**
Россошанская РБ / Rossoshanskaya District Hospital	141	104	**112**
Бобровская РБ / Bobrovskaya Disctrict Hospital	44	98	**91**
Клиническая больница №33 ФМБА России / Clinical Hospital №33 of the Federal Medical and Biological Agency of Russia	76	57	**56**
Лискинская РБ / Liskinskaya District Hospital	5	45	**44**
Богучарская РБ / Bogucharskaya District Hospital	20	11	**19**
Калачеевская РБ / Kalachevskaya District Hospital	32	28	**19**
Аннинская РБ / Anninskaya District Hospital	1	–	**2**
Таловская РБ / Talovskaya District Hospital	–	–	**1**
Бутурлиновская РБ / Buturlinovskaya District Hospital	1	1	**–**
Репьёвская РБ / Repyovskaya District Hospital	–	1	**–**
Каменская РБ / Kamenskaya District Hospital	1	–	**–**
Семилукская РБ / Semilukskaya District Hospital	1	–	**–**
Эртильская РБ / Ertilskaya District Hospital	1	–	**–**
Поворинская РБ / Povorinskaya District Hospital	–	–	**1**
Всего / Total	536	577	**630**

3. The Voronezh Regional Clinical Center for Disaster Medicine plans to further expand the use of telecommunication technologies not only for treatment of victims of road accidents, but also for treatment of victims of other emergencies of man-made and natural origin. This includes the expansion of the list of specialists involved in providing emergency medical aid at different stages of medical evacuation.

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Information article

EXPERIENCE OF ELIMINATION OF MEDICAL AND SANITARY CONSEQUENCES OF EMERGENCY IN MAGNITOGORSK: CHRONOLOGY OF EVENTS

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Abstract. The experience of liquidation of medical and sanitary consequences of the emergency situation caused by domestic gas explosion and collapse of the entrance of a multistory building in Magnitogorsk on December 31, 2018 is presented. Actions to mobilize resources of the Government, the Ministry of Health and the Territorial Center for Disaster Medicine of Chelyabinsk region, organization of coordinated work of ambulance teams and visiting teams of specialized medical care, forensic experts and psychologists were analyzed. The important role of the Ministry of Health of Russia, of the Government and personally of the President of the Russian Federation V. Putin in the organization of care for the victims, in forming the third echelon of medical forces and means using air ambulance was noted.

Key words: *ambulance teams, casualties, Chelyabinsk Oblast Government, Chelyabinsk Oblast Ministry of Health, Chelyabinsk Oblast Regional Center of Disaster Medicine, domestic gas explosion, forensic experts, house collapse, psychologists, regional emergency situation, resource mobilization, specialized medical teams, third echelon of medical forces and facilities, victims*

Conflict of interest. The authors declare no conflict of interest

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Информационное сообщение

ОПЫТ ЛИКВИДАЦИИ МЕДИКО-САНИТАРНЫХ ПОСЛЕДСТВИЙ ЧРЕЗВЫЧАЙНОЙ СИТУАЦИИ В г.МАГНИТОГОРСКЕ: ХРОНОЛОГИЯ СОБЫТИЙ

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Резюме. Представлен опыт ликвидации медико-санитарных последствий чрезвычайной ситуации (ЧС), вызванной взрывом бытового газа и обрушением подъезда многоэтажного дома в г.Магнитогорске 31 декабря 2018 г. Проанализированы действия Правительства, Минздрава и территориального центра медицины катастроф (ТЦМК) Челябинской области по мобилизации ресурсов, организации слаженной работы бригад скорой медицинской помощи (СМП), выездных бригад специализированной медицинской помощи, судмедэкспертов и психологов. Отмечена важная роль Минздрава России, Правительства и лично Президента Российской Федерации В.В.Путина в организации оказания медицинской помощи пострадавшим, формировании третьего эшелона медицинской группировки сил и средств с использованием санитарной авиации.

Ключевые слова: *бригады скорой медицинской помощи, бригады специализированной медицинской помощи, взрыв бытового газа, мобилизация ресурсов, обрушение дома, погибшие, пострадавшие, психологи, судмедэксперты, территориальный центр медицины катастроф, третий эшелон медицинской группировки сил и средств, чрезвычайная ситуация регионального масштаба*

Конфликт интересов. Авторы сообщения подтверждают отсутствие конфликта интересов

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In Magnitogorsk on December 31, 2018 as a result of a domestic gas explosion there was a collapse of the entrance of a multistory apartment building in the center of the city. The explosion destroyed 26 apartments, where 46 people lived. Fifty-one apartments were damaged — 126 people lived there. Thirty-nine people were killed at the scene, including six children. The time of the event was 6:00 a.m. Climatic conditions at that time: air temperature -21 °C, sunrise - 9:20. In the aftermath of the explosion 575 people were involved, 123 vehicles and 10 search and rescue teams of Russian Emergencies Ministry. Search and rescue operation was completed on January 3, 2019 at 17:49.

Organization of medical assistance. On 31.12.2018 at 06:08 the central control room of the Emergency Medical Service Station of Magnitogorsk received a message from the Unified Duty Dispatch Service about the explosion of a residential building at the address: K. Marx Avenue, 164.

The message was received by the senior doctor of the dispatcher service of emergency station. At 06:08, five ambulance crews were sent to the scene of the emergency. The first teams, including resuscitation ones, arrived at the scene of the explosion at 06:15. The arrival time was 7 minutes. Based on the estimated number of victims, 7 more ambulance crews were sent to the emergency area at 06:10. At 06:35, 12 ambulance crews were already working at the scene of the emergency. A resuscitation team doctor took charge of the work of the ambulance crews. A medical triage area was identified on site, and the ambulance crews were ready to conduct it with simultaneous emergency medical care. All ambulance crews were equipped with the necessary medications and additionally equipped with emergency packs. When the first casualties arrived at the triage area, the crews worked as a team. The drivers of the ambulances, given the darkness of the day and weather conditions, illuminated the collection point with their headlights. They prepared stretchers, blankets, a supply of water, a set of transport tires and were ready to act as a recorder.

Since 8:00 on December 31, 2018, in accordance with the Decree of the Governor of the Chelyabinsk region in its territory mode of emergency of regional character was introduced and the zone of the regime — K. Marx Avenue in Magnitogorsk — was determined.

On the site of the emergency around the clock operational headquarters of the Government of the Chelyabinsk region was created to prevent and to eliminate emergencies and to ensure fire safety.

The Commission instructed the Ministry of Health of the Chelyabinsk region:

- to make ready and to send specialists of the territorial center of disaster medicine of the Chelyabinsk region to the zone of emergency;
- to provide health care facilities with the necessary set of medicines and blood;
- to organize medical and psychological support of victims and of personnel involved in the liquidation of the emergency situation.

The Minister of Health of the Chelyabinsk region announced a meeting of heads of medical organizations of Magnitogorsk. The deputy chief physician for civil defense and mobilization work of station of first aid took part in it.

In addition, the following instructions were given:

- To the deputy director of the Center for the coordination of medical organizations of the Chelyabinsk region — to provide operational work on the coordination of medical organizations in Magnitogorsk city district;
- To the chief physician of the Chelyabinsk Regional Clinical Hospital — to prepare and to send to the place of emergency a comprehensive emergency response team. The team consisted of two anesthesiologists-resuscitators, a surgeon, an orthopedic trauma surgeon, a cardiovascular surgeon, and a neurosurgeon; to ensure smooth operation of the emergency consultative medical care department of the Chelyabinsk Regional Clinical Hospital;
- To the chief physician of Chelyabinsk Regional Children's Clinical Hospital - to prepare and to send a comprehensive team of doctors to the place of the event. The team consisted of two anesthesiologists-resuscitators, a pediatric surgeon, an orthopedic trauma surgeon, a neurosurgeon; to ensure uninterrupted operation of the resuscitation and consultation center of Chelyabinsk Regional Children's Clinical Hospital;
- To the Chief Psychiatrist of the Ministry of Health of the Chelyabinsk Region — to coordinate the work on the provision of medical and psychological and psychiatric care to the residents of Magnitogorsk with the participation of psychiatrists and medical psychologists of all services.

The Ministry of Health of the Chelyabinsk region mobilized the necessary resources. The order of the Ministry of Health of the Chelyabinsk region "On the organization of medical care in the Chelyabinsk region for the period of liquidation of consequences of emergencies on the territory of the Magnitogorsk city district" from 31.12.2018 №2756 was issued.

There were deployed:

- at Magnitogorsk City Hospital No. 3 — 446 beds for adults;
- in the Children's City Hospital of Magnitogorsk — 403 beds for children;
- In the Central Clinical Medical and Health Care Unit of Magnitogorsk — 526 reserve beds.

There were 42 ambulance crews ready for action.

Uninterrupted work of structural subdivisions of medical treatment organizations was provided; the reserve and stocks of medicines and medical products were checked; stocks of dressings, equipment, food, drinking water, fuel and lubricants for continuous operation were checked; readiness for uninterrupted work of technical services was provided.

96 artificial pulmonary ventilation devices were put in readiness.

For the treatment of patients with acute renal failure 16 places for dialysis were prepared.

The stock of blood components for transfusion has been checked.

All donors have been notified. Preliminary collection of donor blood was scheduled for 03.01.2019.

A referral scheme was put in place for victims to receive specialized medical care in inpatient settings.

To reinforce the medical team of the territorial Center for Disaster Medicine an anesthesiologist of the Central Clinical Medical Unit was sent to the site of the event.

The work of 11 medical psychologists and psychiatrists was organized in all medical treatment organizations of Magnitogorsk, as well as medical psychologists on the basis of secondary school № 14 and on the site of the emergency situation — 164, K. Marx Ave.

In the department of neuroses of the regional psychoneurological hospital № 5 an office of psychological care was opened.

For the period of emergency response on the territory of Magnitogorsk city district operational group of the Ministry of Health of the Chelyabinsk region was created.

At 9:30 a.m. by order of the operational headquarters 9 mobile ambulance teams were withdrawn from the scene of the emergency.

Since 10:00 on 31.12.2018 medical assistance was provided:

- *at the scene of the event:*

- by three mobile ambulance crews (one — resuscitation, 2 — paramedic);

- in a temporary mobile point — the bus — by the doctor of urgent medical aid of city hospital No. 3 of Magnitogorsk;

- by medical psychologist of the regional psychoneurological hospital No. 5;

- in the operational headquarters on the basis of school №14:

- by visiting medical team of the ambulance;

- in a temporary point of medical care — by the team of emergency medical care of city hospital No. 3 of Magnitogorsk;

- by medical psychologists of the regional psychoneurological hospital No. 5.

In accordance with the order of the Ministry of Health of the Chelyabinsk region "On providing medical assistance to citizens living in temporary accommodation points on the territory of the Magnitogorsk city district" from 31.12.2018 № 2757 2 temporary accommodation points for 50 places each were organized.

On December 31 to Magnitogorsk arrived: the Minister of Health of the Russian Federation V. I. Skvortsova, Deputy Minister of Health of the Russian Federation O. O. Salagai, specialists of the National Medical Research Center of Psychiatry and Narcology named after M. P. Serbsky of the Ministry of Health of the Russian Federation.

Russian Minister of Health V. Skvortsova visited the scene of the accident and the victims hospitalized at the Children's City Hospital and City Hospital № 3.

The same day in Magnitogorsk Russian President Vladimir Putin arrived. He visited the scene of the emergency and the child hospitalized from the scene of the tragedy at the Children's City Hospital.

At 17:00 from Chelyabinsk regional clinical hospital a complex medical team consisting of 2 anesthesiologists-resuscitators, a surgeon, a cardiovascular surgeon, an orthopedic traumatologist, a neurosurgeon was sent to the area of emergency.

Under the guidance of the chief forensic expert of the Chelyabinsk Oblast Ministry of Health, a team of forensic experts was formed, which included 5 employees of the Magnitogorsk interdistrict branch of the Chelyabinsk Regional Bureau of Forensic Medicine.

On 31.12.2018 21 applications of victims for medical assistance were registered. Of these, 16 people (including one child) were treated on an outpatient basis, 5 people (including one child) were hospitalized in a moderate degree of severity. In addition, one adult patient was hospitalized in serious condition.

On 01.01.2019, a medical post continued to work at the operational headquarters. From 8:00 to 20:00, one ambulance team was on duty, a medical psychologist, specialists from the National Medical Research Center of Psychiatry and Narcology named after M.P. Serbsky, and specialists from the regional psychoneurological hospital № 5 were on duty.

Since 01.01.2019 (pending the decision of the Task Force) the number of outreach ambulance teams working around the clock has been increased. The duty of one mobile ambulance team in the Magnitogorsk interdistrict branch of the Chelyabinsk regional bureau of forensic medical examination was organized.

At 10:30 medical workers made a round of all apartments of the nearest entrances (basically 5th and 9th) to determine the state of health of residents.

Two mobile ambulance teams and medical psychologists continued to be on duty at the scene of the emergency.

A temporary accommodation center was open 24 hours a day with 14 people in it (medical examination of the victims was made 3 times a day).

At 16:35, a day and a half after the emergency situation occurred, a child (date of birth — 16.02.2018) was extracted from under the rubble of the house. The provision of medical assistance to him started. The Minister of Health of the Russian Federation V.I. Skvortsova was informed. Under her guidance, S.I. Prikolotin, Minister of Health of Chelyabinsk Region, and E.N. Baibarina, Head of the Department of Medical Care for Children and Obstetric Services of the Russian Ministry of Health, coordinated the medical care for the child.

The resuscitation team of doctors on the resuscitation ambulance of Chelyabinsk Regional Children's Clinical Hospital consisting of two physicians, anesthesiologists-resuscitators and chief freelance specialist, children's surgeon of Chelyabinsk Region Ministry of Health left Chelyabinsk to evaluate the condition of the child and to adjust his treatment.

The council decided on the medical evacuation of the child to the Research Institute of Emergency Pediatric Surgery and Traumatology of the Moscow Department of Health. An air ambulance of the Russian Federal Medical and Biological Agency was called in. The child was handed over to the air ambulance resuscitation team. The child's condition did not deteriorate during the medical evacuation.

Since January 2, 2019, two mobile ambulance crews have been constantly on duty at the scene of the emergency. The residents of the neighboring entrances continued to make door-to-door visits, with no complaints about their state of health.

One of the victims, who was in a serious condition, was evacuated to the Chelyabinsk Regional Clinical Hospital (his condition during transportation was stable).

In the neurosis department at the children's day hospital of Regional Psychoneurological Hospital #5, a medical-psychological consulting room continued to operate

In the temporary accommodation, medical workers were on duty around the clock, and a psychologist worked.

On 03.01.2019 until 22:17 at the place of emergency 2 mobile ambulance teams were on duty.

Blood collection from donors was organized. 99 donations were carried out, more than 60 liters of blood were taken.

04.01.2019 on the basis of school № 14 from 8:00 until the close medical post and psychologist worked. The duty of the ambulance team during the reception of citizens by the Governor of the Chelyabinsk region was organized. On January 5-6, 2019, the medical post at School #14 continued to work. There were no calls to the emergency room.

The Commission on Emergency Situations and Fire Safety of the Chelyabinsk region decided to cancel the emergency regime in the territory of the Chelyabinsk region from 17:00 January 6, 2019. The regional subsystem of the Unified State System of Prevention and Elimination of Emergency Situations was transferred to the mode of daily activities. Medical organizations of Magnitogorsk were transferred to the normal mode of operation.

In total during the period from December 31, 2018 to January 08, 2019 230 people applied for medical and psychological assistance. Of these, 112 people (including 10 children) received psychological care. 112 people received emergency medical care in outpatient settings. Six people, including two children, were hospitalized. Of the 112 people who received emergency medical assistance in outpatient settings, 16 people (including one child) received medical care on site; 93 people (including 12 children) received medical care at school No. 14; 3 people received medical care at a temporary housing center.

Conclusion

1. Emergencies caused by gas explosions in residential buildings usually lead to severe consequences and cause many victims. They require the use of a large number of forces and means to eliminate their medical and sanitary consequences.

The peculiarity of an emergency situation in Magnitogorsk is a large number of deaths. It demanded involvement of a considerable number of forensic experts and medical psychologists to work with relatives of the victims. The potential of the Chelyabinsk region allowed to solve these problems promptly.

3. The second peculiarity of this emergency situation is a relatively small number of victims in need of medical care. The stage of medical triage of the victims at the scene of the emergency was characterized by the gradual arrival of the victims extracted by rescuers from under the rubble. The time of evacuation of victims from the emergency zone (from the moment of their extraction by rescuers of EMERCOM of Russia and transfer to the ambulance crews to hospital) was not more than 20 minutes.

Special attention should be given to the rescue of a child from under the debris one and a half days after the explosion at -20°C. The coordinated and prompt work of the municipal, regional and federal levels resulted in the full recovery and rehabilitation of the rescued child. We believe that in fact in this situation we can talk about the formation of the third echelon of medical forces and means, which is typical for an emergency of the federal scale. Direct participation of the President of the Russian Federation V.V. Putin and members of the Government of the Russian Federation in the liquidation of the consequences of the emergency situation, as well as participation of specialists of medical organizations of the federal level in providing medical and psychological assistance to the victims testify to the federal scale of this emergency situation.

5. The Minister of Health of the Russian Federation V.Skvortsova highly appreciated the work of emergency services — ambulance, emergency response teams of medical organizations of Magnitogorsk and Chelyabinsk region, the territorial center of disaster medicine of the Chelyabinsk region.

It was noted that ongoing regular tactical, special training and joint exercises with structures of Ministry of Emergency Situations and of the Ministry of Internal Affairs and of the territorial Center for Disaster Medicine of Chelyabinsk region allowed to avoid loss of time in this emergency situation, to mobilize the necessary resources and to organize the provision of medical care.

6. We believe that a detailed description of the decisions made and the course of organizational work on the elimination of medical and sanitary consequences of the emergency situation will provide an opportunity to study the experience gained in various exercises and trainings.

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Review article

MENTAL HEALTH SUPPORT MEASURES FOR MEDICAL PROFESSIONALS IN THE CONTEXT OF COVID-19 PANDEMIC: GLOBAL AND DOMESTIC EXPERIENCE

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Abstract. A new coronavirus infection COVID-19 has been declared a pandemic by the World Health Organization (WHO). Medical professionals, who play the leading role in the fight against the spread of the dangerous virus, work under conditions of high and prolonged stress. There is an urgent need for psychologists to intervene and to develop support measures for medical professionals to maintain and to preserve their mental health.
In connection with the need to determine the state of mental health of medical professionals and to assess international and domestic experience in the implementation of measures to support it, the analysis of scientific publications for 2020, devoted to the issue of mental health of medical workers in the pandemic COVID-19 was conducted.
The conclusion is made that the organization of psychological help and psychological support as well as positive world experience of the realized measures of support will allow to keep mental health of medical professionals during the pandemic.

Key words: *anxiety, depression, medical professionals, mental health, new coronavirus infection COVID-19, pandemic, stress, support measures*

Conflict of interest. The authors declare no conflict of interest

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Обзорная статья

МЕРЫ ПОДДЕРЖКИ ПСИХИЧЕСКОГО ЗДОРОВЬЯ МЕДИЦИНСКИХ СПЕЦИАЛИСТОВ В УСЛОВИЯХ ПАНДЕМИИ COVID-19: МИРОВОЙ И ОТЕЧЕСТВЕННЫЙ ОПЫТ

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Резюме. Новая коронавирусная инфекция COVID-19 объявлена Всемирной организацией здравоохранения (ВОЗ) пандемией. Медицинские специалисты, играющие ведущую роль в борьбе с распространением опасного вируса, работают в условиях высокого продолжительного стресса. Существует острая необходимость в оказании психологами мер поддержки медицинским специалистам с целью поддержания и сохранения их психического здоровья.
Для определения состояния психического здоровья медицинских специалистов и оценки мирового и отечественного опыта по реализации мер по его поддержке проанализированы научные публикации за 2020 г., посвященные вопросу психического здоровья медицинских работников в условиях пандемии COVID-19.
Сделан вывод, что использование положительного отечественного и мирового опыта организации оказания психологической помощи и психологического сопровождения медицинских специалистов позволит сохранить их психическое здоровье в период пандемии.

Ключевые слова: *депрессия, медицинские специалисты, меры поддержки, новая коронавирусная инфекция COVID-19, пандемия, психическое здоровье, психологи, стресс, тревога*
Конфликт интересов. Авторы статьи подтверждают отсутствие конфликта интересов

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Introduction

Throughout 2020, humanity has been under severe stress due to the spread of the new coronavirus infection COVID-19. The pandemic that erupted in 2019 still poses a serious threat to public health.

Experience shows that in the context of COVID-19 pandemic, we should take very seriously a possible disruption of not only physical, but also mental health, including in the long term.

This issue is especially relevant for medical professionals working in conditions close to those of an emergency. In such conditions, the preservation and maintenance of their mental health, as well as a decrease in the level of their psychological traumatization, depend on measures taken in time.

By the end of 2020, there were 83.43 million infected and 1.81 million deaths from COVID-19 [1, 2] — Figures 1, 2. The pandemic has dealt a serious blow to the global economy, changed everyone's lifestyle, and affected people's mental health. The health care systems of almost every country in the world are under tremendous pressure and excessive strain [3, 4].

Personnel of medical treatment organizations are at high risk of infection.

