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The authors declare that they have no conflicts of interest

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INTENSIVE CARE SERVICE OPTIMIZATION FOR COVID-19 PANDEMIC IN ALMATY CITY

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Abstract

Since the beginning of the spread of coronavirus infection in the world, the number of infected has exceeded 102.5 million people, and more than 2.2 million people have died. In Kazakhstan, according to the world statistics of COVID-19, the 59th place in the number of detected cases of COVID-19 and the 68th place in deaths from coronavirus was noted. The vast majority of patients with COVID-19 have a mild or moderate illness, but 5% of those with a critical course of the disease require treatment in an intensive care unit. The length of stay in the intensive care unit averages 10.8 days, however, in 22.7% of patients, the duration of treatment in the ICU exceeds 30 days. In order to improve treatment outcomes, many clinics use a team work methodology that requires a sufficient number of highly qualified medical personnel. However, due to the shortage of personnel in intensive care units, measures are being taken to retrain medical personnel of other specialties. At the same time, short training courses do not always improve the results of treatment in a high quality and lead to a deterioration in the results of most patients.

Алматы қаласында COVID-19 пандемия жағдайында қарқынды емдеуді оңтайландыру

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Түйінді сөздер:
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Аңдатпа

Коронавирустық инфекция таралғаннан бастап,осы уақытқа дейін әлем бойынша инфекция жұқтырғандар саны 102,5 млн адамнан асты және2,2млн адам қайтыс болды. Дүниежүзілік статистикаға сәйкес Қазақстан COVID-19 инфекциясының анықталу жағдайы бойынша 59-орында және қайтыс болған науқастар саны бойынша 68-орында тұр. COVID-19-ды жұқтырған науқастардың басым бөлігінде ауру жеңіл немесе орташа ауыр түрінде өтеді, ал 5% науқастарда инфекция аса ауыр ағымда өтеді және бұл науқастар қарқынды терапия бөлімшесі жағдайында ем алуды қажет етеді. Науқастардың қарқынды терапия бөлімшесінде болуұзақтығы орташа есеппен 10,8 күнді құрайды. Дегенмен 22,7% науқастардың қарқынды терапия бөлімшесінде ем қабылдау ұзақтығы 30 немесе одан көп күнді құрайды. Көптеген клиникаларда емнің нәтижесін жақсарту мақсатында командалық жұмыс тәсілін қолданадыБұл тәсілмен жұмыс атқару жоғары білікті мамандар санының жеткілікті болуын қажет етеді. Дегенмен, реанимация бөлімшесінде кадр тапшылығына байланысты, өзге мамандықтағы медициналық қызметкерлерді қайта даярлау шаралары атқарылады Қысқа дайындық курстары, әдетте,реанимациялық көмектің сапасын жақсартпайды және емдеу нәтижесінің нашарлауына әкеліп соқтырады.

Оптимизация интенсивной терапии в условиях пандемии COVID-19 в городе Алматы

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COVID-19 пандемия, организация службы интенсивной терапии

Аннотация

С момента начала распространения коронавирусной инфекции в мире, число зараженных превысило 102,5 млн человек, и более 2,2 млн человек умерли. В Казахстане, согласно мировой статистике COVID-19, отмечено 59-е место по числу выявленных случаев COVID-19 и 68-е место по смертности от коронавируса. У значительного большинства пациентов, болеющих COVID-19, заболевание протекает в легкой или средней форме, однако, у 5% при критическом течении заболевания, необходимо лечение в отделении интенсивной терапии. Продолжительность пребывания в отделении интенсивной терапии составляет в среднем 10,8 дня, однако у 22,7% пациентов продолжительность лечения в ОИТ превышает 30 дней. В целях улучшения результатов лечения, многие клиники используют методику бригадной работы, требующей достаточного числа высококвалифицированного медицинского персонала. Однако, в связи с нехваткой кадров в отделениях реанимации, принимаются меры по переподготовке медицинского персонала других специальностей. При этом, короткие курсы подготовки не всегда высококачественно улучшают результаты лечения и приводят к ухудшению результата большинства пациентов..

Background

In late December 2019, an unusual outbreak of pneumonia characterized by fever, dry cough and wasting, as well as gastrointestinal symptoms in some patients, was recorded at the South China Seafood Wholesale Market in Wuhan, Hubei province, China. The outbreak affected approximately 66% of the seafood market staff; the market was closed on January1, 2020, after an epidemiological alert was issued by the local health laboratory on December 31, 2019. However, the following month (January), thousands of people were involved in an unusual pneumonia outbreak in China, including many provinces (e.g., Hubei, Zhejiang, Guangdong, Henan, andHunan) and cities (Beijing and Shanghai). It has also spread rapidly to other countries such as Thailand, Japan, the Republic of Korea, Vietnam, Germany, the US and Singapore. The first case of the disease was recorded in Kazakhstan on March 20, 2020.

As of February 6, 2020, WHO recorded a total of 28,276 confirmed cases and 565 deaths in at least 25 countries worldwide. It was later confirmed to be a new strain of beta coronavirus, called the 2019 novel coronavirus, similar to the severe acute respiratory syndrome outbreak 17 years ago(SARS 2003 was caused by a different beta coronavirus).