The new SARS-CoV-2 coronavirus infection has multiplied the workload of both medical professionals directly caring for patients with COVID-19 and of other healthcare workers [6, 7]. The need to provide medical care to a much larger number of patients, often in a new environment, forces to change the usual algorithm of medical staff actions. Stress caused by high mortality rate from COVID-19, shortage of medical staff, fears of possible infection of a medical specialist or his family members, and obligation to be in personal protective equipment for a long time — all this causes emotional burnout and psychological trauma to doctors and — especially — to nursing staff [6, 8]. Even in the first months of the pandemic, this caused concern among mental health professionals and health care

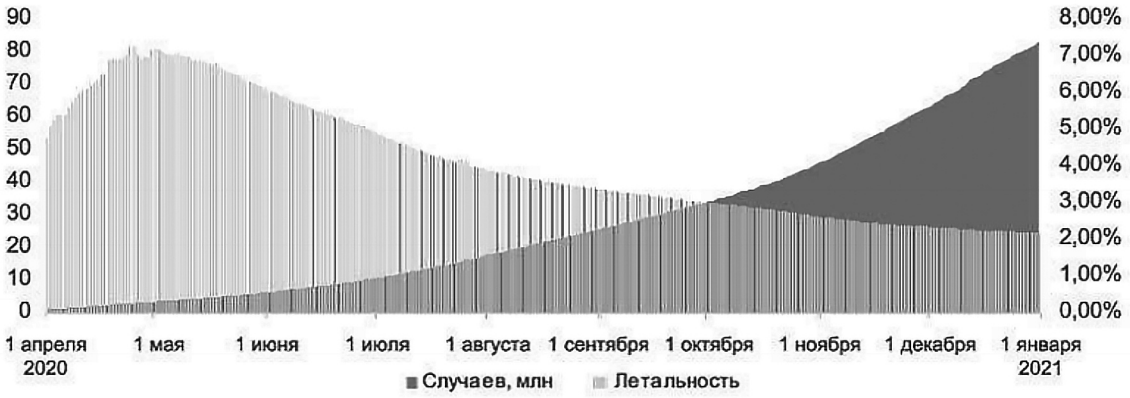

Рис.1. Пандемия COVID-19: заболеваемость и летальность в мире [2]
Fig. 1. COVID-19 pandemic: global morbidity and mortality [2]

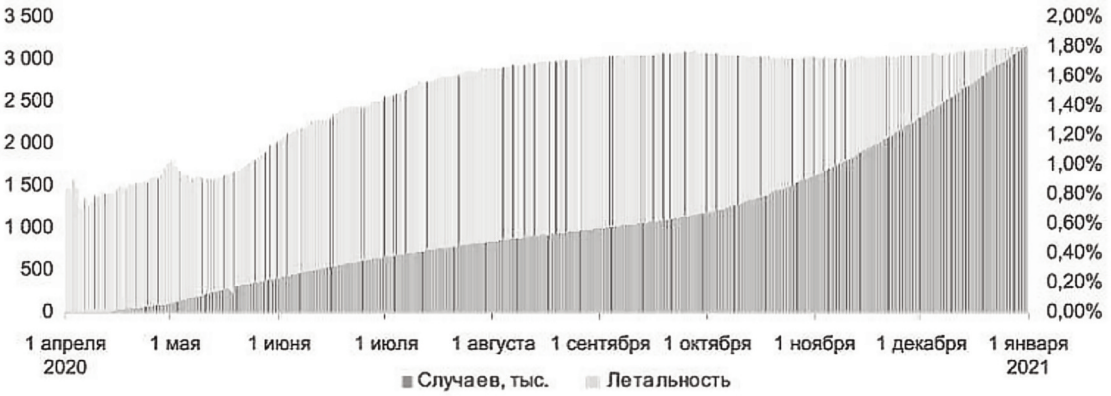

Рис.2. Пандемия COVID-19: заболеваемость и летальность в Российской Федерации [5]
Fig.2. COVID-19 pandemic: morbidity and mortality of COVID-19 in the Russian Federation [5]

organizers about the potential impact of these factors on the mental health of medical workers [9]. This was particularly true for medical professionals working in intensive care units, observing and caring for critically ill patients (10).

In the nearest future, this tension can lead to the emergence of new problems of psychological nature. In this connection, it is very important to effectively organize accessible psychological support for all medical workers. Specialists in the field of mental health must pay attention to this problem and take measures to preserve the psychological stability of persons in these populations [11].

Experience in 2020 has shown that factors such as high-risk environments, direct contact with infected patients, length of work shift, and professional experience also affect the psychological well-being of health care workers. These factors can be controlled to some extent, thus reducing the intensity of the impact of the stressful situation.

Psychological support should be conducted systematically. At the same time it is necessary to pay special attention to the study of each aspect of mental health [12].

The study of the virus and issues related to its impact on physical and mental health in the long term is not only an issue of COVID-19 control, but also one of the public health priorities at the international level.

Even during the first wave of COVID-19 diseases there was a high psychological burden and impact of stress factors on the world population. At present, the negative impact of COVID-19 pandemic on the psyche of the population and — especially — on health care professionals continues to persist. Health professionals, as a high-risk group, have been in direct contact with the virus for a long time. As a result, their mental health requires close attention from specialists [13, 14]. Since the onset of the pandemic, tension, anxiety and other negative emotional reactions began to spread on a large scale. This caused the onset of a psychological crisis for both medical professionals and health care organizers [11].

Heads of medical treatment organizations experienced additional stress due to the responsibility they had for organizing safety measures, for the state of human resources and for their ability to respond quickly to all changes.

Doctors and nurses often had to take on overwhelming tasks. Health care workers, especially in organizations converted to deal with COVID-19, were more vulnerable than the general population. They were in an environment of high risk of infection, as well as of further spread of the virus to their families and colleagues. Post-traumatic stress disorder — PTSD (ICD-10 - F43.1), as well as severe anxiety and depressive disorders associated with PTSD can lead to psychological traumatic experiences in a delayed perspective [15-17].

According to a number of domestic and foreign studies, in the COVID-19 pandemic, health care workers were exposed to negative factors affecting not so much their physical health as their mental health [18-22]. One of the factors reinforcing the psychotraumatic effect of the COVID-19 pandemic was that health care workers caring for patients with a new coronavirus infection were often stigmatized by friends, family, and the public [23, 24]. Lack of support from the community and society has been shown to be a predictor of declining mental health in countries where social and psychological support measures for health workers have been insufficiently addressed by the state. The most frequent indicators of psychological impact were anxiety and depression, which inevitably affected the quality of medical care [25, 26].

Such indicators as length of stay in the "red" zone, work in intensive care units, lack of personal protective equipment, having a family member with a confirmed COVID-19 diagnosis increase the degree of stress and the risk of developing negative, including long-term, consequences [27].

Despite the fact that the above factors are temporary, the consequences of the pandemic will affect health care workers for a long time [28]. In this situation, measures to support health care workers must be taken not only during the pandemic, but also for a long time after its end.

As the experience of past epidemics and the results of studies conducted in 2020 have shown, in addition to meeting basic needs and creating satisfactory working conditions (rest and adequate nutrition, sufficient number of PPE sets and shift work schedules), support measures should be provided to optimize the conditions of health workers in and out of their workplaces [8, 16, 29]. The experience of many countries has shown that the organization of logistics, accommodation, delivery of meals and activities with children of medical workers has a beneficial effect not only on their physical state, but also on their mental health. At the same time, systematic monitoring of their mental state and accessible psychological support for medical personnel both on the territory of the treatment organization and outside of it is necessary. This includes the organization of support hotlines and other measures of communication and feedback.

Currently, the epidemic situation in the Russian Federation is under control. In this regard, the stress of medical personnel can be relieved in a systematic and step-by-step manner, engaging all possible resources for the development of psychosocial and mental support for medical professionals [23, 30, 31].

At the same time, support from medical workers themselves is also important. Since the team of medical specialists has common work experience, common working conditions and solves the same tasks, the use of these factors directly depends on the manager's ability to organize competent and effective work communication [12].

It is important to take into account the experience of previous epidemics and other disasters, when medical workers were "on the front line". During the Ebola outbreak, for example, medical professionals were prone to higher levels of psychosomatic disorders, depression, anxiety, and obsessive compulsions. During the MERS coronavirus outbreak (ICD-10 - B34.2), a large proportion of health care workers were susceptible to obsessive thoughts about contracting MERS and felt unsafe in the workplace. The same experience was also reported during the spread of SARS, with health care workers reporting high risk of infection of themselves and of their immediate environment, emotional distress, insecurity, and stigmatization [27, 31].

Conclusion

Working in a COVID-19 pandemic environment makes health care workers particularly vulnerable to psychological distress. Research show high levels of depression, stress, anxiety, distress, anger, fear, insomnia, and possible consequences in the form of PTSD. This fact requires further research in order to study long-term effects and to

organize measures for support and psychosocial rehabilitation of medical workers.

The psychological and mental health of medical professionals, greatly affected by the COVID-19 pandemic, should be taken very seriously. Although past studies and research on the effects of the COVID-19 pandemic have shown that the mental impact of any major disaster has a broader and more lasting impact on society than physical trauma, the mental health of health professionals is currently receiving much less attention.

The pandemic has greatly altered the usual pace of life and accelerated reorganization in all areas of our country's economy. At the same time, in order to maintain the sustainability and flexibility of the health care system during any crisis situation, as well as to respond effectively to the crisis situation, it is important to maintain a focus on human resources and their support measures, thereby increasing the adaptability of not only the individual health care provider, but also the entire health care system.

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Original article

EXTENDED FIRST AID: PERSPECTIVES AND CHALLENGES OF REGULATORY AND LEGAL FRAMEWORK

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Abstract. In order to improve quantitative and qualitative characteristics of first aid, an urgent need arose to increase its authorised volume for certain categories of first aid providers in accidents, disasters, natural calamities, epidemics, terrorist acts and armed conflicts and under other special conditions.
In accordance with Order No. 3155-r of the Government of the Russian Federation of 28 November 2020, legislative mechanisms should be developed by December 2021 to expand the scope of first aid. Introduction of changes and additions into Art. 31 of Federal Law No. 323-FZ of 21 November 2011 "On Fundamentals of Public Health Protection in the Russian Federation" will make it possible to update current legislation by amending a number of acts and by adopting new documents.
The authors suggest the development of draft amendments to the federal law "On Medical Drugs Circulation", to draft normative legal acts of the Government of the Russian Federation and of federal executive bodies which will be necessary for implementation of norms of the federal law "On Amendments to Art. 31 of the federal law "On Fundamentals of Public Health Protection in the Russian Federation".

Key words: *extended first aid, first aid, normative-legal regulation, scope of first aid*

Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

РАСШИРЕННАЯ ПЕРВАЯ ПОМОЩЬ: ПЕРСПЕКТИВЫ И ПРОБЛЕМЫ НОРМАТИВНО-ПРАВОВОГО РЕГУЛИРОВАНИЯ

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Резюме. Отмечено, что для повышения количественных и качественных характеристик оказания первой помощи насущной потребностью является увеличение объема ее оказания для отдельных категорий лиц, оказывающих первую помощь при авариях, катастрофах, стихийных бедствиях, эпидемиях, террористических актах, в вооруженных конфликтах и в других особых условиях.
В соответствии с Распоряжением Правительства Российской Федерации от 28.11.2020 г. №3155-р к декабрю 2021 г. должны быть разработаны законодательные механизмы, направленные на расширение объема оказания первой помощи. Внесение изменений и дополнений в ст.31 Федерального закона «Об основах охраны здоровья граждан в Российской Федерации» от 21.11.2011 г. №323-ФЗ даст возможность актуализировать действующее законодательство путем внесения изменений в целый ряд актов и принятия новых документов.
Авторами представлены предложения по разработке проектов внесения изменений в Федеральный закон «Об обращении лекарственных средств», в проекты нормативных правовых актов Правительства Российской Федерации и федеральных органов исполнительной власти, которые будут необходимы для реализации норм Федерального закона «О внесении изменений в ст. 31 Федерального закона «Об основах охраны здоровья граждан в Российской Федерации».

Ключевые слова: *нормативно-правовое регулирование, объем оказания первой помощи, первая помощь, расширенная первая помощь*

Конфликт интересов. Авторы статьи подтверждают отсутствие конфликта интересов

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Introduction

For some participants in the provision of first aid, the expansion of its volume is an urgent social need [1]. The need to expand the volume of first aid is due to the fact that some groups of people may be exposed to specific risk factors — potent chemicals, local armed conflicts, terrorist attacks, barotrauma, ionizing radiation, hazardous production, etc. In addition, some groups of persons may face impossibility of timely provision of medical assistance in case of disasters and accidents requiring emergency rescue operations, and in case of natural disasters; when they are in remote areas of the taiga and the Far North, at Roshydromet stations, on ships and aircrafts, in mines, etc.

In the above situations, in order to save lives and to preserve people's health, it is necessary to take such measures as medical triage of victims, inhalation of oxygen, immobilization, transportation, and also — in some cases — anesthesia, blood loss replacement, use of antidotes, etc. Without taking these measures, under conditions when the first aid measures approved by the order of the Ministry of Health and Social Development of Russia dated May 4, 2012 No. 477n[1] will not be enough to save the victim's life, and the provision of medical assistance is impossible or delayed, the person may die or his health may be severely, sometimes irreparably, damaged.

However, at present, these measures are not included in the scope of first aid, approved by the above order.

In this regard, in order to further improve the provision of first aid, it is necessary to differentiate its volume, which is possible through the adoption of appropriate regulatory legal acts. This approach is consistent with international experience.

Abroad, most of the systems for the provision of prehospital medical care include several levels that differ from each other in volume and quality of medical care.

In many countries, the first level of prehospital medical care — First Aid — is provided by people without medical education. They are called First Responders — literally, first aid provider [2]. There are 2 groups within this level.

The first group includes First Responders, who provide basic first aid — First aid. These are people from various social or professional groups (taxi and truck drivers, soldiers, students, workers with no medical education). They are trained in voluntary or compulsory programs to recognize the critical condition of the victim, to call for medical assistance and to provide basic first aid until trained rescuers arrive. The same level of help can be provided by ordinary citizens — witnesses of the event. To learn First Aid skills a course of study that uses simple materials and brochures, which is usually a few hours long [3], is enough.

The second group consists of persons providing Advanced First Aid — extended first aid. This group includes people additionally trained in the first aid. These people, during their daily work, are more likely than ordinary citizens to be exposed to casualties with severe or life-threatening injuries or conditions.

Depending on the circumstances and on the level of need for their involvement in the provision of the first aid, people trained to provide extended first aid work either on a voluntary basis or are paid. They learn the principles of rescuing and retrieving victims from vehicles or rubble, of first aid, of preparation and of safe transport of patients to hospitals. In addition, they are equipped with a small set of equipment and with means for first aid [4].

First Responder training for extended first aid varies from country to country in terms of duration and extent of its provision and of the range of procedures permitted.

For example, in Australia, First Responder is a person trained in advanced first aid skills, including the use of an automatic defibrillator. In rural or other remote areas, he/she is the first to come to aid the victim and to begin to provide the first aid while the ambulance is on the way [5].

In the United States, first aid participants can be of two levels: first responder and certified first responder. The first level of the first aid is provided by ordinary people, including those who have no training or who have completed a short (usually eight hours) course. Certified first responder has an officially issued certificate of completion of courses lasting 40-60 hours and can perform a broader scope of activities [6].

The second level of care is called Basic Life Support (BLS). It is performed by: Emergency Medical Technician (EMT) — Basic; Intermediate Ambulance Techniques — EMT-Intermediate; ambulance technicians - paramedics — EMT-Paramedic [3].

The third — more complex — type of prehospital care is called "Advanced Life Support" — Advanced Life Support (ALS) and includes the implementation of complex interventions to save the life of the victim. It is performed by paramedics and doctors in the prehospital and hospital periods. The World Health Organization (WHO) believes that the decision to provide this level of care should not prejudice the simpler, basic elements of prehospital care [4].

Despite the high cost of advanced life support, WHO does not have sufficient evidence to suggest that this type of care benefits more than just a limited number of patients or victims who are most critically ill. In contrast, a significant improvement in first aid outcomes was recorded after primary trauma care providers were trained in the provision of the first aid [7]. In view of this, WHO recommends that caution is taken in deciding whether to use ALS and that decisions are based on a clear understanding of the relationship between costs and expected treatment outcomes when using these methods [4].

On November 28, 2020, the Government of the Russian Federation approved an action plan for the implementation of the Healthcare Development Strategy in the

[1] Order of the Ministry of Health and Social Development of Russia "On approval of the list of conditions in which first aid is provided, and the list of measures for first aid" dated May 4, 2012 No. 477n

Russian Federation for the period up to 2025[2], clause 7 of which provides for the development and implementation by December 2021 of legislative mechanisms aimed at expanding the volume of first aid, including its provision to victims of road accidents. For these purposes, the Government of the Russian Federation instructed the Ministry of Health, the Ministry of Industry and Trade, the Ministry of Internal Affairs of Russia and interested federal executive bodies to develop a corresponding draft law.

The State Duma has already passed the first reading of the draft Federal Law No. 466977-7 "On Amendments to Art. 31 of the Federal Law "On the Fundamentals of Health Protection of Citizens in the Russian Federation (in terms of providing first aid using automatic external defibrillators)" — hereinafter bill No. 466977-7. This bill should cite the provisions of Art. 31 of the Federal Law "On the Fundamentals of Health Protection of Citizens in the Russian Federation" dated November 21, 2011 No. 323-FZ in accordance with the current needs of the development of legal regulation of first aid and to differentiate first aid into 2 types: basic first aid and extended first aid.

After the adoption of this bill, in order to introduce expanded volumes of first aid, it will be necessary to adopt a number of regulatory legal acts, which is the subject of this article.

The purpose of the study is to provide a systematic comprehensive analysis of the problems and to determine the prospects for the legal regulation of the provision of extended first aid in the Russian Federation.

Research objectives: to assess the compliance of regulatory legal acts with the needs of expanding the volume of first aid, to identify problems and gaps in the regulatory legal framework, to develop proposals for improving the regulatory legal framework in order to expand the volume of first aid.

Materials and research methods. The methodological basis of the research was: general scientific — dialectical analysis and synthesis — and private — the method of legal hermeneutics, formal legal, systemic structural, historical legal, comparative legal and sociological — methods of scientific knowledge. Their use made it possible to carry out a comprehensive and complex analysis of the subject of research, to make theoretical generalizations, practical recommendations, and to formulate conclusions.

The normative and empirical base of scientific research is analytical material on the organization of extended first aid, contained in the works of Russian and foreign scientists. A study of federal laws and by-laws regulating the management of first aid activities, the organization of first aid and equipping of various categories of participants in first aid with first aid kits for its provision was carried out.

Research results and their analysis. Order of the Ministry of Health and Social Development of Russia dated May 4, 2012 No. 477n, providing for an equal volume of first aid for all participants in its provision, can be considered as basic.

Appendix No. 2 to the order contains the following list of first aid measures: measures to assess the situation and to ensure safe conditions for first aid; calling an ambulance, other special services, whose employees are required to provide first aid in accordance with federal law or a special rule; determination of the presence of consciousness in the victim; measures to restore airway patency and determine the signs of life in the victim; arrangements for cardiopulmonary resuscitation before signs of life appear; measures to maintain airway patency; measures for a body check of the victim and for a temporary stop of external bleeding; measures for a detailed examination of the victim in order to identify signs of injuries, poisoning and other conditions that threaten his/her life and health, and to provide first aid if these conditions are detected; giving the victim's body an optimal position; monitoring the condition of the victim (consciousness, breathing, blood circulation) and providing him/her with psychological support; transfer of the injured to an ambulance brigade or to other special services, whose employees are required to provide first aid in accordance with federal law or with a special rule.

This list of measures does not include the use of drugs and invasive techniques, which can be an urgent need for a number of participants in the provision of the first aid under specific risk factors and / or in remoteness from medical care.

The normative limitation of the volume of first aid was of great importance at the stage of formation of the institute of first aid, since it allowed for the first time to normatively delimit the activities of this type of aid from all other types of public health protection. However, to further improve the provision of first aid, it is necessary to normatively differentiate its volume.

Differentiation of first aid into basic and extended will require the adoption of a number of new by-laws, as well as amendments and additions to the current legislation.

At the first stage, it will be necessary to determine which federal executive authorities are interested in expanding the volume of first aid for the subjects controlled by them. To do this, it is necessary to form a circle of persons who will have the authority to provide extended first aid.

Next, it is necessary to determine the scope of provision of extended first aid for each category of persons based on the presence or absence of specific risk factors, on the availability of medical care, of legal authority to provide first aid and on many other factors — to develop lists of conditions in which the corresponding type of extended first aid is provided, and lists of measures to provide the appropriate type of extended first aid. It is necessary to authorize a relevant federal executive body to approve the specified lists, for which it will be necessary to make changes and additions to the Regulations on it.

All participants in the provision of extended first aid will have to undergo training in its provision. This will require exemplary programs of the training course, subject and discipline "Providing extended first aid". Such programs should be developed by interested federal executive bodies in conjunction with the Ministry of Health of Russia and should be approved in the prescribed manner.

For each contingent of participants in the provision of extended first aid, it will be necessary to develop and to approve requirements for the composition of first aid kits. After the approval of these requirements, the interested federal executive bodies, in our opinion, will need to develop their own rules for their supply, as well as the rules for storage, disposal and the procedure for allocating financing for their purchase, as well as for appointing a responsible unit. Lack of these requirements can make it extremely difficult to equip extended first aid participants with first aid kits.

[2] Order of the Government of the Russian Federation of November 28, 2020 No. 3155-r

In our opinion, the most effective from an organizational and legal point of view will be the development and adoption of a single package of the above departmental regulatory legal acts in the context of interagency cooperation. It seems appropriate to carry out work on draft regulatory legal acts within the framework of the Specialized Commission of the Ministry of Health of Russia on First Aid, which includes an expert council for the development of draft bylaws that determine the provision of extended first aid.

Consideration will also need to be given to the regulatory option of including drugs in the equipment of participants in extended first aid. Medicines may be required to provide extended first aid in case of poisoning with potent chemicals (introduction of antidotes), to replenish blood loss in conditions of impossibility of rapid medical care, etc. To realize this opportunity, the following should be prescribed normatively: the procedure for approving requirements for the composition of first-aid kits for basic and advanced first aid, including drugs; the procedure for the purchase, supply, storage and the procedure for the disposal of these medicinal products. Let us consider in more detail the changes and additions, which should be made to the regulatory legal framework.

The Regulation of the Ministry of Health of the Russian Federation — approved by the Decree of the Government of the Russian Federation dated June 19, 2012 No. 608 — empowers this body to approve "requirements for the complete set of medical products for first aid kits" (clause 5.2.12.). Thus, in order to complete the first aid kits not only with medical products, but also with medicines, it is necessary to expand the powers of the Ministry of Health of Russia. To do this, we propose to formulate clause 5.2.12 of the said Regulation in a new edition, which will provide for the vesting of the Ministry of Health of Russia with the authority to approve the requirements for the packaging of medicines and / or medical products for first aid kits.

As for the legal prospects for the procurement, acceptance for supply, storage and disposal of medicines for the provision of extended first aid, it should be noted that in the Federal Law "On the Circulation of Medicines" dated April 12, 2010 No. 61-FZ in Art. 53, 58 are presented: an exhaustive list of entities to which pharmaceutical wholesalers can sell or transfer medicines, as well as an exhaustive list of entities entitled to store medicines. These lists do not include institutions and organizations whose employees will provide extended first aid, since these institutions and organizations are not licensed for pharmaceutical activities. Thus, individuals, for example, tourists, who are not subject to this law, can purchase medicines necessary for the provision of extended first aid at retail from a pharmacy organization, while legal entities in which the performers of extended first aid work, are not allowed to procure and to store medicines unless they are licensed to conduct pharmaceutical activities.

In this regard, it is proposed to supplement Art. 53 of the Federal Law "On the Circulation of Medicines" with a provision providing for the possibility of purchasing medicines for the provision of extended first aid by institutions and organizations that are not licensed to conduct pharmaceutical activities, whose employees are required and / or entitled to provide extended first aid. And also to supplement Art. 58 of this Federal Law by the provision allowing the storage of medicines for the provision of extended first aid in institutions and organizations that are not licensed to conduct pharmaceutical activities.

Art. 58.1 of the Federal Law "On Circulation of Medicines" establishes the procedure for maintaining subject-quantitative records of medicines. The list of medicines for medical use subject to quantitative accounting was approved by order of the Ministry of Health of Russia dated April 22, 2014 No. 183n[3]. In the case of the inclusion of drugs from this list to the composition of first aid kits for providing extended first aid, legal entities purchasing them will need to keep records in accordance with Art. 58.1 of the Federal Law "On the Circulation of Medicines", which will be quite problematic from an organizational and legal point of view. In our opinion, possible ways out of this situation may be: not to include drugs from this list in the equipment for first aid, or, if necessary, to make changes and additions to Art. 58.1, allowing not to keep records of medicines for the provision of extended first aid.