The causative agent of the novel coronavirus infection is thought to be combination of the bat coronavirus, but its origin is apparently unknown; it was named SARS-CoV-2 by the International Committee on Virus Classification on February 11, 2020. At the same time, the World Health Organization (WHO) decided in 2019 that the official name of the novel corona virus infection would be Coronavirus Infections (COVID-19). Given the widespread and rapid spread of SARS-CoV-2, the WHO announced on11 March 2020 that aCOVID-19 pandemic had begun.

Many of the efforts being made to prepare for the pandemic will help buy time to strengthen the health system and improve the efficiency of infrastructure but will do little to optimize the most essential component of health care: medical and support staff in intensive care units.

Trained multidisciplinary specialists (intensivists) are needed to deliver healthcare to critically ill patients. These specialists should be able to control all problems associated with complex diseases and comorbidities or worsening conditions [1].

From open news sources, we know that in order to reduce the load in the intensive care unit and protect staff from infection, each hospital creates separate teams for various routine but dangerous operations under coronavirus infection: tracheal intubation teams, cardiopulmonary resuscitation teams [2, 3], consultation teams a team for intra-hospital transportation of critically ill patients, a team of physiotherapists, etc. At the same time, the composition and appointment of such teams is determined by each individual clinic. For example, in some Chinese hospitals, the tracheal intubation and resuscitation teams include from 4 to18 specialists each.

Such an approach requires a large number of dedicated and well-trained staff. There is also a debate about the appropriateness of such teams, believing that a well-equipped specialized kit for intubation and a ‘point’ for resuscitation would greatly reduce the need for such a team [4].

Tele consultation centers are mostly organized by medical faculties or universities. These centers include specialists from different disciplines such as intensive care, respiratory, hematology, neurology, nephrology and epidemiology. The aims of these centers often include the development of recommendations and guidelines as well as consultative support

[2]. These centers do not provide practicalhelp.

In many developed countries, health systems are largely private and business-oriented and there is no unified approach to management. For example, in the USA, where the health system is highly decentralized, the lack of a single central authority to manage and organize health services has been analyzed as a major disadvantage. On the other hand, the federal government lacks sufficient authority to make such decisions and attempts to centralize the health system on a voluntary basis are often subject to criticism and misunderstanding [5].

In the face of an acute shortage of human resources, many national health authorities have made some attempts to train health professionals from other specialties, such as doctors and nurses, to work in intensive care units. Short-term, superficial courses aim to quickly train the maximum number of intensivists. This, as a rule, leads to a decrease in the quality of intensive care provided and consequently does not decrease morbidity and mortality.

All the above activities are usually decentralized and can only be implemented in specific clinics. This makes it difficult to assess the resources of intensive care units across a city, region or even a country.

In the aspect of the shortage of medical personnel in intensive care units, in order to concentrate information on the available resources and the condition of patients of each medical institution, in our opinion, the most effective will be creation of mobile multi-functional intensive care teams. These teams include well-trained intensive care doctors who can provide coordination, methodological, advisory and practical assistance in every intensive care unit, while covering all clinics of a region. For they can concentrate and analyze information about the technical, medical, and human resources of each intensive care unit and collect information about the condition and dynamics of patients' state in these departments.

Such teams have great potential for providing the listed types of assistance in a timely manner to optimize the therapeutic, diagnostic, and anti-epidemic processes in intensive care units.

In the context of the COVID-19 pandemic, the WHO has set the following tasks for health systems:1) slow down and stop the transmission of the virus; 2) ensure optimal care for all patients; 3) minimize the negative impact of the epidemic on health systems, social services, and economic activity.

To solve these problems, to ensure a timely increase in the volume of clinical and sanitary-epidemiological measures, the WHO document "Practical aspects of the organization of COVID-19 case management in medical institutions and at home" was prepared with a description of the key actions to be taken in each of the following transmission scenarios: absence of cases; sporadic cases; clusters of cases; spread of the virus among the population.

While most COVID-19 patients have mild (40%) or moderate (40%) severity disease, about 15% develop severe disease requiring oxygen support, and 5% have extremely severe disease (critical) with complications such as respiratory failure, acute respiratory distress syndrome, sepsis, septic shock, thromboembolism and/or multiple organ failure, including acute kidney and heart damage [6]. Advanced age, smoking [7, 8], and comorbidities such as diabetes, arterial hypertension, ischemic heart disease, chronic lung disease, and cancer have been reported as risk factors for the development of severe illness and death. The results of multivariate analysis confirmed that advanced age, a high score by SOFA scale assessment, and D-dimer> 1 μg /Lare also risk factors.

The mortality rate of patients in intensive care units may be as high as 40-61%. In some regions it may reach up to 90%, despite the use of high-tech methods of intensive therapy [9, 10, 11].

In addition, providing of intensive care in some clinics was quite problematic due to the lack of resources because of very large number of severe patients.

While COVID-19 has spread globally, the burden on healthcare system is not homogenous. Several regions in Italy that have experienced rapid spread of the virus reported lack of resources in the healthcare system, which appears to have contributed to the high mortality rate [10]. At the same time, clinics in Canada located in regions with a smaller number of infected people reported a mortality rate of resuscitation patients of about 15% [12].

The first reports on patients' profile came from the China Center for Disease Control and Prevention: that of the more than 44,000 confirmed cases of COVID-19, about 81% were asymptomatic or had mild symptoms such as cough, fever, fatigue and myalgia. Although home treatment and self-isolation are appropriate measures for these cases, 14% developed severe disease and 5% developed critical illness requiring ICU hospitalization. Patients with severe COVID-19 typically have a respiratory rate ≥ 30 breaths per minute, oxygen saturation ≤ 93%, and lung infiltrates> 50%, and are at high risk of clinical deterioration and critical illness, including acute respiratory distress syndrome. Hospitalization should be mandatory for patients who develop severe symptoms; however, ICU space should be occupied by patients with the most severe forms, depending on the capacity of the health care system.

Despite differences in culture and practice

around the world, most centers report that about 25% of hospitalized patients require transfer to an ICU [13].

Patients with severe disease should be closely monitored as rapid progression from moderate to severe ARDS can occur.

Acute hypoxic respiratory failure is the most frequent complication occurring in 60–70% of patients admitted to the ICU. Patients at high risk of developing ARDS are people over 65 years of age with high fever (T> 39ºC), neutrophilia, lymphocytopenia, elevated markers of liver and kidney failure (aspartate aminotransferase, alanine aminotransferase, creatinine, and urea), elevated acute phase proteins such as inflammatory markers (highly sensitive C-reactive protein, procalcitonin and serum ferritin) and increased values associated with clotting function (prothrombin time, fibrinogen, and D-dimer).

The main criteria for transfer to ICU include high oxygen demand equal to or exceeding 6–8 L / min to achieve peripheral oxygen saturation ≥90–92%, respiratory failure, shock, acute organ dysfunction, and patients at high risk of clinical deterioration. However, in many countries, due to a shortage of beds in intensive care units, it has generally been the case that only patients requiring intubation and invasive mechanical ventilation have been admitted to the intensive care unit.

In China, Italy and the United States, 70-90% of patients admitted to the intensive care unit required invasive ventilation on the very first day. 65,9% of patients required vasopressor and inotropic support. Acute renal failure was observed in 27,1% of patients admitted to the ICU. At the same time, the average length of stay of patients in the ICU was 10,8 days. Ay 22,7% the duration of treatment in the ICU was 30 days or more.

The COVID-19 pandemic requires more resources, the replenishment of intensive care teams with new staff, a reorganization of the department and a change in protocol. All this can lead to vulnerability and loss of control over all professionals. In many cases, intensives must make their choices based on local politics, structural resources and team ability [14].

Faced with serious challenges in providing medical care to patients with COVID-19, many hospitals around the world have identified the main problems: insufficient number of beds in medical institutions; insufficient number of beds in intensive care units; insufficient number of intensive care doctors; insufficient number of nurses in intensive care and intensive care units; insufficient number of artificial lung ventilation devices.

The pronounced shortage of both medical and non-medical personnel limits the real possibilities of medical institutions.

The surge in demand for health care is adding to the pressure on inpatient unit capacity, affecting the intensive care sector the most.

Rapidly changing conditions necessitate constant professional development of personnel, as well as frequent and accurate information update.

Most countries, along with the organization of logistics activities to equip and provide hospitals with medicines, personal protective equipment, medical equipment, increase the hospital bed capacity, attract additional medical personnel, and create counseling centers. At the state level, programs for additional financing, training, and attracting specialists are being developed, new clinics are being built.

The governments of many countries has taken several measures to organize, optimize and improve the health sector during the pandemic [15].

One of the most important factors contributing to the successful recovery of patients is the team model of care. This model of care has been used in many departments for many years, most often in emergency departments. This model includes three important factors: 1) completion of the nursing assignment; 2) related equipment and medical supplies; and 3) infection control.

As Coronavirus Disease 2019 (COVID-19) spread, it became apparent in many countries that there were not enough beds, ventilators, or personnel in intensive care units to accommodate patients. Many clinics have stopped planned hospitalizations by 100% or almost 100%. In the United States, many cities have brought together specialists in real time to form a multi-disciplinary team of leaders, including hospital administrators, doctors, nurses, intensive care specialists, and healthcare experts. The first goal was to define the minimum physical space, equipment and personnel needed to provide care to ventilated patients in crisis settings, and then to develop new coordinated staffing models that could be adapted for both large academic health centers and small ones, as well as regional hospitals. Following the establishment of system-wide standards, similar integrated steering groups were created at each clinic and met daily for the next two and a half months in spring 2020 to coordinate the opening (and then closing) of the units and directly oversee staffing.