Conclusion

An urgent need to improve the quantitative and qualitative characteristics of first aid is to expand the volume of first aid for certain categories of participants in its provision.

The planned amendments and additions to Art. 31 of the Federal Law "On the Fundamentals of Health Protection of Citizens in the Russian Federation" dated November 21, 2011 No. 323-FZ will make it necessary to update the current legislation by amending a number of regulatory legal acts and by adopting new documents.

1. It will be necessary to develop and to approve the following documents by departmental regulatory legal acts:

- lists of conditions in which extended first aid is provided, and lists of measures for providing extended first aid for each category of participants in its provision;
- preliminary programs of the training course, subject, discipline for providing extended first aid for each category of participants in its provision;
- requirements for the complete set of medical devices and / or drugs of first aid kits for the provision of extended first aid;
- rules of acceptance for supply, storage, and disposal, as well as a procedure for the allocation of finance; responsible unit for each federal executive body, which will be subordinate to the participants in the provision of extended first aid.

2. The above documents must be approved by the relevant federal executive bodies, for which it will be necessary to make changes and additions to their functionality in accordance with the Regulations on them.

3. To provide institutions and organizations whose employees will provide extended first aid, with the powers in the procurement and storage of medical products, it will be necessary to make changes and additions to Art. Art. 53, 58 of the Federal Law "On the Circulation of Medicines", allowing the specified institutions and organizations to purchase and to store them without having a license for pharmaceutical activities.

4. In the event that medicines from the list of medicines for medical use subject to quantitative accounting are included in the requirements for the complete set of medical devices and / or medicines, it will be necessary to make changes and additions in Art: 58.1 of the Federal Law "On the Circulation of Medicines", which allows not to keep records of medicines for the provision of extended first aid.

[3] Order of the Ministry of Health of Russia "On approval of the list of medicines for medical use subject to quantitative accounting" dated April 22, 2014 No. 183n

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Original article

SIMULATION MODELING AND PRACTICE OF INPATIENT EMERGENCY DEPARTMENT IN COVID-19 PANDEMIC

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Abstract. The article presents the experience of using simulation modeling to optimize inpatient emergency department as an admission unit of a hospital — Center for treatment of patients with new coronavirus infection COVID-19.
It was noted that the inpatient emergency department effectively performed the functions of the inpatient department of the Center for treatment of patients with new COVID-19 coronavirus infection for a total of more than 7 months. A correct calculation of staffing and a competent use of the department "zones" ensured efficient and rapid reception of patients during both "waves" of the pandemic. The model also proved positive role of such departments with a large number of patients in a multimillion metropolis needed to be hospitalized on a daily basis.

Key words: *Center for treatment of patients with new coronavirus infection COVID-19, COVID-19 inpatient admission unit, inpatient emergency department, pandemic, simulation modeling*

Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

ИМИТАЦИОННОЕ МОДЕЛИРОВАНИЕ И ПРАКТИКА РАБОТЫ СТАЦИОНАРНОГО ОТДЕЛЕНИЯ СКОРОЙ МЕДИЦИНСКОЙ ПОМОЩИ В УСЛОВИЯХ ПАНДЕМИИ COVID-19

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Резюме. *Цель исследования* – проанализировать опыт применения имитационного моделирования для оптимизации работы стационарного отделения скорой медицинской помощи (СтОСМП) в качестве приемного отделения стационара – Центра для лечения пациентов с новой коронавирусной инфекцией COVID-19 (Центр).
Материалы и методы исследования. Материалы исследования включали в себя данные: о предварительном имитационном компьютерном моделировании работы СтОСМП как приемного отделения Центра; о выполнении экспериментов на компьютерной модели для определения оптимального штатного расписания отделения; о последующем сопоставлении результатов моделирования с практическими данными.
Результаты исследования и их анализ. Результаты исследования показали, что стационарное отделение СМП эффективно выполняло функции приемного отделения Центра для лечения пациентов с новой коронавирусной инфекцией COVID-19 в общей сложности в течение свыше 7 мес, а правильный расчет штатного расписания, грамотное использование зон отделения обеспечили эффективный и быстрый прием пациентов во время обеих «волн» пандемии. В модели была также доказана позитивная роль подобных отделений при необходимости ежедневной госпитализации большого числа пациентов в многомиллионном мегаполисе.

Ключевые слова: *имитационное моделирование, пандемия COVID-19, приемное отделение стационара, стационарное отделение скорой медицинской помощи, Центр для лечения пациентов с новой коронавирусной инфекцией COVID-19*

Конфликт интересов. Авторы статьи подтверждают отсутствие конфликта интересов

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Introduction. The pandemic of new coronavirus infection COVID-19 was a serious challenge for the whole world. Russian medicine on the whole passed the year 2020 with dignity, having surpassed the countries that seemed to be the benchmark for the last 20-30 years in a number of areas [1-3]. Nevertheless, problems emerged in hospitals' work under new conditions. One of them is the congestion of ambulances in front of the admission departments of medical treatment organizations. Even large hospitals have encountered this problem [4-7]. Numerous photos and videos of ambulance queues circulated via social networks and caused social tension. It should be emphasized that difficulties in the work of the emergency departments of medical institutions were due to a shortage of staff and space. Despite long time that has passed since the publication of Order No. 388n of the Russian Ministry of Health "On Approval of the Procedure for Providing Emergency, including Specialized Emergency Medical Care" of July 20, 2013, number of inpatient emergency departments staffed with necessary staff and with premises for such conditions remains insufficient[1].

Modern inpatient departments of emergency medical care work effectively in emergency situations with mass admissions of patients and injured people [9-12]. However, the problem of admitting emergency patients became evident in the COVID-19 pandemic: lack of a waiting room for patients, of diagnostic beds, of "walking distance" intensive care unit, of CT scanner and of laboratory. All of this prevented medical treatment organizations from providing effective medical triage, examination and treatment of incoming patients.

One of the prerequisites for success in the fight against the new coronavirus infection was the decision of the Russian Ministry of Health to reassign federal clinics to infectious disease hospitals. This reduced the burden on regional health care. Decree No. 844-1 of the Government of the Russian Federation completely changed the work of a number of medical institutions, including St. Petersburg State Medical University named after acad. I.P. Pavlov of the Russian Ministry of Health[2]. Within a short period of time, the Center for treatment of patients with new coronavirus infection COVID-19 (hereinafter referred to as the Center) was established at the University on the basis of the Research Institute of Surgery and Emergency Medicine.

The university clinic successfully operates an inpatient emergency department. It receives up to 100 emergency patients daily. When creating it, the main recommendations contained in the order of the Ministry of Health of the Russian Federation №388n were taken into account. The medical staff of the inpatient emergency department is staffed by specialists certified in emergency medicine. The staff of the department have knowledge and skills within the professional standard, including ultrasound screening of lungs [14-15]. Nurses independently conduct daily medical triage of patients and actively participate in the therapeutic and diagnostic process. Up to 65% of those seeking emergency and urgent care receive comprehensive care at the inpatient emergency department stage and are discharged from the hospital within the first day. On the basis of the inpatient emergency departments, the University administration decided to form an admission department of the Center.

The aim of the study is to prepare an inpatient emergency department for the admission of patients with COVID-19. Our previous experience has shown the high reliability of computer simulation in assessing and planning the work of medical treatment organizations [16-18]. To achieve the above goal, the following tasks were planned: preliminary computer simulation of the unit operation; performing experiments on the computer model to determine optimal staffing; comparing the simulation results with the practical data.

Materials and research methods. First, a computer simulation of the activity of an inpatient emergency department as an admission unit of the Center was created. To reproduce the model we chose Flexsim HealthCare software, (developed in 2003, by FlexsimSoftwareProducts Inc.) which includes a special library for creating models of medical institutions. The University was expected to deploy 150 beds to care for patients with the new coronavirus infection. The experience of other medical institutions showed that in the first days of operation of the hospital there was a mass admission of patients with a subsequent decrease in their number.

The department planned the admission and medical triage of patients with a complex of therapeutic and diagnostic measures. The computer layout identified the staff, a triage area for incoming patients, as well as computer tomography (CT) and radiography rooms. The emergency department had: its own intensive care unit ("red zone"); a dynamic observation room with the possibility of minimal respiratory therapy and monitoring ("yellow zone"); and

[1] Order of the Russian Ministry of Health "On Approval of the Procedure for Providing Emergency, including Specialized Emergency Medical Care" No. 388n of June 20, 2013

[2] Professional standard of emergency medicine doctor, approved by the order of the Ministry of Labor and Social Security of the Russian Federation from March 14, 2018 №133n

a comfortable waiting room for patients in satisfactory condition ("green zone") — these rooms were planned for use based on the severity of the patients' condition. Modeling allowed to calculate the duration of patients' stay in the department, the load on the staff, and the waiting time for CT scanning as the key method of investigation in this pathology.

Based on the international recommendations published at that time, and on the Interim Guidelines for Prevention, Diagnosis and Treatment of New Coronavirus Infection COVID-19, we developed a patient admission algorithm [19-22] (Fig. 1).

This algorithm was based on the medical triage of the incoming patients, determining their further routing, and ensuring the maximum amount of examination in the admission department. At the first stage the vital functions were supposed to be assessed. The main attention was paid to the efficiency of gas exchange and hemodynamic stability. Based on the data obtained, it was planned to place the patient in one of the "zones" of the department. Further, depending on the effect of oxygen therapy and on the results of instrumental examination, further routing of the patient was determined. The average values of the duration of examinations and priorities of their performance were established, taking into account the algorithm of patient admission. The following ratio was used to form the model: 10% — intensive care patients; 70 — patients in moderate condition; 20% — patients in satisfactory condition. In this case, we assumed that mainly severe and moderately severe patients will be hospitalized by the ambulance crews to the University. Initially, a shift on duty consisting of two medical registrars, two doctors and four nurses was formed. After entering the information, a mass admission model was run with a triangular distribution of incoming patient flows of varying degrees of severity. Subsequently, the model calculations were statistically compared with actual patient stays according to the University's medical information system (MIS) QMs, for which Student's t-criterion was used to compare the mean values.

In addition, between pandemic waves, an analysis of patient admissions by COVID hospitals in St. Petersburg was performed jointly with the St. Petersburg City Ambulance Station. In spring of 2020 City Ambulance Station was faced with large crowds of ambulances in front of the emergency rooms. This blocked the effective operation of ambulance crews. The information provided made it possible to carry out a simulation of the interaction between the ambulance service and the emergency departments of COVID hospitals in the metropolis. Proposals for solving this problem were formulated.

Results of the study and their analysis. In the course of experiment #1, during the first day the model functioned without any errors, but the level of staff workload bordered on the prohibitive 97-98%. With the constant arrival of patients, queues of 5 or more people began to appear already at the stage of medical triage. At the end of the second day of model time, the process was halted due to the overload of the department. A number of experiments aimed at eliminating queues and optimizing further work were conducted on the model. The first problem was solved by strengthening the service by forming four teams of medical workers (doctor + nurse). It was also necessary to add another medical registrar to keep primary medical records of admissions. A triage nurse was assigned to ensure the primary triage process — measuring blood pressure and SpO2 of all incoming patients and assessing their ability to move independently. Under such conditions, the model functioned adequately and smoothly, and the estimated workload of the full-time staff did not exceed 75%.

In experiment #2, a new staffing schedule was applied. As a result, the deployed bed capacity of the department

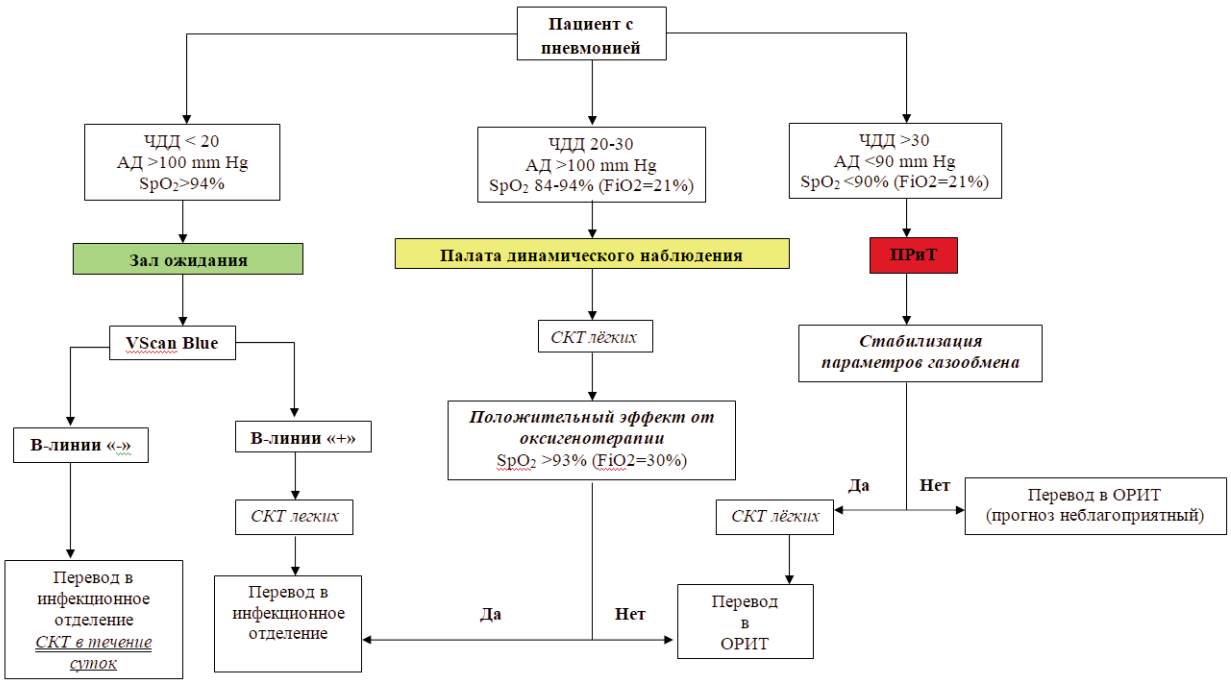

Рис.1. Алгоритм приема пациентов с подозрением на новую коронавирусную инфекцию COVID-19
Fig. 1. Algorithm of admission of patients with suspected new coronavirus infection COVID-19

(6 intensive care beds, 10 beds in the dynamic observation room, and 20 sitting places in the waiting room) was sufficient to admit up to 164 COVID-19 patients per day. The duration of stay in the department was (110±4.6) minutes, during which the patient was fully examined. If necessary, the patient was treated with artificial lung ventilation (ALV).

Using the information obtained, we decided to reinforce the staff of the admission department in the first days of the Center's opening. During the first three days, all of the staff in the inpatient emergency department worked in shifts. This made it possible to ensure, in accordance with the modeling calculations, that a sufficient number of workers was available. The 150 infectious disease and intensive care unit beds allocated to the Center were occupied by the end of the third day. During this period, the admission department efficiently performed admission, medical triage, and diagnostic activities. Thanks to this, crowding of ambulances was completely avoided. The waiting time of the patient and his transfer by the ambulance team to the doctor did not exceed 10 minutes. During the first 10 days of operation, the Center's bed capacity was doubled, reaching a total of 350 beds. As the number of hospitalized persons decreased, the number of teams on duty in the emergency department was reduced. By the end of the month, two teams and one medical registrar remained. The triage nurse was also reduced. Her functions were assigned to a nurse from one of the teams.

During the first month of operation, 865 patients with a new coronavirus infection were admitted to the emergency room. After admission, all patients underwent instrumental and laboratory examinations and received treatment. Retrospective analysis showed that the average time a patient spent in the emergency department was (115±5.8) minutes. This did not differ significantly from our estimated data obtained by simulation modeling, $p>0.05$. During the first "wave" of the disease, the Center received 1785 patients (Table).

In St.Petersburg, the number of patients with new coronavirus infection gradually decreased within three months: the University returned to its daily activities, and the admission department was transformed back into an inpatient emergency department.

The results of the COVID hospitalizations were comprehensively analyzed at various levels of the health care system. Concerns about increased waiting times for ambulance near the emergency departments of medical treatment organizations were reflected in a letter from Russian Minister of Health M.A. Murashko dated November 10, 2020, No. 30-2/I/2-17200, sent to the highest officials of the subjects of the Russian Federation.

Data from the city ambulance station allowed the authors to demonstrate the effectiveness of the inpatient emergency department used as a COVIDinpatient admission unit. During experiment №3 in the model based on real data of all city medical treatment organizations reassigned to receive patients with a new coronavirus infection, the average time of an ambulance team call was (679.2±44.1) minutes, i.e. it exceeded 11 (!) hours. More than 90% of this time the team spent in the hospital queue. Naturally, this situation created and constantly exacerbated the shortage of ambulances in prehospital period. This ultimately blocked the work of the service (Fig. 3). These data were confirmed by numerous photographs and videos demonstrating the prohibitive waiting times for ambulance crews near emergency rooms.

In experiment №4, 10 mobile wheelchair beds with the possibility of oxygen therapy and monitoring were allocated in the emergency wards of COVID hospitals. In other words, a full-fledged, albeit small, dynamic observation ward of an inpatient emergency department was formed. Even this number of beds was enough to completely eliminate queues at the entrance to the medical treatment facility (Fig. 4).

The operating principles and estimated time for such wards were taken from Experiment No. 2. This time, as we remember, was quite enough to perform the necessary complex of therapeutic and diagnostic measures established by the Temporary Methodological Recommendations "Prevention, Diagnosis and Treatment of New Coronavirus Infection (COVID-19)", version 8.1 (01.10.2020), and to determine further patient logistics within a treatment medical organization. In this experiment, the average call time was (37.5±12.2) minutes. The results once again confirmed the need for the transformation of emergency rooms into inpatient emergency departments, the effectiveness of which in emergency conditions is beyond any doubt. Unfortunately, the idea of creating dynamic observation rooms in the emergency departments of the city was not realized due to the work load of all medical and health care organizations. The second wave of COVID-19 turned out to be much larger than the first. In the first days of the Center's reopening, hospitalizations were intense. But after a week of work, the number of daily admissions became constant and fluctuated between 20-30 people (Fig. 5). (Fig. 5). This allowed us to plan the hospital's work, including determining the number of patients to be discharged daily. At the same time the intensity of the treatment process increased significantly, which was indirectly proved by the increased lethality rate in comparison with the first wave of diseases.

Due to organized medical triage in the prehospital period the number of patients requiring respiratory support increased. It should be noted that the minimum requirements for medical activities aimed at prevention, diagnosis and treatment of the new coronavirus infection COVID-19, set out in Annex 10 to Order of the Ministry of Health of Russia № 198n of March 19, 2020 (as amended on October 1, 2020) in terms of providing medical gases for 70% of the bed fund, sometimes proved to be insufficient for effective work.

The shortage of intensive care beds and infectious disease beds equipped with oxygen forced us to use the dynamic observation ward and the intensive care ward of

Таблица / Table

Показатели работы Центра во время первой и второй «волны» заболевания COVID-19

Performance of the Center during the first and second "waves" of COVID-19

Показатель / Indicator	Период работы Центра Period of operation of the Center	
	28.04.20–03.08.20	01.11.20–01.02.21
Число госпитализированных, чел. Number of hospitalized, people	1785	2120
Число пациентов, пролеченных на койках приемного отделения, чел. Number of patients treated in beds of the admission unit, people	174	432
Среднее количество койко-дней Average number of bed-days	10,6	8,9

the admission unit for longer observation and treatment of patients. They accounted for more than 20% of the total number of admissions. We admitted 348 patients in during the period of six hours to one day, 74 patients up to three days, and 10 patients for a longer period. The created infrastructure, equipment and staff ensured all necessary therapy, care and monitoring. All this became possible thanks to a fundamentally different design of the admission ward, created on the basis of the in-patient emergency department. Sufficient space, necessary equipment, staff actively involved in the therapeutic and diagnostic process — all these made it possible to treat a large number of patients without reducing the quality of treatment in everyday work.

Average time of the hospitalized patients' stay in the admission department of less than 6 h was (125±2,2) min, significantly not exceeding that during the first "wave" of the disease, p>0,05. A significant difference, as compared with the simulation results, was due to the need to wait for places in the infectious disease units.

Conclusion

Our experiments, as well as their implementation in practice, confirm the necessity of creating inpatient emergency departments on the basis of the emergency

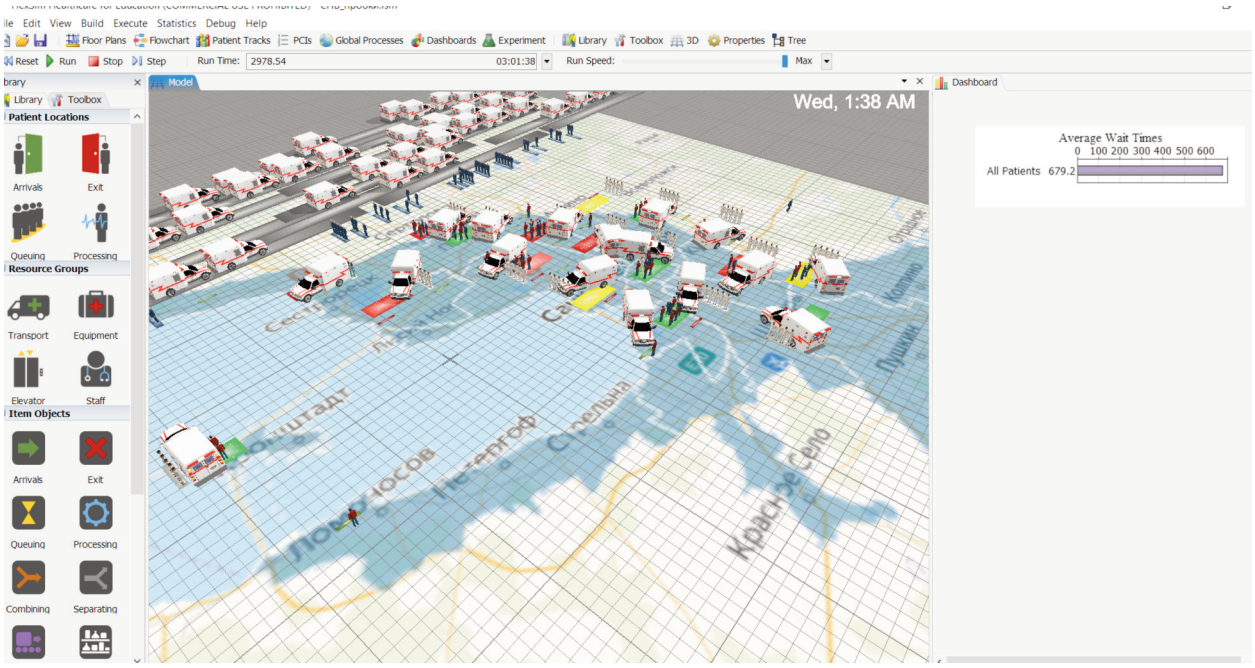

Рис. 2 . Эксперимент №3 (скриншот экрана)
* Автомобиль возле ЛМО обозначает очередь в приемное отделение стационара
Fig. 2. Experiment #3 (screenshot)
* A car near the medical treatment organisation marks the queue to the admission department of the hospital

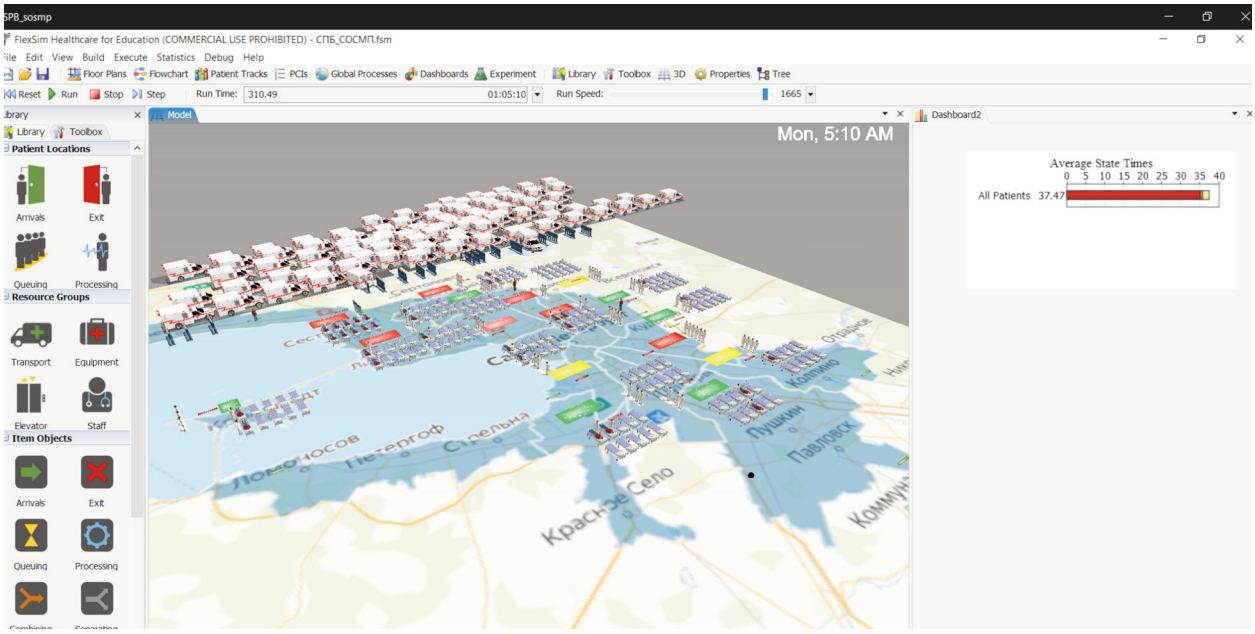

Рис. 3. Эксперимент №4 (скриншот экрана)
* Автомобиль возле ЛМО обозначает очередь в приемное отделение стационара
Fig. 3. Experiment #3 (screenshot)
* A car near the medical treatment organisation marks the queue to the admission department of the hospital

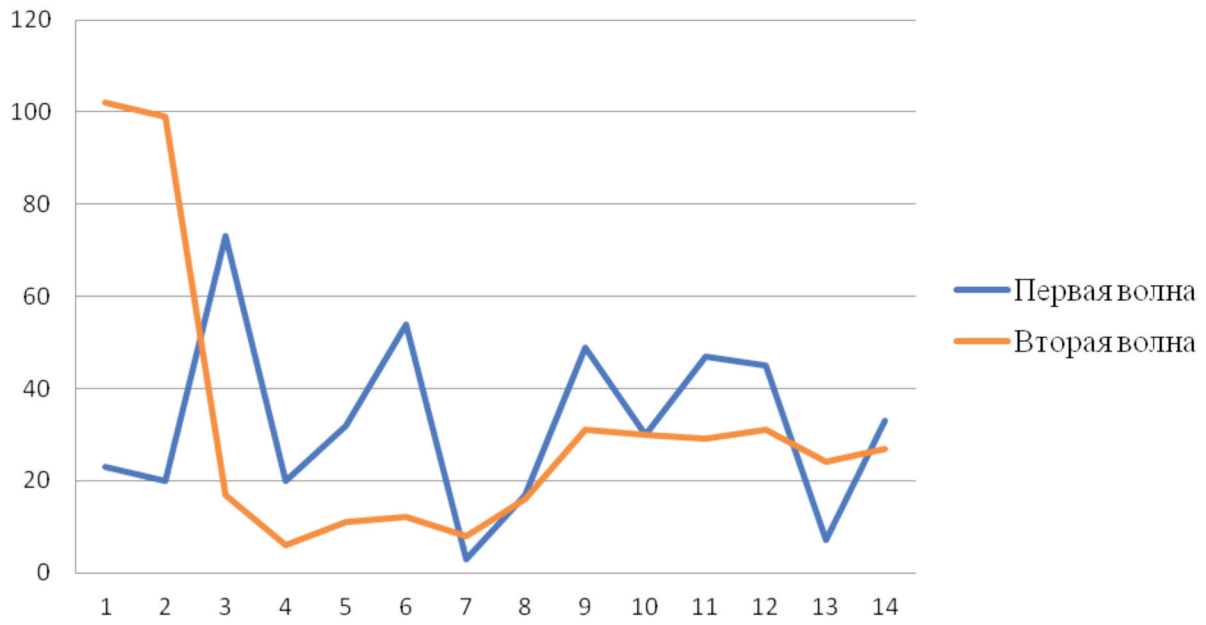

Рис. 4. Сравнение числа госпитализированных в Центр в течение первых двух недель работы в ходе первой и второй «волны» заболевания COVID-19

Fig. 4. Comparison of the number of admissions to the Center during the first two weeks of the first and second "waves" of COVID-19 disease

departments of large multidisciplinary hospitals that receive patients on emergency indications, as stated in the letter of Russian Minister of Health M.A. Murashko. This will increase their capacity and reduce the waiting time for ambulance teams.

The inpatient emergency department of the University Hospital effectively served as the Center's emergency room for the treatment of patients with new coronavirus infection for a total of more than 7 months. Simulation computer modeling performed prior to the start of operations prevented ambulance congestion. Correct staffing calculations and competent use of department "zones" ensured efficient and rapid admission of patients during both "waves" of the pandemic. The model also proved the positive role of such units when a large number of patients had to be hospitalized daily in a metropolis.

Intensive work of the Center during the second "wave" of the disease demonstrated the possibility of using dynamic observation wards and intensive care wards for long-term treatment of patients. An analysis of the three-month operation showed that 432 COVID-19 patients were treated in the emergency room for more than 6 hours. All of them required respiratory therapy of varying volume, from oxygen insufflation to ventilator assistance. Due to the availability of equipment and trained personnel, a quality treatment and diagnostic process was established. With the help of the "switched" bed fund we managed to maintain the daily discharge rate at 9.2% of the total number of beds — (23±0.75) patients per day and 8.9 average bed-days. Such an approach is completely unrealizable in the conditions of an ordinary emergency department and opens new opportunities for inpatient departments of emergency medical care in conditions of mass influx of patients on the background of the inpatient department overload.

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Original article

EMERGENCY MEDICAL CARE FOR PATIENTS IN COMA IN RYAZAN IN 2016-2020

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Abstract. The study objectives were to investigate the prevalence and to determine the most frequent causes of coma in patients in Ryazan; to determine the frequency of fatal outcomes at the stage of medical evacuation and the frequency of hospitalizations; to identify the features of emergency medical care in the prehospital period.
Materials and methods. We analyzed statistical data on the number of witnesses who applied for emergency medical aid in cases of disturbance of consciousness in patients who were subsequently diagnosed as comatose patients; we revealed main causes and types of comatose states, number of fatal outcomes and frequency of hospitalizations in Ryazan. Materials of the study — cards of calls of ambulance crews in Ryazan in 2016-2020.
Results of the study and their analysis. Analysis of statistical data for Ryazan in 2016-2020 showed a steady increase in the number of ambulance calls to patients in coma. In Ryazan, as in Russia as a whole, cerebral coma prevailed, with diabetic coma in second place and toxic coma — in third. In 2016-2020, the proportion of coma-related deaths was 2.7% in the prehospital period and had no upward trend. In 84% of cases patients were hospitalized in medical treatment organisations, patients with hypoglycemic coma sometimes refused hospitalization, there was no tendency in increase of the number of refusals.
In the prehospital period, ambulance care for patients with coma was provided in accordance with the algorithms, average time to reach the call was 12.4 min, which corresponds to the respective norms for emergency calls for Ryazan.

Key words: *ambulance crews, coma, Ryazan, causes of coma, coma patients, ambulance, fatal outcomes, medical evacuation*
Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

ОКАЗАНИЕ СКОРОЙ МЕДИЦИНСКОЙ ПОМОЩИ ПАЦИЕНТАМ В КОМАТОЗНОМ СОСТОЯНИИ В г.РЯЗАНИ В 2016–2020 гг.

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Резюме. *Цели исследования* – изучить распространенность и определить наиболее частые причины развития коматозных состояний у пациентов в г.Рязани; определить частоту смертельных исходов на этапе медицинской эвакуации и частоту госпитализаций; выявить особенности оказания экстренной медицинской помощи (ЭМП) в догоспитальном периоде.
Материалы и методы исследования. Проанализированы статистические данные об обращаемости очевидцев за скорой медицинской помощью (СМП) при нарушении сознания у пострадавших, которым в дальнейшем был поставлен диагноз «кома»; об основных причинах и видах коматозных состояний, количестве смертельных исходов и частоте госпитализаций в г.Рязани. Материалы исследования – карты вызовов бригад СМП в г.Рязани в 2016–2020 гг.
Результаты исследования и их анализ. Анализ статистических данных по г.Рязани за 2016–2020 гг. показал постоянный рост количества вызовов бригад СМП к пострадавшим в коматозном состоянии. В Рязани, как и в России в целом, преобладала церебральная кома, на втором месте находилась диабетическая, на третьем – токсическая кома. В 2016–2020 гг. доля смертельных исходов в результате комы составила в догоспитальном периоде 2,7% и не имела тенденции к росту. В 84% случаев пациенты были госпитализированы в лечебные медицинские организации (ЛМО), от госпитализации чаще всего отказывались пациенты с гипогликемической комой, тенденции к увеличению количества отказов – не наблюдалось. В догоспитальном периоде скорую медицинскую помощь пациентам с комой оказывали в соответствии с алгоритмами и в полном объеме, среднее время доезда на вызов составило 12,4 мин, что соответствует нормативам для экстренных вызовов по г.Рязани.

Ключевые слова: *бригады скорой медицинской помощи, виды комы, г.Рязань, догоспитальный период, медицинская эвакуация, пациенты в коматозном состоянии, причины комы, скорая медицинская помощь, смертельные исходы*

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Introduction. Currently, coma is one of the most severe and dangerous complications of diseases or injuries that require emergency medical care. The prevalence of coma is associated with a high incidence of severe forms of chronic diseases (hypertension, diabetes mellitus, etc.) and infectious pathologies; with a large number of craniocerebral injuries (CCI), as well as with the increasing number of people who abuse alcohol, drugs and psychotropic drugs [1]. It is difficult to diagnose coma in prehospital period due to time and medical equipment shortages and due to the need for emergency medical treatment (EMT) in the short term [2]. Identifying the etiology of the coma as soon as possible is important for determining further EMT strategies, but only after ensuring that vital functions (breathing and circulation[1]) are maintained in the patient.

According to the Russian National Scientific and Practical Society of Emergency Medical Care, in the prehospital period comatose states account for about 5.8 cases per 1,000 calls, and prehospital mortality — 4.4%. According to statistical data, the most frequent cause of coma is acute cerebovascular accident (CVA) and craniocerebral trauma — 59.2%; hypoglycemic coma — 15.3%; hyperglycemic coma — 7.7; hyperosmolar coma — 5.4; alcoholic coma — 3.4%. It is not always possible to establish the exact cause of coma in prehospital period, so, often the etiology of coma remains unclear — 9% — or even not suspected (coma of unclear genesis) — 11.9%. The outcome of coma depends to a large extent on the promptness of the EMT, on the completeness of emergency medical care and on the rapid medical evacuation of the patient to a medical treatment facility[3].

The study objectives were to investigate the prevalence and to determine the most frequent causes of coma in patients in Ryazan; to determine the frequency of fatal outcomes at the stage of medical evacuation and the frequency of hospitalizations; to identify features of emergency medical care in prehospital period.

Materials and methods. We analyzed statistical data on the number of witnesses who applied for emergency medical aid in cases of disturbance of consciousness in patients who were subsequently diagnosed as being in coma; we revealed the main causes and types of comatose states, number of fatal outcomes and frequency of hospitalizations in the city of Ryazan. Materials of the study — cards of calls of ambulance crews in Ryazan in 2016-2020.

Results of the study and their analysis. A total of 791131 ambulance team calls were recorded in 2016-2020 — 168433/ 161872/ 160829/ 144446/ 155551 calls respectively, including 804 coma calls — 95/149/188/161/211 calls respectively. Since coma is one of the most serious complications of some severe diseases, injuries and intoxications, it is rare. Its share in the total number of all calls in Ryazan was 0.1%.

In Ryazan there is a clear trend of increase in number of calls to patients who lost their consciousness and were diagnosed with coma at the scene by ambulance team. Thus, in 2016, ambulance crews responded to coma in 0.05% of calls; in 2017 — in 0.09; in 2018 — in 0.12; in 2019 — in 0.11; in 2020 — in 0.13% of calls (Table 1).

In prehospital period, if there is not enough time to collect the anamnesis, it is allowed to diagnose "unspecified coma" and to specify its presumed causes. A "syndromic" assessment and fixation of causes of pathological condition are also acceptable[2].

To establish the cause of coma is extremely important in case of a hypoglycemic coma, as in such a coma administration of glucose solution is a first priority. This problem has long been solved — the level of blood glucose is measured by express method, using a glucose meter, in all patients with impaired consciousness[4].

We have identified the following as the most common causes of coma — cerebral coma as a result of a stroke or of a traumatic brain injury; diabetic coma; coma as a result of drug or alcohol overdose. Since it is extremely difficult for an EMT in the prehospital period to determine the cause of a coma — he or she can only suspect it, the diagnosis was either "unspecified coma" or "diabetic coma".

As can be seen from the data in Table 2, there was an increase in the number of calls to patients with diabetic coma in Ryazan. It was found that most often it was hypoglycemic coma in patients with type 2 diabetes mellitus, which is comparable with the data of the Ministry of Health of Russia about an increase in number of patients with obesity and associated type 2 diabetes mellitus. Table 2 also shows that there is a clear tendency of increase in number

Таблица 1 / Table No. 1

Общее количество вызовов бригад СМП и количество вызовов бригад СМП к пациентам с комой разной этиологии в г.Рязани в 2016–2020 гг.

Total number of calls of ambulance teams and the number of calls of ambulance teams to patients with coma of different etiology in Ryazan in 2016-2020

Вызовы бригад СМП в г.Рязани Calls of ambulance teams in Ryazan	2016	2017	2018	2019	2020	Итого
Всего вызовов, чел. / Total number of calls, people	168433	161872	160829	144446	155551	791131
В т.ч. количество вызовов к пациентам с комой, чел./% Including the number of calls to patients with coma, people/%	95/0,05	149/0,09	188/0,12	161/0,11	211/0,13	804/0,1

[1] Gizatullin R.H., Lutfarakhmanov I.I., Gizatullin R.R., Rakhimova R.F. Comatose states: a textbook. Ufa, 2018. 63 c.

[2] Algorithms of emergency medical care outside of a medical organization: Manual for medical staff of ambulance teams / Edited by S.F. Bagnenko, M.D., prof., RAS academician, SPb., 2018. 158 c.

of patients with toxic coma — as a rule, this coma develops during drug overdose or from toxic effects of alcohol and its surrogates, indicating that, despite the promotion of a healthy lifestyle, alcohol consumption in the country is increasing. In the city of Ryazan, the indicators are similar: 21% of citizens seeking emergency medical assistance are intoxicated. In connection with the abovementioned it is important to carry out measures to combat alcoholism, to draw people's attention to the fact that the risk of injury to persons under the influence of alcohol increases several times [5]. In about 12% of cases, the etiology of coma in prehospital period could not be established.

In prehospital period comas occur more frequently in men than in women, 59.2% and 40.8%, respectively (Table 3). According to different statistical data and stroke registries, men in Russia are more prone to acute impairment of cerebral circulation than women, especially in the age group 45-59 years old, whereas in the age group 70 and older the morbidity in women is significantly higher than in men. This is explained by relatively low life expectancy of men in our country, as well as by certain physiological features of the female body associated with age [6]. In addition, the higher frequency of coma in men can be explained by the fact that men are injured more often than women and use alcohol and drugs more often.

In 2016-2020, ambulance doctors failed to save the lives of 22 patients (2.7%) in coma, with no significant dynamics identified by year. Despite the fact that coma is an absolute indication for hospitalization, an average of 84% of patients were hospitalized in Ryazan (Table 4). Most often, patients with hypoglycemic coma (or their relatives) refused hospitalization after emergency medical care was provided in the prehospital period.

The volume and rate of medical care rendered by specialists in emergency medical teams depend on the severity of the coma. In any coma, it is recommended to call anesthesiology and resuscitation teams. It should be taken into account that severity of patient's condition does not allow enough time to collect the anamnesis. The interview has to be shortened: the main thing to find out is the circumstances and the exact time of loss of consciousness, the complaints before and the concomitant pathology [7].

Examination of coma patients was performed according to the following algorithm: assessment of general severity and depth of consciousness impairment — using Glasgow scale; signs of external respiration disorders and disorders of central and peripheral circulation — by measuring blood pressure (BP), pulse, respiration rate, saturation; neurological examination — to a minimum extent; presence of vomiting and convulsions, if possible — identification of concomitant pathology such as trauma and somatic pathology, which could affect the severity of coma;

Emergency medical care was provided according to the following protocols: "seizures", "hypoglycemia", "poisoning", "acute respiratory failure". Priority measures: maintenance or restoration of vital functions such as breathing and circulation, sanation of airways, installation of airway, tracheal intubation, artificial lung ventilation, oxygen therapy, control of arterial hypotension using dopamine, noradrenaline, with arterial hypertension — urapidil. In case of any suspected trauma — immobilization of the cervical spine. Peripheral vein and bladder catheterization were always performed; gastric or nasogastric tubes were inserted if indicated [9].

All data obtained during examination and monitoring of the patient's condition during prehospital period, as well as all medical manipulations performed were recorded in the call cards and in the accompanying lists for hospitalization. When we analyzed the call cards, we noted that the doctors of ambulance teams acted in strict conformity with the

Таблица 2 / Table No. 2

Частота вызовов бригад СМП к пациентам с комой различной этиологии в г.Рязани в 2016–2020 гг.

Frequency of ambulance calls to patients with coma of different etiology in Ryazan in 2016-2020

Этиология комы / Etiology of coma	2016	2017	2018	2019	2020	Итого / Total
Кома неуточненная, чел./% / Unspecified coma, people/%	86/90,5	118/79,2	148/78,7	115/71,4	140/66,3	607/75,5
Кома неуточненная – церебральная /токсическая, чел. Unspecified coma –cerebral/toxic, people/%	69/7	81/23	102/32	66/39	83/45	401/146
Кома диабетическая, чел./% / Diabetic coma, people/%	9 /9,5	31/20,8	40/21,3	46/28,6	71/33,7	197/24,5

Таблица 3 / Table No. 3

Частота вызовов бригад СМП к мужчинам и женщинам с комой в г.Рязани в 2016–2020 гг., чел./% /

Frequency of ambulance teams calls to men and women with coma in Ryazan in 2016-2020, people/%

Показатель / Indicator	2016	2017	2018	2019	2020	Итого / Total
Кома у мужчины – неуточненная/ диабетическая / Coma in a man — unspecified/diabetic	62 – 58/4	84 – 73/11	115 – 97/18	105 – 81/24	110 – 71/39	476/59,2
Кома у женщины – неуточненная/ диабетическая / Coma in a woman — unspecified/diabetic	33 – 28/5	65 – 45/20	73 – 51/22	56 – 34/22	101 – 69/32	328/40,8

Таблица 4 / Table No. 4

Итоги работы бригад СМП с пациентами в коматозном состоянии в г.Рязани в 2016–2020 гг.

Results of work of ambulance teams with patients in coma in Ryazan in 2016-2020

Показатель / Indicator	2016	2017	2018	2019	2020	Итого, чел./% Total, people/%
Число пациентов, доставленных в ЛМО, чел./% Number of patients delivered to medical treatment organisatio, people/%	79/83,0	132/88,0	163/86,0	126/78,0	178/84,0	678/84,0
Количество смертельных исходов, чел. Number of fatal outcomes, people	7	4	6	2	3	22/2,7

algorithms of emergency medical care for comatose states; the time of ambulance arrival did not exceed 20 minutes; the average time of arrival was 12.4 minutes. It took an average of 61.8 min to provide ambulance care (Table 5).

The proportion of fatal outcomes among patients with coma in prehospital period — 2.7% — also highlights speed and competence of emergency medical care, as well as high qualification of doctors and paramedics of ambulance teams (see Table 4).

Таблица 5 / Table 5

Среднее время доезда бригады СМП к пациенту в коматозном состоянии и среднее время оказания помощи на месте вызова в г.Рязани в 2016–2020 гг.

Average time of arrival of ambulance team to the patient in coma and average time of assistance at the scene of the call in Ryazan in 2016-2020

Показатель, мин Indicator, min	2016	2017	2018	2019	2020	Итого Total
Среднее время доезда Average drive time	13	13	13	11	12	12,4
Среднее время, проведенное у постели больного / Average time spent at the patient's bedside	60	61	63	62	63	61,8

Conclusion

1. Analysis of statistical data for Ryazan for 2016-2020 showed a steady increase in the number of ambulance calls to patients in coma.

2. In Ryazan, as well as in Russia as a whole, cerebral coma prevailed, diabetic coma was in second place, toxic coma in third place.

3. In 2016-2020, the proportion of coma-related deaths was 2.7% in prehospital period, with no upward trend.

4. In 84% of cases patients were hospitalized in medical treatment organisations, patients with hypoglycemic coma refused hospitalization more often, there was no tendency for increasing of number of refusals.

5. In prehospital period, emergency medical care for patients with coma was provided in accordance with the algorithms and in full volume, the average time of arrival to the call was 12.4 minutes, which corresponds to the norms for emergency calls in Ryazan.

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Reviev article

MODERN APPROACHES TO THE DIAGNOSIS OF ACUTE KIDNEY INJURY USING INNOVATIVE BIOMARKERS IN PATIENTS WITH COMBINED TRAUMA: REVIEW OF SCIENTIFIC PUBLICATIONS

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Abstract. A review of scientific publications analyzing modern approaches to the diagnosis of acute kidney injury using innovative biomarkers in patients with concomitant trauma is presented. The authors of the review note that pathological processes of cellular damage, which determine the etiology and pathogenesis of acute kidney injury syndrome, require prompt and early initiation of preventive measures. Given this, the problem of early diagnosis of acute kidney injury and the scientific search for ways to optimize it remain relevant at the present time. In cases associated with the possibility of formation of acute kidney injury, as well as in situations when the renal tissue is already damaged, it is very relevant to determine markers of acute kidney injury in biological fluids.