At the peak of morbidity, many clinics were operating at ~ 250% of their pre-crisis capacity. The knowledge and skills of intensive care physicians and intensive care nurses are essential to ensure optimal treatment and care. Specialists in intensive care units, moreover, specialists trained in internal medicine were also lacking to meet the standards of personnel in

intensive care. It was also clear that, in contrast to patients usually admitted to intensive care units, COVID-19 patients had relatively uniform initial manifestations. Therefore, US clinics have shared the traditional roles and titles of doctors, nurses and created de novo teams. Some of the clinic staff have been certified as service personnel. Some of those present worked as trainees. Nurses, physiotherapists, perfusionists, and other healthcare professionals have made some of the tasks of intensive care nurses easier. Likewise, doctors and nursing staff from other departments assisted with some of the nursing tasks.

In Italy, the number of patients quickly became so large that the number of beds in intensive care units began to run out, causing chaos in both the medical community and the population [16]. On the other hand, one of the measures aimed at mitigating the situation was the creation of field hospitals, as well as the relocation of intensive care units specialized in certain conditions to treat patients with complications of COVID-19, as was the case with Bergamo. The cardiology department, where 60% of beds were occupied by patients positive for COVID-19 [17], in addition, pediatric hospitals with intensive care units were used for adults [18].

Despite this, the level of workload remained extremely high in the teams working on the front lines. These teams include intensive care physicians, nurses and physical therapists. Stress reactions in ICU staff were defined as organic, mental and social reactions to harmful stimuli experienced by a person [19].

It takes most nurses years to become clinically competent in caring for patients in intensive care units.

Thus, to provide quality care to critical patients with COVID-19, healthcare organizations will have to expand the several intensive care nurses they already have at their bedside.

One way to do this is to implement a model that has been used by nurses for decades: team staffing. Instead of assigning a small number of patients to a single nurse, managers assign a large group of patients to several staff members. The theory behind this approach is that the collective wisdom of a group provides better care for their assigned patients than a single nurse could do alone.

In the treatment of COVID-19, this approach has broadened the experience of a limited number of experienced intensive care nurses. These nurses, either experienced nurses or emergency nurses, lead the team. They are directly responsible for some very complex care activities but spend most of their time watching their team.

Most often in the USA, Italy, Spain, and other countries, where the number of patients exceeded the reserves of intensive care units, the following schemes were used: combination of an experienced ICU nurse with express trained nurses; combining intensive care staff with surgical staff for cross-training; appointment of paramedics as team leaders with nursing and support staff to work in the ICU.

The risk of the team model is that team members do not always have a clear understanding of what they are directly responsible for, leading to oversight or overlap in patient care and treatment. To create an effective model, you need to follow two guidelines below:

Clearly delineate team roles and responsibilities. The most important part of recruiting a team is clearly defining roles. There is no single answer to the question of what each team member should be responsible for - it depends on the composition of the team. However, to prevent missed or duplicate assistance, each team member needs to know exactly what caregiving actions they are responsible for and what their teammates will get.

As a starting point, ICU leaders should compile a list of COVID-19 treatment-related care activities. Basic nursing skills - initial assessment, basic intravenous administration - should be transferred to retrained nurses. Those critical care personnel should be subordinate to a team leader or be performed by cross-trained nurses under the supervision of a more experienced one.

An expert should be appointed and trained to delegate authority to team members. The choice of an employee as an expert will depend on the available staff of each organization. Emergency nurses and experienced critical care nurses are excellent leaders in COVID-19 teams. However, experienced operating theater nurses can also be considered as they have experience and competencies critical to the treatment of COVID-19 (specifically setting up and preparing ventilators).

Regardless of who the leader is, it is important to set clear limits on what they are responsible for and what they should delegate to other employees. Team leaders are likely to find it difficult to delegate authority, especially those with no formal leadership experience. Managers must actively support them in developing these skills. To do this, consider applying the following strategies: Train leaders to provide prompt feedback; another option is to develop and communicate a Feedback Guide to leaders.

Daily clinical rounds are a great opportunity to build report, review care plans, identify lacks, and re-delegate roles to team members. At the end of each shift, responsible persons ask employees about their work done. In addition to improving leadership skills, these tests can also serve as emotional support for all employees.

Colleagues from Europe, during the period of the influx of severe patients, have developed recommendations for increasing the capacity of intensive care units: When considering the possibility of increasing the areas of intensive care, it is necessary first of all to consider the possibility of using adjacent premises before opening remote ones; Maintain a normal nurse-to-patient ratio for as long as possible; A risk assessment should be carried out when considering the placement of personnel. This should be based on the individual experience and skills of staff [Royal College of Nursing UK.RCN guidance on redeployment - COVID-19]; The use of specialized ward staff as reinforcements in intensive care units must be carefully considered in accordance with the requirements of the intensive care unit. It must be admitted that at a time of an acute shortage of qualified specialists, during a pandemic all over the world, sometimes residents or young or inexperienced doctors were in place of doctors. For the treatment of seriously ill patients, volunteers or doctors who did not have special training in the field of intensive care were involved. All these were dictated by the circumstances when the crisis in the health care system was felt around the world, expressed in a lack of human and material resources.

A special role during the pandemic is played by nursing staff, whose acute shortage was also felt. Nurses are the link that directly brings to fulfillment all the treatment that the doctor prescribes. There is also a need to increase support staff to help nurses continue to deliver high-quality care.