Key words: *acute kidney injury, classification of biomarkers, diagnosis, innovative biomarkers, patients with combined trauma*

Conflict of interest. The authors declare no conflict of interest

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Обзорная статья

СОВРЕМЕННЫЕ ПОДХОДЫ К ДИАГНОСТИКЕ ОСТРОГО ПОВРЕЖДЕНИЯ ПОЧЕК С ПРИМЕНЕНИЕМ ИННОВАЦИОННЫХ БИОМАРКЕРОВ У ПАЦИЕНТОВ С СОЧЕТАННОЙ ТРАВМОЙ: ОБЗОР НАУЧНЫХ ПУБЛИКАЦИЙ

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Резюме. Представлен обзор научных публикаций, в которых анализируются современные подходы к диагностике острого повреждения почек (ОПП) с применением инновационных биомаркеров у пациентов с сочетанной травмой. Авторы обзора отмечают, что патологические процессы клеточного повреждения, определяющие этиологию и патогенез синдрома ОПП, требуют быстрого и раннего начала проведения профилактических мероприятий. Учитывая это, проблема ранней диагностики острого повреждения почек и научный поиск способов ее оптимизации остаются актуальными и в настоящее время. В случаях, связанных с возможностью формирования ОПП, а также в ситуациях, когда почечная ткань уже повреждена, очень актуально определение в биологических жидкостях таких веществ, как маркеры острого повреждения почек.

Ключевые слова: *диагностика, инновационные биомаркеры, классификация биомаркеров, острое повреждение почек, пациенты с сочетанной травмой*

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In recent years, there has been a steady increase in the number of victims with injuries of various localizations, which are the leading cause of death, as well as temporary and permanent disability in persons under age of 40. A characteristic feature of modern trauma is the prevalence of multiple and combined injuries. This leads to a high and not decreasing mortality rate. Co-injury is characterized by simultaneous damage to several anatomical and function-

al areas. It is observed in 50-70% of the patients with severe mechanical injuries. In the Russian Federation, more than 35,000 people die annually as a result of combined trauma. Combined trauma is one of the three main causes of death among the population. Moreover, this cause comes first for people under age of 40. In Russia, the mortality rate from combined trauma is 59-65 cases per 100,000 people [1, 2].

Mechanical trauma causes distinct changes in the functioning of almost all organs and systems of the body. Thus, changes in renal function in trauma can increase the duration of treatment, worsen the prognosis, and lead to the development of late complications. In the pathogenesis of traumatic shock, renal dysfunction is a constant factor. Often they determine, in case of acute renal failure development, the outcome of traumatic disease [2-4]. This is especially true when the trauma is of multiple or combined nature and is accompanied by extensive soft tissue injuries. Acute renal failure is one of the most severe complications of the urinary system in patients with concomitant trauma. Unfortunately, there is still no unified approach to early diagnosis of this disease in polytrauma patients. In routine clinical practice, creatinine and urea are classic indicators of acute renal failure. However, since their levels rise in blood when more than 60% of nephrons are involved in the pathological process (on the 3rd and 4th day of oliguria), creatinine and urea do not play a significant role in the early diagnosis of acute renal failure. In particular, elevated serum creatinine levels are informative neither in terms of the exact timing of acute renal failure, nor in terms of its localization, much less in terms of the severity of glomerular or tubular damage [5-7]. The issues of correction of changes and prevention of renal dysfunction in combined trauma also remain unresolved. Thus, there is an urgent need to develop a technique for early diagnosis of renal dysfunction in patients with concomitant trauma.

Acute renal injury is a syndrome in which renal dysfunction forms and develops rapidly. It leads to significant changes in homeostasis and — sometimes — to death. Acute kidney injury is quite frequent — 181-288 cases per 100,000 population — and the number of patients with acute kidney injury tends to grow continuously [8-10].

The success of preventive measures directly depends on the timely detection of these disorders. All methods of laboratory diagnosis of acute kidney injury are based on determining the concentration and/or content of biomarkers of acute renal injury [11]. The functional capacity of kidneys is usually determined by detecting the quantity and quality of serum and urine creatinine and urea. Currently, these diagnostic methods are not sensitive enough and are not suitable for the detection of acute renal impairment [12]. For example, the concentration of serum creatinine occurs only 48-72 h after damaging effect on the kidneys, which indicates the impossibility of early diagnosis of acute renal damage [13]. At the current stage of medical science development, innovative methods with high sensitivity and reliability, capable of responding immediately to the damaging effect, are being developed. In the future, such methods will make it possible to evaluate the dynamics of the features of glomerular-tubular renal dysfunction development and to use the results in the development of methods of preventive treatment of acute kidney damage [14].

Biological substances, the levels of which in the urine and blood are of great importance for diagnosis and prognosis in the treatment of patients with renal dysfunction, were given the unified name of biomarkers of acute kidney damage. Their timely detection requires the use of unified techniques, which is possible in any medical treatment organization. Thanks to scientific developments performed at the end of the 20th-beginning of the 21st centuries, a list of possible biological markers of acute kidney damage was created, classification of these compounds was developed, and their informative role in pathological process detection was revealed, including determination of damage level (glomeruli or tubules) and etiology of biological marker synthesis [15, 16].

Biological compounds used as markers of acute kidney injury must meet certain requirements [17]. First of all, biological material should be easily accessible, and sample detection should be noninvasive and atraumatic. In addition, standardization of the used methods of laboratory diagnosis is necessary. Detectable markers must have a high tropicity to the localization of the site of nephron damage (vessels, tubules, glomeruli). Also, they should correspond to: causes of damage and time since its receipt; clinical features of the development of the pathological process; patient's need for hemodialysis; final stage of pathology (reconvalescence, lethal outcome, transition to chronic course); presence of an adequate response to the ongoing therapy [18]. At present, it has been proved that a number of markers of acute kidney injury absolutely comply with the above requirements [19, 20]. In spite of this, the problem of scientific research on the search for biomarkers of acute kidney damage is still relevant [21-23].

Scientists have developed 4 classifications of biomarkers of acute kidney damage - pathophysiological, topical, clinical and working (Table 1).

According to the pathophysiological classification, markers of acute kidney injury are divided into groups depending on their ability to determine one or another stage of the development of the pathological process in kidneys. For example, renal dysfunction can be determined by creatinine and cystatin C in blood; fat peroxidation by 4-ON-2-nonenal and 8-A2α-isoprostane; damaging effects on nephrons and interstitial tissue by IKM-1, L-FABP, NGAL; immune response by immunogram; annexin-5 is a marker of apoptosis of cell structures [26].

Topical classification divides markers into 5 groups: α1-microglobulin, β2-microglobulin, albumin, s-cystatin C — indicate glomerular nephrocyte alteration; cystatin C, NGAL (neutrophil gelatinase-associated lipocalin-2), interleukin-18 (IL-18), IKM-1 (renal damage molecule-1), α-GST (α-glutathione-S-transferase), L-FABP (protein-binding fatty acid BSA), etc. are markers of proximal tubule damage.etc.; π-GST (π-glutathione-S-transferase) together with NGAL can identify damage to the distal parts of the tubule system. In F.G.Henle loop damage, sodium hydrogen exchanger-3 acts as a marker, and OPN (osteopontin) is an indicator of collecting tubule alteration [26].

The clinical classification considers the ability to use these markers for: early diagnosis of acute kidney injury; monitoring of factors that determine the risk of pathological process; identification of characteristic features in the etiology and pathogenesis of acute kidney injury; dynamics of treatment and effectiveness of ongoing therapeutic measures, etc. [28].

Таблица 1 / Table No. 1

Классификация биомаркеров острого повреждения почек
Classification of biomarkers of acute kidney damage

Топическая классификация / Topical classification	
1. Клубочек / Glomerulus	Альбумин, цистатин С сыворотки, альфа1-микроглобулин, бета2-микроглобулин и др. / Albumin, serum cystatin C, alpha1-microglobulin, beta2-microglobulin, etc.
2. Проксимальный каналец / Proximal tubule	NGAL, KIM-1, L-FABP, цистатин С мочи, IL-18 и др. / NGAL, KIM-1, L-FABP, urinary cystatin C, IL-18, etc.
3. Дистальный каналец / Distal tubule	GST, NGAL
4. Собирательная трубка / Collection tube	Калибиндин D28 / Calibindin D28
5. Петля Генле / Loop of Henle	Остеопонтин NHE-3 / Osteopontin NHE-3
Патофизиологическая классификация / Pathophysiological classification	
1. Биомаркеры функции почек / Biomarkers of renal function	Креатинин, цистатин С сыворотки и др. / Creatinine, serum cystatin C, etc.
2. Биомаркеры оксидативного стресса / Biomarkers of oxidative stress	8(A2a)-изопростан, 4-OH-2-ноненал и др. / 8(A2a)-isoprostane, 4-ON-2-nonenal, etc.
3. Биомаркеры структурного и клеточного повреждения: - подоцитов - тубулоинтерстиция - факторы экзосомальной транскрипции / Biomarkers of structural and cellular damage: - podocytes - tubulointerstitium - exosomal transcription factors	Подокаликсин, нефрин NGAL, KIM-1, L-FABP, АТФ-3 / Podocalyxin, NGAL nephrine, KIM-1, L-FABP, ATP-3
4. Маркеры иммунного ответа / Markers of immune response	Иммуноглобулины, хемокины, компоненты комплемента / Immunoglobulins, chemokines, complement components
5. Маркеры фиброза / Fibrosis markers	TGF-β1, CTGF, Big-H3, Collagen type IV
6. Маркеры апоптоза / Apoptosis markers	Аннексин-5, TIMP-2, IGFBP7 / Annexin-5, TIMP-2, IGFBP7
7. Маркеры задержки клеточного цикла в фазе G2 / Markers of cell cycle delay in the G2 phase	TIMP2/IGFBP
Клиническая классификация / Clinical classification	
1. Маркер в качестве фактора риска развития ОПП / Marker as a risk factor for the development of acute kidney damage	
2. Маркер, использующийся при скрининге ОПП / Marker used in acute kidney damage screening	
3. Диагностический маркер, указывающий на патогенетический вариант ОПП / Diagnostic marker indicating pathogenetic variant of acute kidney damage	
4. Биомаркер, стратифицирующий тяжесть процесса / Biomarker stratifying the severity of the process	
5. Маркер с высокой предиктивной значимостью / Marker with high predictive value	
6. Маркер, характеризующий ответ на терапию / Marker describing response to therapy	
Рабочая классификация / Working classification	
1. Белки, экспрессия которых повышается при ОПП / Proteins that are up-regulated in acute kidney damage	NGAL, L-FABP, KIM-1, IL-18
2. Функциональные маркеры / Functional markers	Цистатин С сыворотки / Serum cystatin C
3. Низкомолекулярные белки мочи / Low-molecular-weight urine proteins	Цистатин С мочи, альфа1-микроглобулин, бета2-микроглобулин / Urinary cystatin C, alpha1-microglobulin, beta2-microglobulin
4. Внутриклеточные энзимы / Intracellular enzymes	NAG, α-GST, p-GST, ГГТП, ЩФ / NAG, α-GST, p-GST, GGT, ALP

Примечание: NGAL – липокалин, ассоциированный с желатиназой нейтрофилов; KIM-1 – молекула почечного повреждения; L-FABP – печеночный протеин, связывающий жирные кислоты; GST – глутатион-S-трансфераза; NHE-3 – натрий-водородный обменник 3; TGF-β1 – фактор роста опухолей β1; CTGF – фактор роста соединительной ткани; NAG – N-ацетил-D-глюкозаминидаза; ГГТП – гамма-глутамилтранпептидаза; ЩФ – щелочная фосфатаза; TIMP-2 – ингибитор металлопептидаз-2; IGFBP7 – белок, связывающий инсулиноподобный фактор роста 7 [24, 25]

Note: NGAL – lipocalin associated with neutrophil gelatinase; KIM-1 – renal injury molecule; L-FABP – hepatic fatty acid binding protein; GST – glutathione-S-transferase; NHE-3 – sodium-hydrogen exchanger 3; TGF-β1 – tumor growth factor β1; CTGF – connective tissue growth factor; NAG – N-acetyl-D-glucosaminidase; GGT – gamma-glutamyltranspeptidase; ALP – alkaline phosphatase; TIMP-2 – metallopeptidase inhibitor-2; IGFBP7 – insulin-like growth factor 7 binding protein [24, 25]

The working classification is represented by 4 groups: Group 1 are proteins whose formation is significantly increased in acute kidney injury (L-FABP, NGAL, IL-18, IKM-1); Group 2 is a marker of renal dysfunction, serum cystatin C; Group 3 is a number of low molecular weight urinogenic proteins, such as α1-microglobulin, β2-microglobulin, cystatin C. Group 4 includes intracellular enzymes (alkaline phosphatase (ALP), lactate dehydrogenase (LDH), NAG (N-acetylglutamate), α- and π-GST, GGTP-γ-glutamyl transpeptidase [28].

In recent years, in acute kidney injury, it became possible to detect parenchymal damage 24-48 h before the appearance of clinical signs of disease. In acute kidney damage, the effect of ischemic, toxic and other causes on kidneys initially provokes molecular transformations that turn into damage of cellular structures. The latter begin to form specific markers, and only then the pathognomonic symptomatology of renal pathology appears.

For the purpose of preventive diagnosis of ischemic acute tubular necrosis it is appropriate to detect the number of granular cylinders, tubular enzymes (α-glutathione-S-transferase, leucinaminopeptidase, alkaline phosphotase, N-acetyl-β-D-glucosaminidase (NAG), γ-glutamyl transpeptidase), cells of tubular epithelium in the urine. Currently, for the early detection of acute kidney damage the most promising are biological markers associated with renal parenchyma damage, cell proliferation, apoptosis, differentiation, immune disorders, formation of chemokines and cytokines, but not with a decrease in glomerular filtration rate. The study of biomarker excretion processes is used to investigate preventive diagnosis and other clinical problems of acute renal failure, which cannot be solved using conventional functional tests. The latter include: early differentiation of prerenal, renal, postrenal acute renal failure; study of its causes (renal toxins, sepsis, ischemia, acute inflammation of renal parenchyma in nephropathy and

urinary tract infections, ischemia-reperfusion syndrome); completion of terminal uremia as a prognosis of possible fatal outcome; reaction to the ongoing therapy. Of great importance are markers associated with the early stage of acute kidney injury.

Among the markers of acute kidney injury, the detection of which is increasingly used, we should mention lipocalin associated with neutrophil gelatinase (NGAL), a protein with a molecular weight of 25 kDa, initially detected in neutrophils and subsequently — in a small volume — in the tubular epithelium. Due to ischemia and toxic effects on the kidneys, its excretion in tubule cells increases significantly, its excretion in the urine also increases, indicating in one to two days an increase in serum creatinine blood levels. Increased amount of NGAL in serum and urine is detected 2-6 hours after cardiac surgical treatment and reflects the initial stage of postoperative acute kidney injury.

The sensitivity and specificity of this study are over 90%. As a predictor of renal transplant ischemia-reperfusion syndrome, an increased number of NGAL indicates delayed functional capacity and the need of the recipient for urgent hemodialysis.

The first clinical studies on this issue were performed in pediatric practice in patients after cardiac surgical interventions. The role of this marker as a sensitive predictor of the development of acute kidney damage after surgical intervention with the use of a heart-lung machine as well as after coronarography was proved. In clinical practice, in the diagnosis of acute kidney injury, a number of limitations of NGAL use should be considered. There is evidence that serum NGAL levels can increase in chronic kidney disease, arterial hypertension, infections, anemia, hypoxia, and malignant neoplasms. In addition, there is experimental and clinical data showing the dependence of NGAL excretion with urine on the level of proteinuria. The latter fact is particularly important in the diagnosis of acute kidney damage in patients with nephrotic syndrome, who are known to be initially predisposed to prerenal acute kidney damage. Examination of 79 patients with primary glomerular pathology revealed that proteinuria above 3.5 g/day significantly increased urinary NGAL excretion. Table 2 presents data on the diagnostic significance of serum and urinary NGAL determination in the diagnosis of acute kidney injury.

Dynamic monitoring of urinary NGAL level is informative: when building a prognosis of the severity of acute kidney damage due to post-diarrheal hemolytic-uremic syndrome in childhood; in patients of intensive care units; in X-ray-contrastinduced nephropathies. An increase in blood serum α1-microglobulin, which also belongs to the lipocalin group, is specific in the early diagnosis of acute tubular necrosis (specificity — 81%, sensitivity — 88%) and in the diagnosis of the need for acute hemodialysis (Table 3).

Cystatin C is a cysteine protease inhibitor formed in a significant number of cells containing the nucleus and is filtered by the glomeruli. Because serum cystatin C concentration is unrelated to age, muscle mass volume, and gender identity, it is a significantly better determinant of the functional state of renal filtration capacity compared with creatinine. The increase of serum cystatin C outstrips the increase of creatinine level in blood for 24-48 hours, it is considered as I-II stages of acute kidney damage in patients after surgical treatment and patients of intensive care units. This method, unlike the determination of N-acetyl-β-D-glucosaminidase (NAG) and β1-microglobulin in urine, belongs to the most specific and highly sensitive diagnostic methods. It should be noted that in acute kidney injury, an increase in serum concentration of cystatin C occurs 10 h after the detection of increased NGAL excretion.

Cystatin C is a 13 kDa polypetide chain consisting of 120 amino acids. It belongs to the inhibitors of lysosomal proteinases and is produced by all nuclear cells of the body, protecting it from uncontrolled activation of proteolysis of its own proteins. Cystatin C enters the bloodstream uniformly from the cells, and its serum concentration is maintained at a constant level [14, 25]. The small molecular weight and low affinity to other serum proteins determine the ability of this molecule to filter freely in the renal

Таблица 2 / Table No. 2

Роль NGAL в диагностике острого повреждения почек*
Role of NGAL in the diagnosis of acute kidney damage*

Вариант ОПП / Acute kidney damage variant	Биоматериал / Biomaterial	AUC, мкг/ мл × мин / AUC, μg/ml × min	PPV, %	NPV, %	Se, %	Sp, %
После кардиохирургических вмешательств / After cardiac surgery interventions	Кровь / Blood	0,76	52,3	90,6	67,9	83,0
	Моча / Urine	0,77	48,4	67,7	75,7	76,0
У пациентов ОРИТ** / In ICU patients	Кровь / Blood	0,79	64,7	81,5	78,5	77,5
	Моча / Urine	0,76	87,7	82,0	70,6	79,9
Постконтрастное ОПП / Postcontrast acute kidney damage	Кровь / Blood	0,73	20,0	97,0	–	–
	Моча / Urine	–	–	–	–	–
У пациентов приемного отделения / In emergency room patients	Кровь / Blood	0,82	70,0	99,0	–	–

Примечание (здесь и далее): *p <0,05; ** ОРИТ – отделение реанимации и интенсивной терапии; AUC (area under curve) – среднее значение площади под характеристической кривой диагностического теста (ROC-кривой – receiver operating characteristics); PPV (positive predictive value) – среднее значение прогностической ценности положительного результата (отношение истинно положительных результатов к положительным результатам, определенным с применением диагностического теста); NPV (negative predictive value) – среднее значение прогностической ценности отрицательного результата (отношение истинно отрицательных результатов к отрицательным результатам, определенным с применением диагностического теста); Se (sensitivity) – чувствительность диагностического теста (доля лиц с заболеванием, имеющих положительный результат диагностического теста); Sp (specificity) – специфичность диагностического теста (доля лиц без заболевания, имеющих отрицательный результат диагностического теста); данные представлены на основании обзоров исследований, опубликованных в 2013 г. [22, 23, 25]

Note (hereafter): *p < 0.05; ** ICU —intensive care unit; AUC (area under curve) —mean value of the area under the diagnostic test characteristic curve (ROC curve –receiver operating characteristics); PPV (positive predictive value) — mean value of the prognostic value of a positive result (ratio of true positive results to positive results determined using a diagnostic test); NPV (negative predictive value) — mean value of the prognostic value of a negative result (ratio of true negative results to negative; Se (sensitivity) is the sensitivity of the diagnostic test (the proportion of people with the disease who have a positive diagnostic test result); Sp (specificity) is the specificity of the diagnostic test (the proportion of people without the disease who have a negative diagnostic test result); data are based on reviews of studies published in 2013 [22, 23, 25]

Таблица 3 / Table No. 3

Информативность некоторых биомаркеров при остром повреждении почек
Informativity of some biomarkers in acute kidney damage

Биомаркеры Biomarkers	Варианты и стадии ОПП / Variants and stages of acute kidney damage			
	послеоперационное ОПП / postoperative acute kidney damage	РКС-нефропатия X-ray contrast nephropathy	пациенты ОРИТ, в т.ч. с сепсисом / ICU patients, including those with sepsis	СИР после трансплантации почки Ischemia reperfusion syndrome after kidney transplantation
NGAL, плазма, моча NGAL, plasma, urine	++ I	++ I	++ I	++ I
Цистатин С, плазма, моча Cystatin C, plasma, urine	+ I–II	+ I–II	++ I–II	+ I–II
ИЛ-18, моча Interleukin-18, urine	++ I–II	Не информативно Not informative	++ I–II	++ I–II
KIM-1, моча KIM-1, urine	++ I–II	Не информативно Not informative	Не изучено Not explored	Не изучено Not explored

Примечание. РКС – рентгеноконтрастная нефропатия; СИР – синдром ишемии – реперфузии; ИЛ-18 – интерлейкин-18; IKM-1 (KIM – kidney injury molecule-1 – молекулы почечного повреждения-I)
Note. KIM-1 (KIM – kidney injury molecule-1)

tubules, enter the tubules, where it is reabsorbed by megalin-cubulin-mediated endocytosis and then completely metabolized in the proximal tubule epithelial cells. As a consequence, cystatin C is excreted in minimal amounts in the urine in normal conditions.

The average parameters of diagnostic significance of cystatin C in patients with acute kidney injury are presented in Table 4.

L-FABP (liver fatty acid binding protein) is a cytoplasmic protein with a molecular weight of 15 kDa that is expressed in tissues with increased fatty acid metabolism. It belongs to the family of fatty acid transporter proteins that are involved in the transport of long-chain fatty acids between the intra- and extracellular space and regulate oxidative stress by binding lipophilic products, limiting their damaging effects on cell membranes.

In humans, this molecule is mainly synthesized in the liver; in small amounts, it is found in the kidneys and small intestine. Under normal conditions, L-FABP is not present in the urine. Since, filtered in the glomeruli, it is then completely reabsorbed in the proximal tubules, which allows the diagnosis of acute kidney damage. This was first demonstrated in an animal model of ischemic tubular necrosis. This marker proved to be a sensitive predictor of acute kidney damage in children after cardiac surgical interventions with the use of a heart-lung machine. In patients with acute kidney damage against the background of septic shock, L-FABP levels are elevated and determine the relative risk of mortality. The study of urinary concentrations of this marker suggested it as an acceptable biomarker of acute kidney damage in patients admitted to intensive care units (AUC, 0.95; PPV, 100%; NPV, 85%) - [21, 25].

KIM-1, the renal injury molecule or cell receptor-1 of hepatitis A virus, is also a biomarker of early renal damage. It is a membrane protein that is not detected in normal renal tissue and urine, but is detected in damaged proximal tubule epithelium due to ischemia or nephrotoxic effects. High sensitivity of KIM-1 determination in urine enables to differentiate acute kidney damage of ischemic and toxic origin from prerenal hyperazotemia, chronic kidney disease, urinary tract infection, X-ray-contrast-induced nephropathy. In acute kidney injury, a high concentration of KIM-1 in the urine is prognostically unfavorable.

Interleukin-18 is a proinflammatory cytokine that is localized in renal macrophages, podocytes, and dendritic cells. An increase in interleukin-18 provokes the formation of free oxygen radicals, which alters the epithelium of the convoluted tubules. Increased urinary excretion of interleukin-18 in ischemic acute tubular necrosis and ischemia-reperfusion syndrome is correlated with enzymuria (α-glutathione-S-transferase, NAG) and preempts changes in serum creatinine concentration. Given its high (over 90%) specificity and by dynamically monitoring IL-18 levels, we can distinguish between: ischemic acute kidney injury, including renal transplant ischemia-reperfusion syndrome; chronic kidney disease; urinary tract infection; prenatal acute renal failure. In patients who are in the intensive care unit with adult respiratory distress syndrome (ARDS), increased urinary excretion of interleukin-18 becomes a marker of acute renal failure, outpacing hyperazotemia by two days.

Таблица 4 / Table No. 4

Роль цистатина С в диагностике острого повреждения почек*
Role of cystatin C in the diagnosis of acute kidney damage*

Вариант ОПП Acute kidney damage variant	Биоматериал Biomaterial	AUC, мкг/ мл × мин / AUC, μg/ml × min	PPV, %	NPV, %
После кардиохирургических вмешательств After cardiac surgery	Кровь/Blood	0,73	63	84
	Моча/ Urine	0,65	52	82
У пациентов ОРИТ In ICU patients	Кровь/Blood	0,80	42	85
	Моча / Urine	0,68	75	95
Постконтрастное ОПП / Postcontrast acute kidney damage	Кровь/Blood	0,93	56,7	98,0
У пациентов приемного отделения In emergency room patients	Кровь/Blood	0,87	48,0	94,0
	Моча / Urine	0,59	32,0	84,0

Примечание (здесь и далее): * p <0,05; AUC (area under curve) среднее значение площади под характеристической кривой диагностического теста (ROC-кривой – receiver operating characteristics); PPV (positive predictive value) – среднее значение прогностической ценности положительного результата (отношение истинно положительных результатов к положительным результатам, определенным с применением диагностического теста); NPV (negative predictive value) – среднее значение прогностической ценности отрицательного результата (отношение истинно отрицательных результатов к отрицательным результатам, определенным с применением диагностического теста) – данные представлены на основании обзоров исследований, опубликованных в 2013 г. [25]

Note (hereafter): * p < 0.05; AUC (area under curve) —average value of area under the diagnostic test characteristic curve (ROC curve receiver operating characteristics); PPV (positive predictive value) average value of prognostic value of a positive result (ratio of true positive results to positive results determined using a diagnostic test), NPV (negative predictive value) —average value of prognostic value of a negative result (ratio of true negative results to negative results determined using a diagnostic test) [25]

Other marker proteins are used in experimental work on acute renal failure and have not yet been tested clinically. These include, for example, uromodulin or Tamm-Horsfall protein found in the epithelium of the distal renal tubules. In the early stages of acute renal failure, the concentration of uromodulin is significantly reduced.

The detection of several markers in the urine at the same time is very promising. In particular, detection of NGAL, KIM-1, matrix metalloproteinase makes it possible with high sensitivity to early diagnose acute renal failure as a consequence of cardiac surgery in pediatric patients.

In a multicenter study, simultaneous assessment of urinary excretions of NGAL and KIM-1 has been shown to predict the initiation of renal replacement therapy and the relative risk of mortality [11, 25]. A two-center study of 529 patients admitted to the intensive care unit compared the role of 6 urinary biomarkers-Gamma glutamyl transpeptidase, alkaline phosphatase, NGAL, cystatin C, KIM-1, and IL-18. The biomarkers NGAL, cystatin C, and IL-18 were predictors of the need for dialysis therapy, whereas all markers except KIM-1 were predictors of mortality risk [16, 25]. Currently, there is no answer to the question which combination of biomarkers is optimal. According to some authors, that should be a combination of markers with high sensitivity on the one hand, and with specificity on the other.

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Original article

STRUCTURE OF PROTECTIVE AND COPING RESPONSE IN POLICE OFFICERS SUFFERING FROM SOMATOFORM VEGETATIVE DYSFUNCTION OF GASTROINTESTINAL TRACT, IN RELATION TO PSYCHOHYGIENE TASKS

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Abstract. *The aim of the study* was to identify differences of protective and coping behavior and its dynamics in conditions of asthenization and anxiety-depressive response in employees of internal affairs bodies, suffering from somatoform vegetative dysfunction of the gastrointestinal tract.
Materials and methods of research. To reveal structural and dynamic characteristics of the protective response and character of the asthenization depression and anxiety influence on the internal affairs employees, 64 police officers with somatoform vegetative dysfunction of the gastrointestinal tract (F. 45.3) according to criteria of ICD-10 were investigated.
Results of the study and their analysis. The study revealed that the differences were both purely individual and cross-cutting, reflecting a pronounced intrapersonal conflict. This indicates the weakness of the defense system in police employees suffering from somatoform vegetative dysfunction of the gastrointestinal tract, regardless of gender identity, emphasizing their low adaptive capacity, making it difficult to recognize the problems. The basic socio-professional characteristics of police officers are reflected and their role in protective and coping response is shown. The results of the study are offered to use in psychohygienic work with employees, prone to somatoform reactions.

Key words: *coping behavior strategies, mechanisms of a protective reaction, police officers, psychohygiene, somatoform vegetative dysfunction of gastrointestinal tract*

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Оригинальная статья

СТРУКТУРА ЗАЩИТНО-СОВЛАДАЮЩЕГО РЕАГИРОВАНИЯ У СОТРУДНИКОВ ОРГАНОВ ВНУТРЕННИХ ДЕЛ, СТРАДАЮЩИХ СОМАТОФОРМНОЙ ВЕГЕТАТИВНОЙ ДИСФУНКЦИЕЙ ЖЕЛУДОЧНО-КИШЕЧНОГО ТРАКТА, В СВЯЗИ С ЗАДАЧАМИ ПСИХОГИГИЕНЫ

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Резюме. *Цель исследования* – выявление различий защитно-совладающего поведения и его динамики в условиях астенизации и тревожно-депрессивного реагирования у сотрудников органов внутренних дел (ОВД), страдающих соматоформной вегетативной дисфункцией желудочно-кишечного тракта (СВД ЖКТ).
Материалы и методы исследования. С целью выявления структурно-динамических характеристик защитно-совладающего реагирования и характера влияния астенизациии, депрессии и тревоги на сотрудников органов внутренних дел были обследованы 64 пациента, у которых в соответствии с критериями МКБ-10 были диагностированы соматоформные вегетативные дисфункции желудочно-кишечного тракта (F. 45.3).
Результаты исследования и их анализ. В ходе исследования было выявлено и показано, что различия защитно-совладающего поведения у обследованных носят как сугубо индивидуальный, так и сквозной характер, что отражает выраженную внутриличностную конфликтность. Это указывает на слабость системы защиты у сотрудников ОВД, страдающих СВД ЖКТ, независимо от их гендерной принадлежности, подчеркивает их невысокие адаптивные возможности, затрудняющие осознание проблем. Отражены основные социально-профессиональные характеристики сотрудников ОВД и показана их роль в защитно-совладающем реагировании. Результаты исследования предложено использовать в психогигиенической работе с сотрудниками ОВД, склонными к соматоформному реагированию в условиях несения службы, что будет способствовать их профессиональной успешности.

Ключевые слова: *механизмы защитного реагирования, психогигиена, соматоформная вегетативная дисфункция желудочно-кишечного тракта, сотрудники органов внутренних дел, стратегии совладающего поведения*

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A fundamental feature of somatoform disorders according to the International Classification of Diseases, 10th Revision (ICD-10) is the recurrent presentation of somatic symptomatology. It is combined with insistent demands for medical examinations despite negative results and lack of physiological basis for the complaints presented. Somatoform disorders have a polymorphic clinical picture. Therefore, reducing somatoform pathology to an assessment of perceptual functional limitations leads to a duplication of the traditional clinical method. This method is valuable medically, but insufficient for realization of the biopsychosocial approach[1, 2]. Only an in-depth study of the dependencies between the biological and psychosocial levels, as well as the inter- and intralevel connections that determine the patterns of patients' full sense of well-being and its dynamics, can ensure its realization. Such research is possible only on an interdisciplinary basis. Their results can be used for the development of psychoprophylactic and psychohygienic programs [3-7].

The aim of the study was to identify the differences of protective and coping behavior and its dynamics in asthenization and anxiety-depressive response in employees of internal affairs suffering from somatoform vegetative dysfunction of gastrointestinal tract.

Materials and methods of research. A total survey of 184 employees of internal affairs bodies who applied for psychiatric care in the clinic of the Federal State Institution of Health Care "Medical and Sanitary Unit of the Russian Ministry of Internal Affairs of Moscow" in 2019-2021 was carried out. For further study, 64 employees who were diagnosed with somatoform vegetative gastrointestinal dysfunction according to ICD-10 criteria (F.45.3) were selected. All respondents were divided into 2 groups: Group 1, 30 men (49%), mean age (36.8±2.6) years; Group 2, 34 women (51%), mean age (35.2±1.6) years. Clinical and experimental-psychological methods were also used, using the psychosocial questionnaire we developed and a battery of tests. The Asthenic State Scale (Malkova L.D., 1977) [8]; Depression Detection Questionnaire (BDI) (Beck A., et al., 1961) [9]; Scale of Personal and Situational Anxiety (Spielberger C.D., L. Khanin, 1976) [9]; the Plutchik-Kellerman-Konte Life Style Index (1979) [9]; Lazarus' Co-occurring Behavior Strategies questionnaire (1988) [8]. The material was statistically processed using the SPSS-22.0 software package and Student's t-criterion; Pearson's criterion (r) was used to determine the mutual influence of psychopathological disorders and socio-psychological characteristics. The level of statistical significance was $p \leq 0.05$.

Results of the study and their analysis. Clinical manifestations of gastrointestinal somatoform disorders in both groups of respondents were represented by the following symptomatology. The clinical picture was defined by the symptomatology of intestinal crisis, where in addition to somato-vegetative manifestations, fears for the own health dominated. Fears were connected with discomfort, unpleasant sensations in abdominal cavity and characterized by insuperability of their occurrence and subjective awareness of their strangeness. Critical attitude to fears of missing intestinal gases or intestinal contents and attempts to actively overcome them persisted. Patients considered their fears unreasonable and denied the presence of serious gastrointestinal disease, though admitting the possibility of its development. Patients willingly engaged in general physical training. Thus, they proved to themselves that success in sports was an indicator of their physical well-being. But the persisting vegetative-somatic manifestations made them doubt it. The distressing character of the disorders for patients was determined by the contradictory attitude to the clinical symptomatology. The experience of fear with the understanding of its unreasonableness continued, there was a feeling of internal clamping and at the same time the persistence of fear. Patients could not resist it and tried to get rid of it by any means. A combination of insecurity and stenicism in achieving one's own goals was characteristic. At the same time, the most pronounced were the affective intensity of experiences, an excruciating struggle with fears accompanied by bashfulness and aspiration to overcome them. Somatoform vegetative dysfunction of the gastrointestinal tract developed in persons with anxious character traits after long overwork or conflict situations at work. The disorder was manifested by abdominal pain of a pressing, aching nature, localized and prolonged in duration. Gradually anxious attitude to one's health, fear of possible onset of severe disease of abdominal organs, fear of missing intestinal gas and intestinal contents were formed. Patients noted slightest fluctuations of well-being and constantly monitored their state of health. Because of this, the range of their interests narrowed, being limited to questions of somatic well-being. The patients ceased to aspire to improvement or maintenance of their professional status, chose quieter activities and even lost their wages. The provoking factors for that were various deleterious influences — alcoholic excess, smoking, coffee consumption, temperature overheating, physical overexertion, and acute respiratory viral infections.

The results of the "Coping Behavior Methods" technique revealed that the scales were generally within the normative interval (40-60 T-points). This indicated a moderate degree of strategy preference. In a comparative analysis, the most pronounced significant differences were on the scales of "seeking social support," "taking responsibility," "positive reassessment" and "distancing". The scales of "seeking social support," "planning problem-solving," "positive reevaluation," and "distancing" were significantly preferred by men. The significantly more frequent use of these strategies indicates that men, as compared to women, were more frequently oriented toward increased support from others. They often aspired to systematic and purposeful decision of problems with an opportunity of positive reassessment of a problem situation. At the same time they made attempts to cope with the stressful situation by decreasing its significance for

themselves and by not being emotionally involved in it. Besides, they were significantly less inclined to self-blaming and self-criticism (Table 1).

Women used the strategies "self-control" and "acceptance of responsibility" significantly more often. This indicates attempts to reduce internal tension and anxiety by avoiding problem solving, by self-blaming, by being too demanding of oneself, and over-controlling one's behavior. At the same time, it is necessary to pay attention to the women's difficulties in expressing their feelings, to their weak desire to speak out in the conversation with the doctor, and to their low motivation to open up about their feelings.

In both groups of respondents, "self-control", "problem-solving planning", "escape", and "confrontation" strategies were observed. This indicated an aspiration to self-control, high behavior control, and restraint of emotions. At the same time, attempts to systematically search for a way out of a difficult situation were characterized by excessive rationality, low spontaneity and intuitiveness. They were carried out by shifting attention, self-effacement and humor. It allowed to lower the emotional stress quickly, however, it had a short-term effect and led to an accumulation of psycho-emotional tension, the realization of which was delayed. Thus, the stable character of coping strategies in individuals suffering from gastrointestinal somatoform disorders, irrespective of their gender identity, testifies to their low adaptability, which makes it difficult to realize intrapersonal problems.

The analysis of the structure of protective response mechanisms, according to the "Life Style Index" methodology, showed the following significant differences in men and women. The total tension of protective mechanisms did not exceed the threshold value of 50 points: for men — (18,9±3,8) points, for women (28,15±2,4) points. This testified to the absence of significant unresolved conflicts. The mechanisms of "regression", "projection", "hypercompensation" and "rationalization" prevailed significantly more often in women. This can be seen as a propensity for dependent behavior, as a way to increase self-esteem, when values and attitudes borrowed from others are used in behavior, but do not become part of the personality itself. And high demandingness to others allows to justify own behavior, motives and intentions, which also contributes to an increase in self-esteem. Along with this, women were characterized by hypertrophied sociality and normativity. It speaks about suppression of aspirations which are socially disapproved. One of the basic mechanisms of protective reaction in women is "rationalization". It is the development of one's own conception of illness, as well as the behavioral choices associated with it. The defense has a passive-defensive nature, acquiring pathological forms and reinforcing patients in the role of the sick. In an effort to suppress anxiety and fear for their health, patients, first of all, sought help from internal medicine doctors. They underwent numerous examinations and received symptomatic treatment, which brought them short-term relief or had no effect at all. Restrictive behavior formed an adaptive response style in the patients and contributed to the expansion of the circle of compulsions. They developed obsessive-compulsive perceptions and defensive behaviors. Patients, experiencing fear for their health, tended to continue to work and to perform their daily duties. The hypochondriac condition was not formed in them, the phobic syndrome had monothematic character, protective actions were united by an uniform plot. The patients maintained a critical attitude toward their own painful experiences and had a desire to get rid of them as quickly as possible. However attempts to independently overcome fears and concerns were not successful. In the majority of cases, they led to the formation of "phobophobia" — fear of the occurrence of intestinal crisis and the acute sense of shame accompanying it. The results of comparison of male and female protective mechanisms testify that the preferable use by women of immature, unconstructive mechanisms allows us to say that they (the mechanisms) are based on the feeling of insecurity, lack of self-sufficiency, fear of self-expression and self-disclosure, fear of revealing their experiences to others (Table 2).

Таблица 1 / Table No.1

Структура стратегий совладающего поведения у мужчин и женщин, по тесту Лазаруса, баллы, (M±m)

Structure of coping strategies in men and women, according to Lazarus test, points (M±m)

Шкалы Scales	Мужчины Men	Женщины Women	P	T
Самоконтроль Self-control	51,14±7,21	56±5,76	-	1,112
Поиск социальной поддержки Seek social support	60,28±5,13	56,7±5,4	0,05	1,327
Принятие ответственности Accept responsibility	49,7±5,7	56,13±4,8	0,001	-2,708
Планирование решения проблемы Problem solving	66,7±0,9	64±3,1	-	0,268
Положительная переоценка Positive revaluation	61,7±6,8	53±3,33	0,005	3,274
Дистанцирование Distancing	63,57±7,6	54,87±6,06	0,001	2,815
Бегство/избегание Escape/avoidance	54,57±5,05	53±6,7	-	1,233
Конфронтация Confrontive coping	58,14±6,7	54±5,3	-	0,502

In both groups of respondents there was a cross-cutting character of the mechanisms of "displacement," "substitution," "denial," and "compensation," which can be interpreted as a tendency to form an internal conflict. This reflects the inflexibility of the defense system, indicating difficulty in recognizing one's own problems and the inability to cope with them. Passive behavioral stance, ignoring problematic situations, devaluing own efforts and intentions, determining the refusal of effective coping — all this significantly limits the possibilities of constructive resolution of interpersonal problems and contributes to the occurrence of somatoform disorders.

During the study of the respondents it was possible to find out that the indicators of the main mental states (asthenia, depression, personal anxiety, situational anxiety), regardless of gender identity and the leading clinical syndrome, had a complex structural and syndromal configuration. Characteristic features of the disorders were: decreased working capacity; pronounced fatigue after minimal physical exertion; signs of physical fatigue in the form of decreased efficiency of solving professional tasks and everyday problems due to difficulties in concentration, irritability, unstable mood, vegetative lability, sleep disturbances when falling asleep and frequent awakenings at night. Even with minor deviations from the established

Таблица 2 / Table No. 2

Механизмы защитного реагирования у мужчин и женщин по методике «Индекс жизненного стиля», баллы, (M±m)

Protective response mechanisms in men and women according to the "Life Style Index" methodology, points, (M±m)

Шкалы Scales	Мужчины Men	Женщины Women	P	T
Вытеснение Displacement	17,14±4,74	13,75±3,24	–	1,049
Регрессия / Regression	14,3±4,8	25,13±5,2	0,005	-2,890
Замещение Replacement	8,5±4,04	12,5±4,1	–	-0,267
Отрицание / Denial	32,1±8,18	34,9±6,4	–	0,954
Проекция / Projection	21,95±8,8	40,64±4,3	0,001	-3,502
Компенсация Compensation	18,57±6,3	20±6,8	–	0,654
Гиперкомпенсация Hypercompensation	5,7±2,9	27,5±4,1	0,001	-4,579
Рационализация Rationalization	36,7±7,21	45,8±5,45	0,001	-3,026

order, patients complained about deterioration of well-being, sleep disorders, heaviness and weakness in the whole body, and difficulties in concentrating. These manifestations were combined with attention deficit and with difficulties in assimilating and reproducing information. Sleep disorders were permanent, lasted less than a month, and were accompanied by a lack of recovery after sleep. As a result, significant fatigue during the day was observed. Patients restricted their life by the framework of narrow interests, imperceptibly lost their earlier social activity, cheerfulness, there was a reduction of the feeling of satisfaction with life. In the structure of asthenia, phenomena without a shade of vitality dominated, against which vegetative-somatic disorders became predominant and sounded more grievous.

Anxiety and depression included vegetative and somatosensory components. Their occurrence and dynamics created a "tangled pattern" of the somatovegetative reaction itself. According to the study, a mild degree of depression and anxiety were significantly more prevalent in women. The duration of disorders, as a rule, ranged from several weeks to two months. The clinical symptomatology was represented as a decrease in mood, depression, narrowing of the range of interests, decrease in professional interest and social activity, and was involved in the formation of somatoform autonomic dysfunction (Table 3).

As for marital status, married men prevailed among the surveyed men, and unmarried and divorced women prevailed among women — Fig. 1.

As for the educational level, those with specialized secondary education prevailed among men, and those with higher education among women, which characterizes the desire of the latter for career advancement — Fig. 2.

Data on the composition and length of service of internal affairs officers (men and women) suffering from somatoform disorders of the gastrointestinal tract are presented in Fig. 3, 4.

The results of the analysis of socio-professional characteristics showed that men were characterized by: average age — (36,8±2,6) years; predominance of privates and junior officers; length of service — 5-10 years; predominance of persons with specialized secondary education; predominance of married persons. Women were characterized by: average age — (35.2±1.6) years; predominance of senior officers (major, lieutenant colonel); 5-10 years' seniority; predominance of persons with higher education; predominance of unmarried and divorced persons. It is noteworthy that many police officers, both men and women, with higher education remain in junior commanding positions. This can be explained by the fact that many are satisfied with the work schedule (per diem shifts, internal posts), it gives an opportunity to make extra money or leaves more time for household and domestic activities. Attention should also be paid to the large proportion of divorced women (12%), which should be taken into account when forming groups "at risk of developing psychosocial maladaptations in the future".