During a pandemic, hospitals must establish an approved program to increase ICU staff who may be required to work beyond the usual minimum standards and guidelines [20]. This will require will and a non-standard approach in decision-making from the heads of health care institutions.

There is a need to provide an accelerated awareness program, timely education and retraining in the early stages of pandemic planning. In these conditions, it is possible to organize short-term improvement courses or even retraining of specialists: doctors and nurses. In case of emergency, we see it as expedient to use the labor of residents who have completed two years of study, who have mastered the most necessary knowledge and skills of conducting intensive therapy, under the supervision of doctors and mentors.

New staffing models have transformed ICU attendance into a supervisory function to disseminate the experience to 50 patients simultaneously and create new, non-traditional teams around them, with rapidly upgraded nurses and other staff [21], which is the subject of this research.

Thus, an analysis of the available literature indicates that, despite the availability of international experience, the problem of organizing medical care, especially intensive care, for patients with coronavirus infection remains open. Today, there are various models of a team approach in the provision of intensive care for patients with COVID-19 in hospitals. Although the work of teams with different functions in intensive care units is described, nevertheless, there are no examples of an integrated approach in the literature: providing both practical and advisory-methodological assistance in the treatment of patients with severe coronavirus pneumonia, covering all infectious hospitals of the whole metropolis.

All above and the experience gained in the work of intensive care doctors during the pandemic of the Republic of Kazakhstan, allowed us to identify three key lessons that helped our teams to succeed. We detail here the teams we created and the types of people who were able to fill each role. We discuss the lessons we have learned from implementation and our vision for the future intensive care unit in the hope that this can serve as a guideline for others should they face similar crises.

Materials and methods

We performed analysis of available world literature on optimization of intensive care services in countries with the highest number of cases of COVID-19. Review and analysis of scientific and available literature according to the Cochrane Library data, according to the PubMed, e-library, Web of Science and EMBASE databases, reference publications, special periodicals, monographs, scientific articles - 200 units.

The retrospective descriptive research also was carried out including government hospitals of the Almaty City, according to medical data received from the Almaty branch of the Republican Center for Electronic Health.

We assessed the work of the Center of Anesthesiology and Intensive Care, which coordinates the work of intensive care units of city hospitals. We performedthe analysis of intensive care indicators in patients with COVID-19 in Almaty Cityand demographic and medical data of patients were studied. A comparative analysis of the studied indicators was carried out before the start of the Center of Anesthesiology and Intensive Care and after the start of its work.

The study included 266 patients with COVID-19 who were in the departments of anesthesiology and resuscitation of the city of Almaty for the period from July 1 to August 31, 2020.

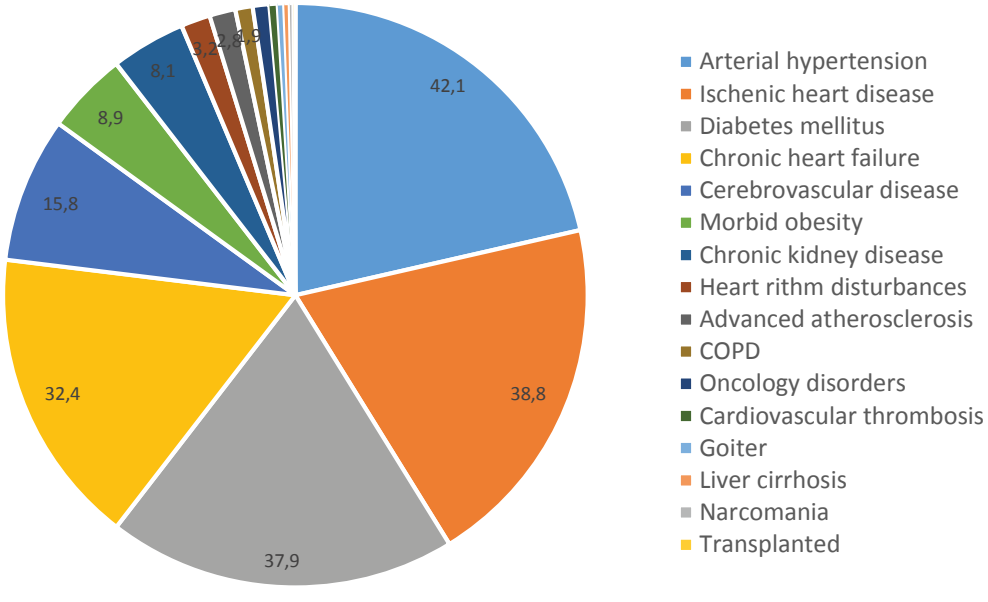
Results

Characteristics of patients in the intensive care units of infectious hospitals in the city. A daily analysis of the dynamics of the number

of severe patients in ICU and deaths in clinics providing medical care to patients with coronavirus infection was carried out.

The Figure 1 shows that most common comorbidities in intensive care unit patients were arterial hypertension, which accounted for 42.1% of all concomitant diseases. In second place, according to the prevalence of concomitant diseases in patients with covid pneumonia, patients with coronary artery disease 38.8%. They are followed by patients with concomitant CHF 32.4% and diabetes mellitus 37.9%, respectively. Then there are patients with cerebrovascular diseases with 15.8% and patients with chronic renal failure and cardiac arrhythmias, each of which accounted for 3.2%. Patients with cancer accounted for 1.8%. Patients with atherosclerosis and chronic obstructive pulmonary diseases accounted for 1.9% each. All other conditions: human immunodeficiency syndrome, obesity, thrombus formation, goiter, chronic anemia, conditions after organ transplantation, drug addiction and liver cirrhosis were less than 1% each.

Figure 1.
Comorbidity in patients in intensive care units



Study of the activities of the Center of Anesthesiology and Intensive care, which coordinates the work of the intensive care units of the city hospitals.

In the city of Almaty, to optimize intensive care for patients with severe forms of COVID-19, theCenter of Anesthesiology and Intensive Care was established. This Center consists of multi functional intensive care teams, including well-trained intensive care physicians, who simultaneously provide coordination, methodological, advisory, and practical assistance in the field - in intensive care units, covering all infectious diseases clinics in the city of Almaty. The legal basis for the functioning of the Center of Anesthesiology and Intensive Care was the order of the Public Health Department of Almaty.

Structure of the Center of Anesthesiology and Intensive Care: Head of the Center of Anesthesiology and Intensive Care- chief anesthesiologist of the Department of Healthcare of the Almaty city; Rapid-response Intensive careteams of the Center of Anesthesiology and Intensive Care; The head of the Rapid-response Intensive careteams which is a highly skilled intensivist, with medical science degree; Highly skilled intensivists - 4; Advisory and methodological group of the Center of Anesthesiology and Intensive Care; Highly experienced anesthesiologists and intensivists who areProfessors in the field of intensive care and anesthesiology.

We analyzed the activities of the Center of Anesthesiology and Intensive Carefor the month of July 2020. The Center of Anesthesiology and Intensive Carehas performed the following work: Familiarization and detour of infectious diseases clinics together with colleagues from Moscow. There are 14 hospitals in total (12 of them have 13 intensive care units + 2 hospitals of the ICU); Study of the personnel potential of intensive care units; Stratification of intensive care units according to echelons (1-3); A visit to the RGBR in infectious diseases hospitals is under way; Consultations of the RGBR are carried out in infectious diseases hospitals; If the need arises, the transfer of patients between infectious diseases hospitals of the city to provide treatment at a higher level; Participation in extended headquarters meetings – 12; Visits with practical and advisory assistance to city clinics – 249; Local consultations – 589; Concilium; Online (remotely) – 28; Onsite – 15;

Meetings of the Center for Anesthesiology and Intensive Care – 9.

The NEWS scale was used to assess the patient's condition.

The analysis showed that in the period from July 1 to August 31, 2020, 631 out of 4605 patients with COVID-19 viral infection were in the intensive care units of Almaty, which amounted to 13,7%.

The average age of patients was 64,3 (20-96) years, 337 men, 294 women. The average length of stay in the ICU was 3,7 days, the average length of stay in the clinic was 8.4 days. 98 patients survived; 168 patients died.

Table 1.
Indicators of patients with COVID-19

Index	Group I	Group II	p=
Total number of ICU patients	142	489	
Age (years)	64,8±12,1	65,1±14,5	0,54
Gender (M / F)	75/67	262/227	0,11
Daily number of ICU patients	35,9±3,6	43,9±1,9	<0,01
Duration of ICU stay (days)	1,38±2,9	4,21±4,3	<0,01
Length of hospital stay (days)	4,66±5,2	12,3±4,7	<0,01
Died (n)	108	257	<0,01
Length of stay in the ICU of the deceased (days)	0,83±1,4	2,31±2,4	<0,01
Mortalityin ICU (%)	76,1	52,6	<0,01

hus, all the studied indicators were divided into two groups: Group I — from July 1 to 14 and Group II — from July 15 to 31, 2020 (Table 1). The first group included data from 142 patients with COVID-19, the second group included data from 489 patients (Table 1). The groups did not differ in age. In both groups, men predominated: Group I – 52,8%, Group II –53,6%.

Patients of the first group were in the hospital for 4,66±5,2 (1-42) days, of which 1,38±2,9 (0-10) in the intensive care unit. The duration of stay in the hospital and the intensive care unit in patients of the second group was higher –12,3±4,7 (1-43) days in the hospital and 4,21±4,3 (0-13) days in intensive care. The average number of patients in the ICU during the day was 35,9±3,6 in the first group, 38,2±5,2 in the second group. The duration of stay in the intensive care unit for deceased patients was 0,83±1,4 days in the first group and 2,31±2,4 days in the second group.

When studying the duration of stay in the intensive care unit among deceased patients, it was found that the patients of the first group mostly died in the early stages, in the second group of patients only a third died on the first day (Figure 2).