Conclusion

Differences in the style of the protective and coping response were manifested as follows. Men significantly more often resorted to the search for social support as a coping behavior, considering various ways of solving the problem, along with social distancing with elements of confrontation. They were inclined to search for people who could help, with whom they could discuss their difficulties. For women, strategies of "problem-solving planning" and "distancing" were characteristic, which indicates a constructive approach to solving difficult situations — the ability to purposefully analyze the situation, to develop a tactical plan of action taking into account living experience. From the point of view of mechanisms of a protective reaction, men gave preference to such mechanisms, as "displacement", "denial" and "rationalization", which led to "flight into an illness", while "pleasant conditionality and desirability" of existing disorders were absent. In women, "regression", "replacement", "projection" and "hypercompensation" mechanisms were significantly more prevalent, which may be regarded as an infantile attitude toward dependent behavior. Women were characterized by high demandingness to others, excessive sociality and a pronounced desire to conform to generally accepted standards of behavior, which indicates the suppression of aspirations that are socially disapproved. In both groups of respondents, there was a cross-cutting character of the mechanisms of "denial," "compensation," and "rationalization. This can be interpreted as a marker of prolonged and pronounced intrapsychic conflict. The tension of professional activity and high demands imposed on police officers caused the unfolding of adaptive mechanisms focused on stabilizing the intrapersonal state. The structure of adaptive

Таблица 3 / Table No. 3

Проявления астении, депрессии и тревоги у мужчин и женщин по методикам «Шкала астенического состояния», «Опросник для выявления депрессии» (BDI), «Шкала личностной и ситуативной тревожности», баллы, (M±m)

Asthenia, depression, and anxiety in men and women according to the "Asthenia Scale," "BDI— Beck Depression Inventory", "Personal and Situational Anxiety Scale," scores (M±m)

Вид расстройства Type of disorder	Мужчины Men	Женщины Women	P	T
Астенические проявления / Asthenic manifestations	41,43±6,9	45,38±3,06	-	1,049
Депрессивные состояния / Depressive states	6,29±3,29	9,87±2,77	0,005	2,890
Тревога личностная Personal anxiety	41,43±3,03	48,87±4,54	0,001	2,267
Тревога ситуационная Situational anxiety	37,29±3,87	43,5±3,9	0,001	3,075

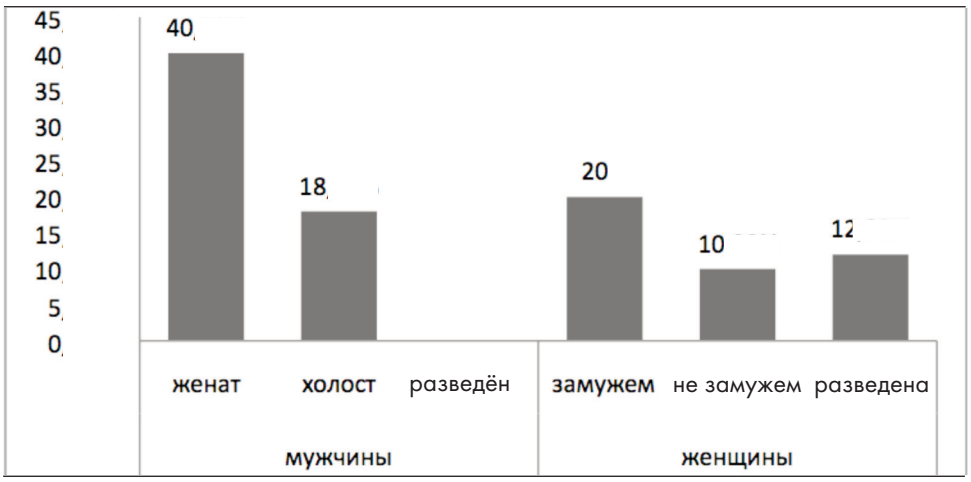

Рис.1. Семейное положение сотрудников ОВД (мужчины и женщины), страдающих СВД ЖКТ, %
Fig.1. Marital status of police officers (men and women) suffering from GI vegetative dysfunction syndrome, %

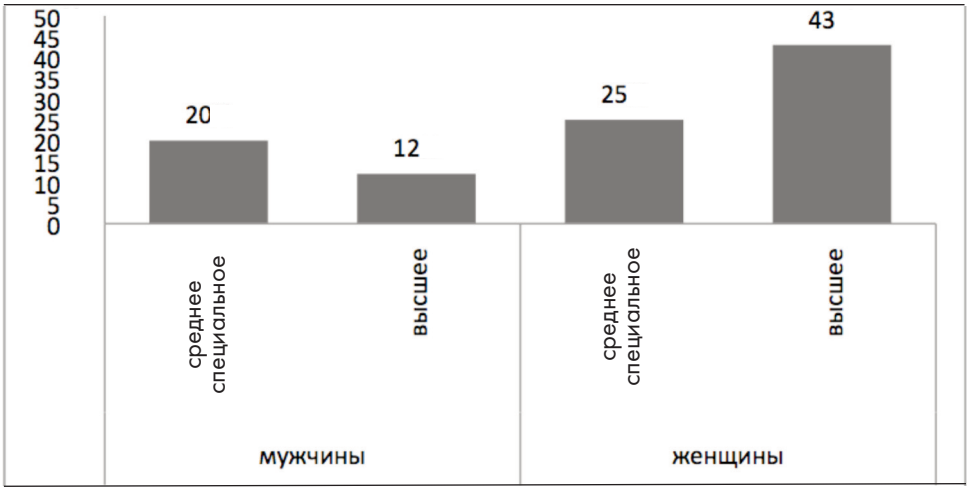

Рис.2. Образовательный уровень сотрудников ОВД (мужчины и женщины), страдающих СВД ЖКТ, %
Fig.2. Educational level of police officers (men and women) suffering from GI vegetative dysfunction syndrome, %

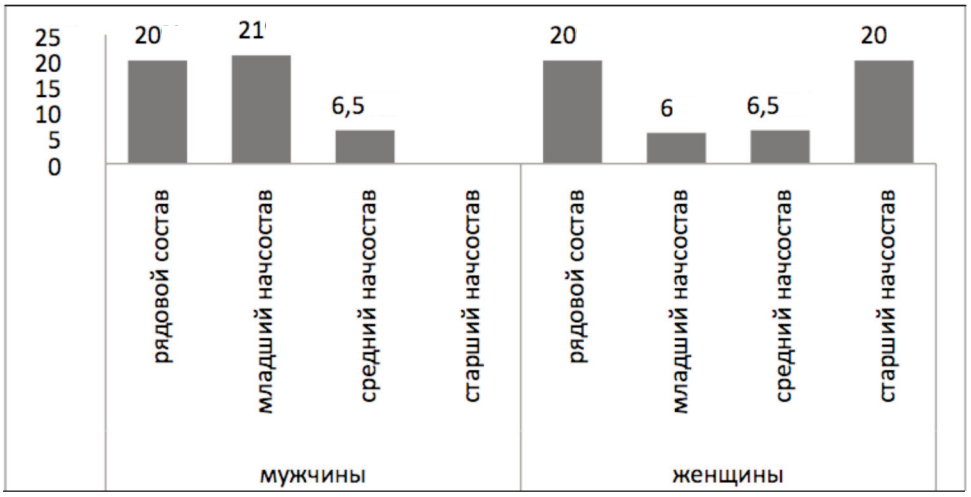

Рис.3. Состав, к которому относятся сотрудники ОВД (мужчины и женщины), страдающие СВД ЖКТ, %
Fig.3. Contingent to which police officers (men and women), suffering from GI vegetative dysfunction syndrome, belong, %

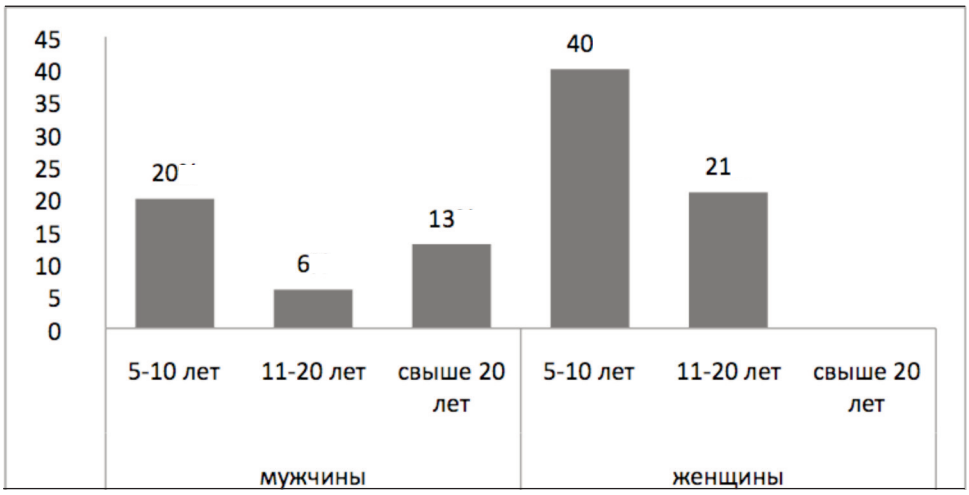

Рис.4. Выслуга лет у сотрудников ОВД (мужчины и женщины), страдающих СВД ЖКТ, %
Fig.4. Length of service of IAB employees (men and women) suffering from Gastrointestinal ENS, %

behavior, hierarchy of its elements, qualitative uniqueness of its interrelations are the key to reliable prediction of the style of adaptive response, increasing the effectiveness of its accompaniment programs and formation of optimal adaptive effects as well as of the provision of timely and highly qualified medical care. The spectrum of possibilities for realization of adaptive behavior is wider, and therefore the design of these mechanisms is more diverse, which looks very optimistic. From the point of view of innovative development of departmental health care and management of health risks, protection of mental health of law enforcement officers represents an important social task, occupying an important place in the hierarchy of therapeutic and preventive priorities.

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Short report

USE OF INNOVATIVE TECHNOLOGIES IN THE TREATMENT OF PATIENTS WITH SEVERE CONCOMITANT INJURY WITH LIVER DAMAGE: CLINICAL OBSERVATION

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Abstract. Liver injury is one of the most common abdominal injuries in patients with severe trauma.
A total of 2988 patients with concomitant injuries were treated at the city clinical hospital named after S.S. Yudin during the period from 2010 to 2020, of which 371 (12.4%) were found to have closed abdominal trauma. Damage to the liver was revealed in 124 (33.4%) patients with closed abdominal trauma. The number of discharged patients was 78 (62,9%), lethal outcome — 46 patients (37,1%). The severity of injury according to ISS was (38,1±11,3) points. The development of innovative multimodal approaches, such as endovascular trauma and bleeding management (EVTM), as well as damage control tactics have significantly increased the likelihood of nonoperative treatment for individual patients.
A clinical observation is presented that allows to evaluate the effectiveness of innovative technologies in the treatment of patients with severe concomitant trauma with liver damage.

Key words: *closed abdominal trauma, innovative technologies, liver injury, non-surgical treatment of victims with severe concomitant trauma, polytrauma, X-ray endovascular treatment*

Conflict of interest. The authors declare no conflict of interest

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Краткое сообщение

ПРИМЕНЕНИЕ ИННОВАЦИОННЫХ ТЕХНОЛОГИЙ ПРИ ЛЕЧЕНИИ ПОСТРАДАВШИХ С ТЯЖЕЛОЙ СОЧЕТАННОЙ ТРАВМОЙ С ПОВРЕЖДЕНИЕМ ПЕЧЕНИ: КЛИНИЧЕСКОЕ НАБЛЮДЕНИЕ

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Резюме. Отмечено, что травма печени – одно из наиболее частых повреждений органов брюшной полости у пациентов с тяжелыми сочетанными травмами. В 2010–2020 гг. в Городской клинической больнице им. С.С.Юдина проходили лечение 2988 пострадавших с сочетанной травмой, у 371 из них (12,4%) была выявлена закрытая травма живота, повреждения печени выявлены у 124 пациентов (33,4%). Выписаны 78 пациентов (62,9%), летальный исход – 46 пациентов (37,1%). Тяжесть травмы по ISS составила (38,1±11,3) баллов. Применение новых инновационных мультимодальных подходов, таких, как рентгенэндоваскулярное лечение травм и кровотечений (EVTM-endovascular trauma management), значительно повышает возможность безоперационного лечения (non-operative management) и улучшает его результаты.
Представлено клиническое наблюдение, позволяющее оценить эффективность применения инновационных технологий при лечении пострадавших с тяжелой сочетанной травмой с повреждением печени.

Ключевые слова: *безоперационное лечение, закрытая травма живота, инновационные технологии, повреждение печени, политравма, пострадавшие с тяжелой сочетанной травмой, рентгенэндоваскулярное лечение, тактика damage control*

Конфликт интересов. Авторы сообщения подтверждают отсутствие конфликта интересов

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The incidence of liver damage in closed abdominal trauma, according to various authors, ranges from 11.0% to 41.5%. Damage to the spleen is also often noted — 16.1–40.3%; less often kidney damage is detected — 7.1–18%; pancreas — 1.4–8.5%; small intestine — 19.6–37.8%; colon — 6.1-11.5%; Duodenal ulcer — 1.04-10.0%; bladder — 6.1-16.9%; mesentery — 10.7–31.0%; diaphragm — 2.0–3.0%; large vessels — 1.9–2.5% [1, 5].

From 2010 to 2020 in the city clinical hospital named after S.S. Yudin 2988 patients with concomitant trauma were treated, of which 371 (12.4%) had a closed abdominal trauma. Liver injuries were observed in 124 (33.4%) patients with closed abdominal trauma. 78 (62.9%) patients were discharged, 46 (37.1%) died. The severity of the injury according to the ISS was 38.1 + 11.3 points. According to the AAST injury scale, out of 124 patients: with I injuries. — 45 (36.2%), II — 49 (39.5%), III — 16 (13%), IV — 11 (8.9%), V — 3 (2.4%).

The development of new innovative multimodal approaches, such as endovascular trauma management (EVTM) and damage control tactics, have significantly increased the likelihood of non-operative management for individual patients [5]. This advanced strategy requires a multidisciplinary approach, comprehensive diagnostic testing, and 24/7 availability of equipment and services. This became possible in the last decade in our hospital thanks to the modernization of Moscow healthcare and the associated technological re-equipment, training of medical personnel, fast transportation of victims, introduction of the damage control concept into clinical practice. Those are the key conditions for a successful multidisciplinary approach to a victim with concomitant trauma (2, 3, 6).

In this regard, therapeutic and diagnostic tactics have radically changed: conservative therapy is indicated for all hemodynamically stable patients with any degree of isolated liver injury. With signs of ongoing bleeding on CT in combination with stable hemodynamics, endovascular embolization is necessary, which is effective in 50–94% of cases [7]. Obviously, the more severe the liver injury, the greater the risk of failure of non-surgical treatment. Ineffectiveness of endovascular embolization or recurrent bleeding is an indication for discontinuation of conservative therapy and for an emergency surgery. Non-operative management based on CT data helps to reduce mortality and cost of treatment [4].

This approach is illustrated by the following clinical example. 22 years old woman, was admitted to the hospital on an emergency basis on 02/04/2021 after falling from a height of the 9th floor with a diagnosis of Catatrauma (ISS 26 points): closed abdominal trauma with liver damage. Central intraparenchymal hematoma of the liver (AAST II). Closed head injury. Brain concussion. Closed complicated chest trauma: pneumomediastinum, bilateral pneumothorax, fracture of the left scapula body. Lung contusion. Contusion of soft tissues of the chest, extremities. Fracture of the body of the left scapula without displacement of fragments. Traumatic shock.

According to EFAST ultrasound: heterogeneous fluid accumulation in the right lobe of the liver measuring 54x52x54mm.

CT scan with intravenous contrast revealed an extensive lesion, with the formation of a hematoma, affecting the IV, VII, VIII segments of the liver with extravasation of contrast agent into arterial and venous phases (Pic. 1-2)

As a result of instrumental and laboratory examination no data was obtained for active intra-abdominal bleeding, the size of the hematoma corresponded to WSES I / AAST II, — it was decided to perform selective angiography followed by occlusion of the branch of the left hepatic artery (Pic. 3-4)

According to the data of ultrasound of the abdominal organs in dynamics, the hematoma size regressed. On the 6th day, the patient was discharged home in a satisfactory condition.

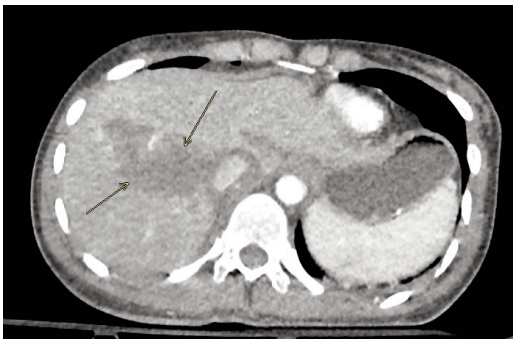

Рис. 1. Рис. 1. Компьютерная томография органов брюшной полости (ОБП) – артериальная фаза: гематома IV, VII, VIII сегментов печени с экстравазацией контрастного вещества
Fig. Abdominal CT (arterial phase): hematoma of IV, VII, VIII segments of the liver with contrast extravasation

Рис. 2. Компьютерная томография ОБП – венозная фаза: гематома IV, VII, VIII сегментов печени с экстравазацией контрастного вещества
Fig. 2. Abdominal CT (venous phase): hematoma of IV, VII, VIII segments of the liver with contrast extravasation

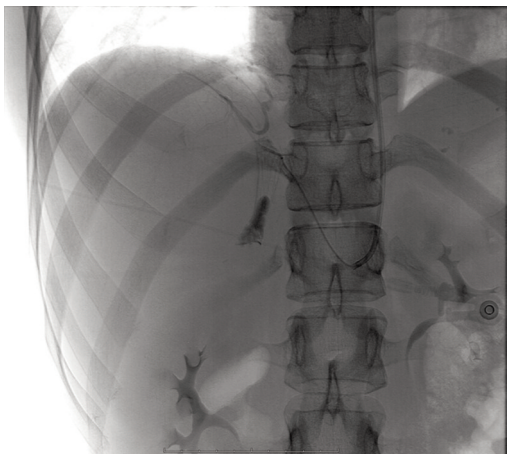

Рис. 3. Экстравазация контрастного вещества при селективной ангиографии левой ветви собственной печеночной артерии
Fig. 3. Contrast extravasation during selective angiography of the left branch of the intrinsic hepatic artery

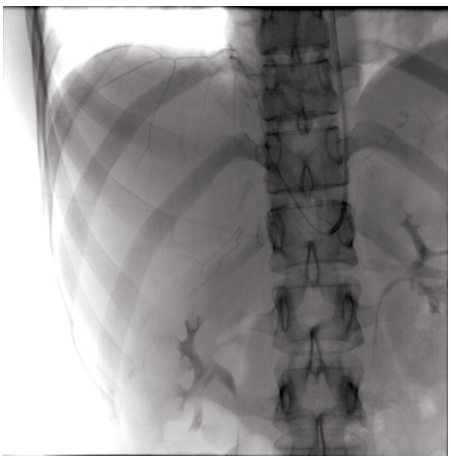

Рис. 4. Контрольная ангиография после эмболизации – отмечено отсутствие экстравазации.
Fig. 4. Control angiography after embolization — no extravasation observed

The treatment of liver injury is interdisciplinary. When feasible, non-surgical treatment (NOM) — angioembolization should be considered as the treatment of choice for liver injury with ongoing bleeding. A non-surgical method of treating patients with closed abdominal injuries is the preferred option for all hemodynamically stable patients (WSES I, AAST I - II), with moderate (WSES II, AAST III) and severe (WSES III, AAST IV - V) injuries in the absence of other internal injuries requiring surgical intervention [6,7]. A prerequisite for the non-surgical treatment of severe concomitant trauma with liver damage is the round-the-clock availability of all necessary examination and treatment methods, including angiography, EFAST ultrasound, computed tomography with intravenous contrast, and trained medical personnel.

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Short report

ORGANIZATION OF MEDICAL SUPPORT FOR THE MILITARY SERVICE CALL-UP OF CITIZENS DURING NEW CORONAVIRUS INFECTION COVID-19 PANDEMIC

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Abstract. *The aim of the study* was to evaluate the organization of screening of conscripts for COVID-19 infection in one of the subjects of the Russian Federation — Orenburg region.
Materials and methods of the study. The study of organization of examination of conscripts for COVID-19 infection included study of the experience of the Center of Military Medical Examination of the Military Commissariat of Orenburg Region in carrying out military conscription under conditions of the COVID-19 pandemic; methodological recommendations approved by the Head of the Main Military Medical Department of the Defense Ministry of Russia as well as the analysis of the activities carried out at different stages of medical sorting.
Results of the study and their analysis. The results of the study of the organization of COVID-19 screening of conscripts in Orenburg Region showed that sufficient and effective barrier medical screening was organized at all stages. Conscripts in good health condition were sent to the Armed Forces for military service under conscription. No claims were received from military units about poor quality selection of conscripts. In 2020, during the COVID-19 pandemic, recruitment commissions of Orenburg Region coped successfully with the task of drafting citizens for military service.

Key words: *barrier function, conscripts, medical sorting, medical support, military service, Orenburg Oblast, COVID-19 pandemic, signs of disease*

Conflict of interest. The authors declare no conflict of interest

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Краткое сообщение

ОРГАНИЗАЦИЯ МЕДИЦИНСКОГО ОБЕСПЕЧЕНИЯ ПРИЗЫВА ГРАЖДАН НА ВОЕННУЮ СЛУЖБУ В УСЛОВИЯХ ПАНДЕМИИ НОВОЙ КОРОНАВИРУСНОЙ ИНФЕКЦИИ COVID-19

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Резюме. *Цель исследования* – дать оценку организации обследования призывников на предмет инфицирования COVID-19 в субъекте Российской Федерации – Оренбургской области.
Материалы и методы исследования. Исследование организации обследования призывников на предмет инфицирования COVID-19 включало в себя изучение: опыта работы центра военно-врачебной экспертизы Военного комиссариата Оренбургской области при проведении призыва граждан на военную службу в условиях пандемии COVID-19; методических рекомендаций, утвержденных начальником Главного военно-медицинского управления (ГВМУ) Минобороны России, а также анализ мероприятий, проведенных на различных этапах медицинской сортировки.
Результаты исследования и их анализ. Результаты исследования организации проведения обследования призывников в Оренбургской области на предмет инфицирования COVID-19 показали, что на всех этапах обследования был организован достаточный и эффективный барьерный медицинский осмотр. В Вооруженные Силы для прохождения военной службы по призыву были направлены годные по состоянию здоровья призывники. В адрес призывных комиссий претензий из воинских частей о некачественном отборе призывников – не поступало. В 2020 г. в период пандемии COVID-19 призывные комиссии Оренбургской области с задачей по призыву граждан на военную службу успешно справились.

Ключевые слова: *барьерная функция, военная служба, медицинская сортировка, медицинское обеспечение, Оренбургская область, пандемия COVID-19, признаки заболевания, призывники*

Конфликт интересов. Авторы сообщения подтверждают отсутствие конфликта интересов

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Introduction

The World Health Organization (WHO) has officially declared a pandemic of a new coronavirus infection, COVID-19, and predicts various options for the development of the epidemic situation and its socio-economic consequences [1].

The main components of the fight against epidemics are anti-epidemic, restrictive and disinfection measures, as well as informing the population about ways to protect themselves from infection [2, 3].

The new coronavirus infection COVID-19 is included in the list of dangerous diseases [4, 5].

The main source of the new coronavirus infection is a sick person, also during the incubation period. The infection is transmitted by airborne, air-dust and contact routes by coughing, sneezing, talking at a distance of less than 2 m, shaking hands, through surfaces and environmental objects, on which the infection persists for up to 3 days.

As the infection spreads throughout the Russian Federation, the legislative and executive authorities at the federal level and at the level of the subjects of the Russian Federation issue regulations describing regime-restrictive measures as well as determining the procedure for the functioning of medical treatment organizations.

In the current situation it was necessary to organize the conscription of citizens for military service and to prevent the appearance of a new coronavirus infection COVID-19 in the Armed Forces of the Russian Federation.

The aim of the study was to evaluate the organization of screening of conscripts for COVID-19 infection in the subject of the Russian Federation, the Orenburg region.