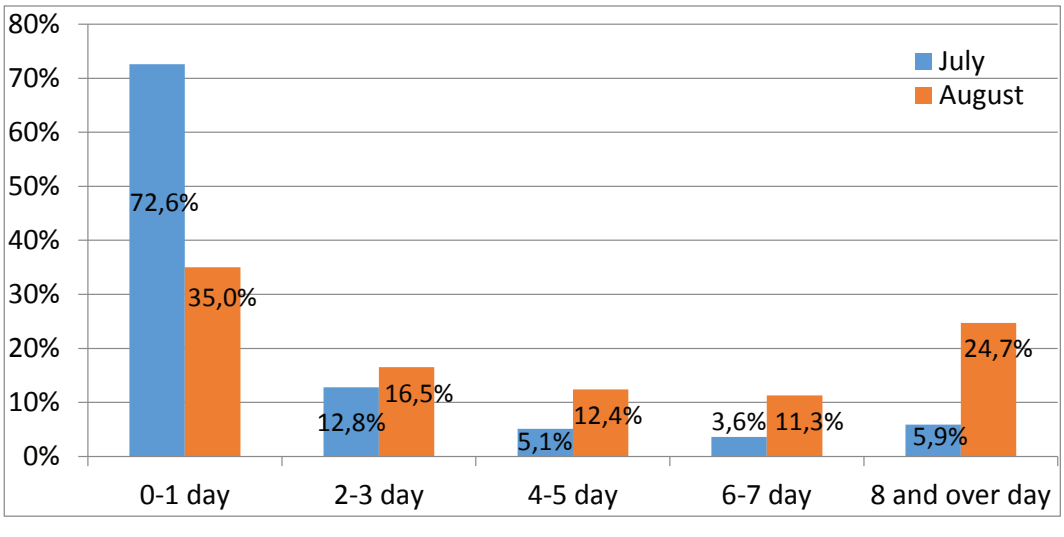
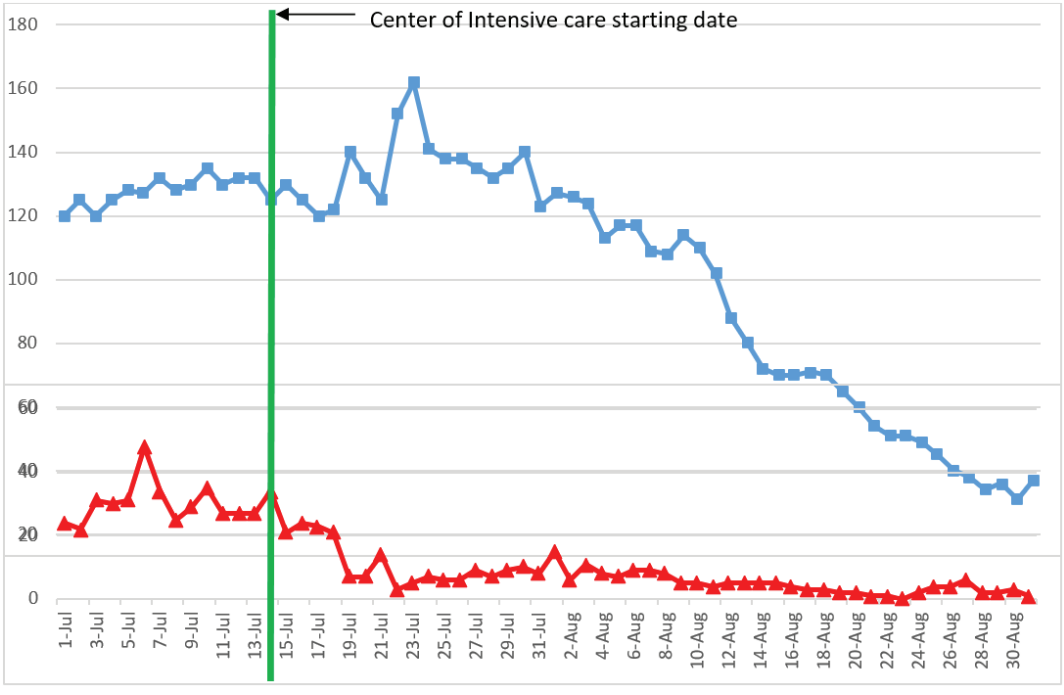


Figure 2.
Time of death in ICUs

Mortality in intensive care units was 76,1% in the first group and 52,6% in the second group. We revealed that the odds ratio OR (OddsRatio), when comparing the mortality of both groups, was 3,39 (95% CI: 2,01-5,71). The relative risk RR (RelativeRisk) was 1,57 (95% CI: 1,28-1,93).

With a decrease in the number of deaths on the first day, an increase in the daily number of patients in intensive care units is also associated (Figure 3).

Figure 3.
Dynamics of the number of ICU patients and deaths in the studied groups.



Thus, the analysis of the activities of the Center of Anesthesiology and Intensive Careand the organization of assistance to patients in intensive care units of hospitals providing assistance to patients with coronavirus infection in order to effectively provide care to patients with coronavirus pneumonia, we have developed an algorithm for the interaction of specialists of the Center for Anesthesiology and Intensive Care, which describes the functions and interactions of each link, that is, doctors of the Center and hospitals.

Discussion

While most COVID-19 patients have mild (40%) or moderate (40%) severity, about 15% develop severe disease requiring oxygen support, and 5% have extremely severe (critical) course with complications such as respiratory failure, acute respiratory distress syndrome (ARDS), sepsis, septic shock, thromboembolism and / or multiple organ failure, including acute kidney and heart damage [6].

The mortality rate of patients in intensive care units at the peak of the first wave reached 40–61%, and in some regions up to 90%, despite the use of high-tech methods of intensive therapy [22–24].

Most of the undertaken activities do little to optimize the most essential element of health care, medical and support staff in intensive care units. To provide medical care to critically ill patients, trained multidisciplinary specialists (resuscitators) are required who can control any changes associated with both this complex disease and the decompensation of existing concomitant pathologies [7].

To reduce the workload on staff in intensive care units and protect them from infection, each hospital separately creates different teams that perform separate functions: a team for tracheal intubation, a team for cardiopulmonary resuscitation [8, 25], a team of consultants, a team transporting critically ill patients inside the hospital, teams of physiotherapists, etc. At the same time, the composition and appointment of such teams is determined by each clinic itself. For example, in hospitals in China, the team of specialists in tracheal intubation and the team for resuscitation involves 4-18 people in each, in addition to basic practical assistance in the departments of the clinic where these teams are created, they are engaged in methodological assistance in the form of developing various hospital guidelines and algorithms.

This approach requires many committed and well-trained staff. In addition, there is debate about the appropriateness of such teams, believing that the creation of a sufficient number of fully equipped special kits for tracheal intubation and “points” for resuscitation, significantly reduces the need for such teams [26].

Remote counseling centers are most often organized by medical schools and universities. These centers include specialists from various areas in the field of intensive care, pulmonology,

hematology, neurology, nephrology, epidemiology, and other areas of medicine. The tasks of these centers, in addition to advisory assistance, usually include the development of recommendations and guidelines [8]. Such centers do not provide practical assistance.

Experiencing a sharp shortage of personnel, health systems in many countries are taking measures to train and retrain medical personnel of other specialties to become doctors and nurses in intensive care units. Short and superficial courses designed to quickly train the maximum number of intensive care specialists, as a rule, lead to a deterioration in the quality of the resuscitation care provided, does not improve the results of treatment and mortality.

All above activities, in general, are of a decentralized nature and are applicable in individual clinics, which makes it difficult to assess the resources of intensive care units on a city or regional scale, and even more so in the country.

In the aspect of the shortage of medical personnel in intensive care units, as well as in order to concentrate information on the available resources and the condition of patients of each medical institution, in our opinion, the most effective will be to create mobile multifunctional resuscitation teams. These include well-trained intensive care physicians who can simultaneously provide coordination, methodological, advisory and practical assistance in the field - in intensive care units, covering all infectious diseases clinics of the settlement. By concentrating and analyzing information on the material, technical and human resources of individual intensive care units, information on the condition and dynamics of patients in these departments. Such teams have the potential to provide the listed types of assistance in a timely manner to optimize treatment, diagnostic and anti-epidemiological processes in intensive care units.

The need to create such teams is also dictated by the fact that during the period of the pandemic there is a massive admission of severe patients, which at a certain moment can cause discord and stagnation in the work of hospitals that were previously unprepared for such conditions. Therefore, coordination in the work of the resuscitation and intensive care services makes sense.

Using the example of the city of Almaty, where the Center for Anesthesiology and Intensive Care was created, which provides practical assistance on the ground, advice, methodological assistance and control over the organization and implementation of intensive care for patients with COVID-19, the effectiveness of this approach can be considered.

After the introduction of mobile resuscitation teams into the work of intensive care units, there is an increase in the duration of patients' stay in intensive care units and in the hospital. This situation is directly related to a significant decrease in the number of deaths in 0-1 days after admission to the hospital and the intensive care unit.

At the same time, the load on the intensive care units remained unchanged, the average number of patients per day was 35,9±3,6 in the first group, 38,2±5,2 in the second group.

Along with a decrease in the number of deaths in the early period of patients admission, as a result of the work of the Center of Anesthesiology and Intensive Care, there is a decrease in mortality in intensive care units from 76,1% to 48,4%.

Conclusion

Thus, the results of the study made it possible to draw the following:

Based on the study of international experience, it can be argued that there are different types of team approach in the treatment of patients with coronavirus infection in intensive care units. At the same time, there are no examples like those in our case, when a team of resuscitators provides comprehensive advisory and practical assistance to critically ill patients with COVID 19.

The average number of resuscitation patients who were daily in the city hospitals in July was 37.1 patients, of which 24.3% were patients in an extremely serious unstable condition. The main comorbidities were pathologies of the heart, brain, and kidneys. The severe course of pneumonia with coronavirus infection is accompanied by a high mortality rate.

The work of the resuscitation service in Almaty was optimized by creating an Anesthesiology and Resuscitation Center for the treatment of critically ill patients with COVID-19. The functioning of the Center leads to an improvement in treatment results, in the form of a significant reduction in mortality, which is confirmed by the odds ratio (OR) = 3.39 and relative risk (RR) = 1.57.

4. An algorithm for the interaction of specialists from the Center for Anesthesiology and Intensive Care with doctors of hospitals has been developed and is successfully applied in practice.

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