Materials and methods of research. The study of organization of examination of conscripts for COVID-19 infection included study of the experience of the Center of Military Medical Examination of the Military Commissariat of the Orenburg region in carrying out conscription of citizens for military service under conditions of the COVID-19 pandemic; methodological recommendations approved by the Head of the Main Military Medical Directorate of the Ministry of Defense of Russia [6] as well as analysis of the activities carried out at different stages of medical triage[1].

Results of the study and their analysis. In 2020 during the period of conscription for military service (spring call-up from April 1 to July 15; autumn call-up from October 1 to December 31) the priority in the work of conscription commissions of municipal entities and regional call-up commissions was given to organization and implementation of a complex of preventive measures aimed at preventing the spread of COVID-19 in the Armed Forces of the Russian Federation.

The implementation of the barrier function began in the region's municipalities. There, the polymerase chain reaction for coronavirus were taken from conscripts through a swab from the mucosa of the mouth and nasopharynx. This allowed even asymptomatic patients to be diagnosed. Those with negative results were sent to the regional assembly point.

On the day of departure, the team of recruits was examined at the assembly station by a general practitioner or a paramedic.

In order to prevent conscripts with signs of infectious diseases and with suspected or probable COVID-19 disease from being sent to the assembly station, health complaints were interrogated, epidemiological anamnesis was collected, conscripts were examined and their body temperature was measured.

From the municipalities, recruits were taken to the regional assembly point in groups of no more than 10 people. For this purpose, a motor transport was allocated and each conscript was provided with individual protection equipment: masks and rubber gloves.

The next barrier was set at the assembly point. Two medical and nursing teams worked there, including a therapist, a nurse and a medical registrar. No more than 50 recruits arrived to the assembly point daily.

The first stage of the barrier medical examination (medical triage) of conscripts at the assembly point was changing their personal protective equipment and performing thermometry tests. This was performed by a nurse in the vehicle that delivered the coscripts.

If at least one conscript had an elevated body temperature (above 37.0 C), the entire group delivered in one vehicle was not allowed to undergo further medical examination. They were sent back to their place of residence for examination and inpatient or outpatient treatment. After thermometry, the medical examination was performed by a general practitioner.

It should be noted that every two hours the recruits changed their personal protective equipment at the assembly point.

To ensure epidemiological safety, all the premises of the assembly point were equipped with special equipment for air disinfection. A sufficient air exchanges as provided through mechanical ventilation. In addition, the rooms were regularly moist cleaned with disinfectants.

Every case of acute respiratory viral infection with a body temperature above 37.0 C and one or more of the following symptoms was considered suspicious for COVID-19

- cry cough or cough with scanty sputum;
- dyspnea at rest;
- feeling of tightness in the chest;
- pain in the throat when swallowing;
- runny nose and other catarrhal symptoms;
- weakness;
- headache;
- anosmia;
- diarrhea.

A probable case of COVID-19 was considered to be every case of acute respiratory infections with the specified symptoms if at least one of the following epidemiological signs was present:

[1] SanPiN 2.1.3.2630-10. Sanitary and Epidemiological Requirements for Organizations Engaged in Medical Activities. (In Russ.).

- returning from a foreign trip 14 days prior to the onset of symptoms;

- presence in the last 14 days of a close contact with a person under COVID-19 observation who subsequently became ill;

- close contact in the last 14 days with a person who has been laboratory confirmed to have COVID-19;

- working with individuals who have had a suspected or confirmed diagnosis of COVID-19.

The therapist distinguished the following streams when making medical triage:

- The first stream — individuals who had symptoms of an infectious disease, a suspected or probable case of COVID-19, as well as individuals who had contact with them at the time of delivery to the collection point. All persons of this flow were returned for further observation and, if necessary, treatment at their place of permanent residence.

- The second flow was the rest of the conscripts, who were sent to the next stage: laboratory examination with the subsequent interpretation of the results. For this purpose we used an unscreened immunochromatographic test system designed to detect IgG/IgM SARS-CoV-2 antibodies. The study was conducted on the collection site in a temporarily deployed immunological laboratory. The laboratory was equipped at the expense of the Orenburg Regional Clinical Hospital. The laboratory equipment met all the necessary requirements for qualitative immunochromatographic studies. The laboratory was staffed with a doctor and a nurse.

Depending on the results of the study, the general practitioner distinguished the following groups of the second stream.

The first group consisted of individuals who had no suspected or probable case of COVID-19 but had positive immunochromatographic test results for IgM or — simultaneously — for IgG and IgM, as well as individuals who came into contact with them when brought to the collection point.

The second group were persons who had no suspected or probable case of COVID-19, with positive IgG or negative immunochromatographic test results.

The routing of citizens of the first flow and the first group of the second flow was carried out according to a scheme that provided for their return to the municipalities of their place of residence.

Individuals of the second group of the second flow were sent for a control medical examination, which was conducted by medical specialists: a surgeon, a therapist, a neurologist, a psychiatrist, an ophthalmologist, an otorhinolaryngologist, a dermatologist, and a dentist.

After successful completion of the control medical examination, conscripts were enrolled in military teams with subsequent referrals to the place of military service.

A total of 5,789 citizens were called up for military service in 2020 by municipal conscription commissions, of whom 3,984 were sent to the troops. A total of 1,805 people were not sent to the troops as failing to pass the barrier barriers, including 117 people who were returned from the collection point.

Conclusion

1. The results of a study of the organization of COVID-19 examination of conscripts in the Orenburg region showed that sufficient and effective barrier medical examination was organized at all stages of the examination.

2. Conscripts in a good health condition were sent to the Armed Forces for military service.

3. No complaints were received from military units about poor quality screening of conscripts.

4. In 2020, during the COVID-19 pandemic, the Orenburg Region's conscription boards successfully accomplished their task of calling up citizens for military service.

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Original article

PECULIARITIES OF RESPIRATORY SUPPORT IN PATIENTS WITH SEVERE PATHOLOGY DURING AIR AMBULANCE EVACUATION

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Abstract. *The aim of the study* is to identify and to analyze the features of respiratory support in patients with severe acute respiratory failure when performing air ambulance evacuation by light class helicopters by specialists of aeromedical teams.
Materials and methods. We used materials containing data on the frequency and peculiarities of ventilator usage and tracheal intubation during emergency medical care for patients with acute respiratory failure over the last 5 years (2016-2020). During this period emergency medical care was provided to 53579 patients, 298 of whom were in extremely severe and serious condition requiring ventilator usage and tracheal intubation.
The following methods were used in the study: historical, statistical, analytical.
Results of the study and their analysis. Trauma prevailed among nosological forms in patients with acute respiratory failure. Artificial lung ventilation with tracheal intubation should be started before the patient is transported to the helicopter cabin.
During air ambulance evacuation of patients with acute respiratory failure by helicopter of light class, doctors should take differentiated approach to the choice of type and mode of respiratory support and of method of airway patency assurance.

Key words: *acute respiratory failure syndrome, air ambulance evacuation, artificial lung ventilation, aviation medical teams, patients with severe pathology, respiratory support, tracheal intubation*

Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

ОСОБЕННОСТИ ВЫПОЛНЕНИЯ РЕСПИРАТОРНОЙ ПОДДЕРЖКИ У ПАЦИЕНТОВ С ТЯЖЕЛОЙ ПАТОЛОГИЕЙ ВО ВРЕМЯ ПРОВЕДЕНИЯ САНИТАРНО-АВИАЦИОННОЙ ЭВАКУАЦИИ

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Резюме. *Цель исследования* – выявление и анализ особенностей выполнения специалистами авиамедицинских бригад (АМБр) респираторной поддержки у пациентов с тяжелой формой острой дыхательной недостаточности (ОДН) во время проведения санитарно-авиационной эвакуации вертолетами легкого класса.
Материалы и методы исследования. В работе использованы материалы, содержащие данные о частоте и особенностях выполнения искусственной вентиляции легких (ИВЛ) и интубации трахеи при оказании экстренной медицинской помощи (ЭМП) пациентам с тяжелой формой ОДН за последние 5 лет (2016–2020). За этот период ЭМП была оказана 53579 пациентам, из которых 298 находились в крайне тяжелом и тяжелом состоянии, потребовавшем выполнения ИВЛ и интубации трахеи.
При выполнении исследования применялись следующие методы: исторический, статистический, аналитический.
Результаты исследования и их анализ. Анализ результатов исследования позволил сделать следующие выводы:
1. У пациентов с острой дыхательной недостаточностью среди нозологических форм преобладает травма.
2. Искусственную вентиляцию легких с интубацией трахеи необходимо начинать до транспортировки пациента в салон вертолета.
3. Во время проведения санитарно-авиационной эвакуации пациентов с острой дыхательной недостаточностью на вертолете легкого класса врачи АМБр должны дифференцированно подходить к выбору вида и режима респираторной поддержки и способа обеспечения проходимости дыхательных путей.

Ключевые слова: *авиамедицинские бригады, интубация трахеи, искусственная вентиляция легких, пациенты с тяжелой патологией, респираторная поддержка, санитарно-авиационная эвакуация, синдром острой дыхательной недостаточности*

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Introduction

In acute respiratory failure the respiratory support in prehospital period is an important issue [1, 2]. It is due to the fact that patients with acute respiratory failure often apply for emergency medical aid. Also, there are some peculiarities characteristic for this syndrome — rapid increase in severity of the condition, requiring a comprehensive intensive care including respiratory support [3-5].

The experience, presented in works of several authors, shows that in severe forms of acute respiratory failure artificial lung ventilation with tracheal intubation is an indispensable element of treatment [6, 7].

There is still an opinion that tracheal intubation is a "gold standard" allowing to provide recovery and patency of airways. The effectiveness of tracheal intubation in comparison with other methods of ensuring airway patency in terms of prevention of aspiration complications and dislocation of airway tube is particularly noteworthy. Also tracheal intubation provides an opportunity to optimize respiratory support and to use instrumental methods of diagnosis and treatment in the hospital period (sanation bronchoscopy) [8, 9].

At the same time there is a point of view according to which tracheal intubation is not always safe and not always feasible. The dependence of this technique efficiency on the level of professional training has been noted [10, 11].

An important role in providing emergency medical care to patients with acute respiratory failure is played by medical professionals in the prehospital period. The decisions they make, the promptness of the actions of emergency medical team personnel, and the rapidity of medical evacuation affect not only the patient's condition, but also his/her prognosis [12-14].

Air ambulance evacuation in emergency situations, including rapid delivery of medical workers to the scene of the event and medical evacuation of the injured, testify to the advantage of air ambulance helicopters over other vehicles [15-18].

The long-term experience of aviation medical teams of the Moscow Scientific and Practical Center for Emergency Medical Care shows that in megapolis conditions, in particular in emergency situations, in congested highways and complicated traffic, the use of an air ambulance helicopter staffed by qualified medical specialists and equipped with modern medical equipment allows successful emergency evacuation of the injured [19, 20].

In the light-class air ambulance helicopter cabin, performing intubation is an extremely difficult task. At the same time, performance of artificial lung ventilation with tracheal intubation is a life-saving manipulation, which cannot be postponed.

As A.L. Ershov and other authors fairly mention in their works, in prehospital period when performing tracheal intubation, there is a high probability of making a mistake and of encountering difficulties. These authors also emphasize that it is not always possible to comply with the standards of tracheal intubation in prehospital period in contrast to the hospital period [4, 7, 10, 15]. Difficulties of performing respiratory support in emergency victims and patients with severe acute respiratory failure prompted this study to explore the possibilities of improving the effectiveness of emergency medical care and of immediate evacuation of patients with severe pathology by light-class ambulance helicopter.

The aim of the study was to reveal and to analyze the peculiarities of respiratory support in the patients with severe acute respiratory failure when performing air ambulance evacuation by light class helicopters.

Materials and methods of the study. The data on the frequency and peculiarities of artificial lung ventilation and tracheal intubation during emergency medical care for patients with severe acute respiratory failure over the past 5 years (2016-2020) were used in this work. During this period of time, emergency medical care was provided to 53579 patients, of whom 298 were in extremely severe and severe condition that required artificial lung ventilation and tracheal intubation.

The following methods were used: historical, statistical, analytical.

Results of the study and their analysis. Data on the severity of patients and victims in emergency situations during the last 5 years (2016-2020) are presented in Table 1.

Observing the data in Table 1 we can see that the proportion of patients who were in extremely severe and serious condition was on average 9.1%, the proportion of patients on artificial lung ventilation was 0.5%.

Frequency of artificial lung ventilation by the Emergency Medical Center and ambulance teams is presented in Table 2.

Таблица 1 / Table No. 1

Структура контингента больных и пострадавших в ЧС по степени тяжести состояния в 2016–2020 гг., чел./%

Structure of the contingent of patients and victims of emergencies by severity 2016-2020, people/%

Степень тяжести состояния / Severity	2016	2017	2018	2019	2020	Итого
Крайне тяжелое на ИВЛ / Extremely severe on ventilator	27/0,3	34/0,3	28/0,2	42/0,4	45/0,4	176/0,3
Тяжелое на ИВЛ / Severe on ventilator	14/0,1	19/0,2	23/0,2	33/0,3	33/0,2	122/0,2
Всего на ИВЛ / Total on ventilator	**41/0,4**	53/**0,5**	**51/0,4**	**75/0,7**	**78/0,6**	**298/0,5**
Крайне тяжелое / Extremely severe	61/0,7	36/0,4	37/0,3	89/0,9	54/0,5	277/0,5
Тяжелое / Severe	595/6,7	684/6,9	754/6,0	1223/12,5	1068/8,5	4324/8,1
Всего в крайне тяжелом и тяжелом состоянии / Total, in extremely severe and severe condition.	**656/7,4**	720/**7,3**	**791/6,3**	**1312/13,4**	**1122/9,0**	**4601/8,6**
Всего, в т.ч. на ИВЛ / Total, including on ventilator	**697/7,8**	**773/7,8**	**842/6,7**	**1387/14,1**	**1200/9,6**	**4899/9,1**

From Table 2 it follows that in 85.6% of cases medical evacuation of ventilated patients was performed by emergency medical center teams, including 47.0% of cases — by air ambulance teams.

Of 140 cases of ventilator-assisted ambulance evacuations, 33 cases involved interhospital evacuations and 107 cases were flights to a primary call to an emergency victim or patient.

The structure of diseases and injuries in patients who were ventilated during air ambulance evacuations in 2016-2020 is shown in the figure.

The figure shows that the most frequently — on average, in 51% of cases — artificial lung ventilation was performed in patients with trauma (polytrauma, combined trauma).

A much smaller proportion (12% on average) were patients with acute cerebral circulation disorder.

Compared to 2016-2019, the proportion of patients with pneumonia increased in 2020, averaging 13% of the total number of patients who were ventilated.

The aeromedical teams consisted of physicians trained in anesthesiology and resuscitation and of a paramedic.

All air medical teams were equipped with one of the following artificial lung ventilation devices: Medumat Standard A, Medumat Transport (Weinmann Emergency, Germany); Oxylog 2000, Oxylog 3000+ (Draeger, Germany); Rulmonetic LTV-1200 (Sage Fusion, USA); Ambu bags for manual artificial lung ventilation. In one case, specialists of the aviation medical team used "Stephan 120 Mobil" apparatus, which allows invasive respiratory support for newborns with body weight <5 kg. The doctors had at their disposal the tools necessary to perform tracheal intubation and noninvasive artificial lung ventilation. The oxygen supply in 2 and 5 L cylinders was sufficient for respiratory support.

The type and mode of respiratory support was chosen depending on the severity of the patient's condition, taking into account: degree of consciousness impairment, severity of respiratory failure, tendency to deterioration and nosological unit that caused the development of critical condition.

One of the peculiarities of respiratory support in the practice of helicopter aviation medical teams is more stringent requirements for the choice of respiratory support and the method of providing patency of upper airways, than in case of transportation by ambulance or by fixed wing air ambulance. This is due to the fact that the space in the helicopter cabin is limited, making it difficult to perform such manipulations as tracheal intubation, pleural puncture, venous catheterization, and also making it impossible to stop en route to perform additional manipulations. When preparing patients for transportation the doctors of helicopter aviation medical teams have to follow more aggressive tactics in comparison with the doctors of "ground" teams, including anesthesiology-resuscitation teams, or doctors of "big" sanitary aviation, and often in comparison with the doctors of intensive care units of hospitals.

Thus, patients with depression of consciousness to the level of soporus or deeper (12 points or less on the Glasgow coma scale), as a rule, were transferred to artificial lung ventilation using sedation, analgesia, myorelaxation and tracheal intubation before transportation: in the hospital calling the air medical team to transfer the patient to the specialized hospital; in the cabin of the ambulance team car; immediately after the patient arrived on board the helicopter (before starting the engines); sometimes — at the scene of the event. We follow the same tactics when providing emergency medical care to patients and victims with unstable hemodynamics, severe acute respiratory failure and immediate threat of circulatory arrest. Even if at the time of the initial examination by the aviation medical team the patients are clearly conscious and external respiratory function seems to be adequate.

In those cases where emergency team or in-patient clinics provided adequate upper airway patency and pulmonary ventilation prior to the arrival of the air medical brigade, there was usually no need for endotracheal tube

Таблица 2 / Table 2

Частота проведения медицинской эвакуации пациентов на ИВЛ бригадами ЦЭМП и СМП в 2016-2020 гг., чел./%

Frequency of medical evacuation of patients on ventilator by emergency medical care center and ambulance teams in 2016-2020, people

Бригады, проводившие медицинскую эвакуацию Teams that performed medical evacuations	2016	2017	2018	2019	2020	Итого / Total
Авиамедицинские бригады / Air medical teams	29/70,7	26/49,0	28/54,9	42/48,0	21/26,9	140/47,0
Бригады ЦЭМП / Emergency medical care center teams	7/17,1	18/34,0	20/39,2	20/32,0	46/59,0	115/38,6
Бригады СМП / Ambulance teams	5/12,2	9/17,0	3/5,9	13/20,0	11/14,1	43/14,4
Всего / Total	41/100,0	53/100,0	51/100,0	75/100,0	78/100,0	298/100,0

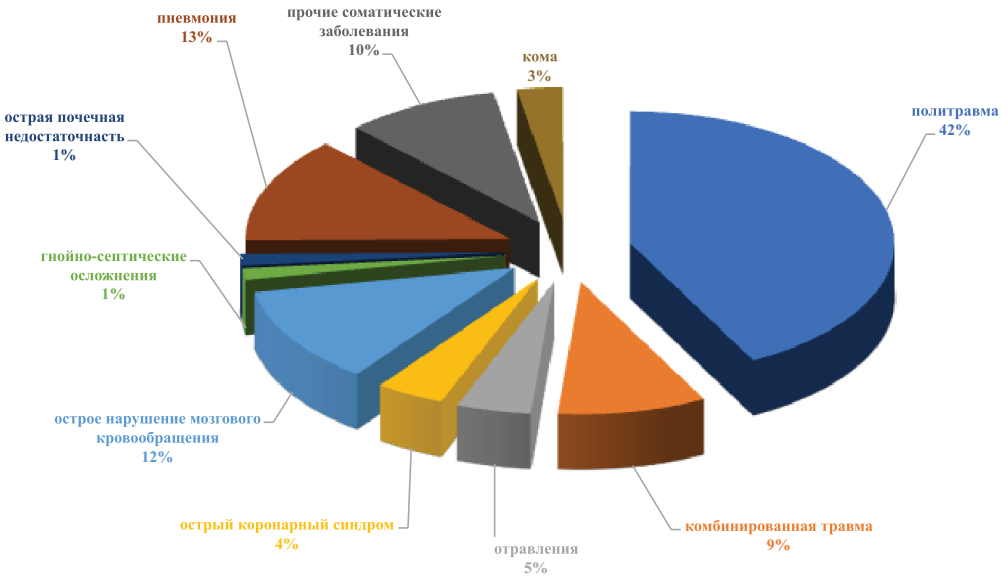

Рисунок. Доля пациентов с указанной патологией в общем числе больных и пострадавших, находившихся на ИВЛ во время проведения санитарно-авиационной эвакуации авиамедицинскими бригадами ЦЭМП, %
Figure. Proportion of patients with the above pathology in the total number of patients who were on ventilation during air ambulance evacuation by air medical teams of the Center for Emergency Medical Care, %

replacement. The exceptions were cases of increasing upper airway obstruction, for example, in thermoinhalation trauma, when the emergency team specialist used methods of providing upper airway patency that did not protect the subclavian space — esophagolaryngeal tube, Combi Tube type airway, S-airway.

In cardiac pathology preference is given to noninvasive artificial lung ventilation in CPAP mode (continuous positive airway pressure) with the use of hermetically fitting face mask. It allows, firstly, to save the verbal contact with the patient; secondly, to reduce the traumatic nature of respiratory support, which can cause such complications as fatal disorders of heart rhythm and conduction, accompanied by a critical fall in hemodynamics — ventricular fibrillation, paroxysmal ventricular tachycardia without pulse, complete transverse AV-blockade, etc, in patients with cardiac profile (for example, in acute coronary syndrome).

In invasive artificial ventilation, orotracheal intubation was preferred. Through endotracheal tube placed nasotracheally or tracheostomy, we performed artificial lung ventilation during interhospital transfers (continuous artificial lung ventilation), and conicotomy — on site when it was impossible to provide upper airway patency by other means. Esophagolaryngeal tubes and Combi Tube were used by specialists of aviation medical teams while performing cardiopulmonary resuscitation and medical care in difficult conditions at the scene of an emergency.

When choosing a mode of artificial lung ventilation we usually give preference to modes with preservation of spontaneous breathing elements as they are more physiological (SIMV, P-SIMV). And only when it is impossible to achieve adequate ventilation by these methods and there is a need for myoplegia (uncompensated seizure syndrome, high oxygen cost of breathing in acute pulmonary heart failure) or administration of muscle relaxants before tracheal intubation we used regimens of forced artificial lung ventilation without preservation of spontaneous breathing elements.

In some patients who were clinically dead and required cardiopulmonary resuscitation, respiratory support was provided by Ambu bag.

Machine assisted lung ventilation was performed in these patients after cardiac recovery. In 13 patients in whom resuscitation measures were ineffective (9% of the total sample), artificial lung ventilation was performed exclusively with Ambu bag, in the remaining cases artificial lung ventilation was used.

In all cases artificial lung ventilation was preceded by tracheal intubation.

Out of 141 patients in the analyzed group, 117 were delivered to the hospital, in 24 of them death was registered in the presence of the team. The total mean duration of artificial lung ventilation performed by emergency team specialists was (61±35.9) minutes. When 24 patients in whom artificial lung ventilation was performed as part of cardiopulmonary resuscitation were excluded from this sample, the average duration of artificial lung ventilation increased to (85±19.7) min — this is the time from tracheal intubation to transfer of the patient to the hospital.

Conclusion

1. In patients with acute respiratory failure, trauma prevailed among nosological forms.

2. Artificial ventilation with tracheal intubation should be started before the patient is transported to the helicopter cabin.

3. During air ambulance evacuation of patients with acute respiratory failure by light class helicopter, doctors of aviation medical teams should differentiate the choice of type and mode of respiratory support and method of ensuring airway patency.

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