

FEATURES OF MANAGEMENT OF A PATIENT WITH A NEW CORONAVIRAL INFECTION IN THE OBSERVATOR ON THE BASIS OF STUDENT'S DORMITORY

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The article is devoted to the peculiarities of clinical manifestations and the severity of a new coronary virus infection in a university student transferred to an observatory organized in a hotel-type hostel to prevent the spread of COVID-19 among students living in hostels. The data on the epidemiological history of the patient, the results of clinical observation and examination are provided. The tactics of managing a patient with a suspected of COVID-19 on an outpatient basis, symptoms that determine the indications for hospitalization, the results of examination and treatment in a hospital, and further observation at the observatory are considered.

A new coronavirus infection can lead to a rapid deterioration in the condition of young patients, which does not correlate with indicators indicating lung damage on the 5th day of the disease. Persistent hyperthermia and severe weakness with anorexia can be indicators of the complicated course of the disease, including the development of hyperactive inflammatory syndrome. Hypochromic anemia can be another disease, which is an unfavorable background for the development of COVID-19. The course of the new coronavirus infection in young patients requires careful attention and further study.

Keywords: COVID-19; management and medical care; indications for admission to hospital; observatory at hostel.

ОСОБЕННОСТИ ВЕДЕНИЯ ПАЦИЕНТА С НОВОЙ КОРОНАВИРУСНОЙ ИНФЕКЦИЕЙ В УСЛОВИЯХ ОБСЕРВАТОРА НА БАЗЕ СТУДЕНЧЕСКОГО ОБЩЕЖИТИЯ

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Статья посвящена особенностям клинических проявлений и оценке тяжести течения новой коронавирусной инфекции у студентки вуза, перемещенной в обсерватор, который организован в общежитии гостиничного типа университета для предотвращения распространения инфекции COVID-19 среди обучающихся, проживающих в общежитиях. Приведены данные об эпидемиологическом анамнезе пациентки, результатах клинического наблюдения и обследования. Рассмотрены тактика ведения пациентки с подозрением на COVID-19 в амбулаторных условиях, клинические проявления, определившие показания к госпитализации, результаты обследования и лечения в стационаре, а также дальнейшее наблюдение в обсерваторе.

Новая коронавирусная инфекция может привести к быстрому ухудшению состояния у молодых пациентов, при этом показатели, свидетельствующие о поражении легких на 5-е сутки заболевания, не отражают реальную ситуацию. Устойчивая гипертермия и выраженная слабость с анорексией могут быть индикаторами осложненного течения заболевания, включая развитие гиперактивного воспалительного синдрома. Гипохромная анемия может стать еще одним заболеванием, создающим неблагоприятный фон для развития COVID-19. В связи с особенностями течения новой коронавирусной инфекции у молодых пациентов необходимо дальнейшее изучение этого вопроса.

Ключевые слова: COVID-19; организация медицинской помощи; показания для госпитализации; обсерватор; общежитие для студентов.

Introduction

The various serotypes of coronaviruses cause a host of acute and chronic infectious diseases – ranging from mild forms of an acute respiratory infection to a severe acute respiratory syndrome. The SARS-CoV-2 coronavirus is believed to be a recombinant virus (i.e., bat coronavirus and an unknown origin coronavirus). The pathogen enters human body through the epithelium of the upper respiratory tract and epithelial cells of the stomach and intestinal tract. During the early stage of the infection, the SARS-CoV-2 virus penetrates target cells that have angiotensin-converting enzyme type II (ACE2) receptors. The ACE2 receptors are present on the cell membranes in the respiratory tract, kidneys, esophagus, bladder, ileum, heart, and central nervous system. This feature underlies the diverse clinical appearances that have been described recently in people who have become ill with acute coronavirus infection. The main and quickly achievable target is the alveolar cells of type II (AT2) of the lungs that determines the development of lung damage and leads to the development of pneumonia. Additionally, it has been found that SARS-CoV-2 dissemination from the systemic bloodstream or through the lamina cribrosa can cause brain damage. Moreover, a change in the sense of smell (hyposmia) of a patient at an early stage of the disease may indicate both damage to the central nervous system and edema of the nasopharyngeal mucosa. Nevertheless, further comprehensive study is yet required to understand the several aspects of the pathogenesis of coronavirus infection [1]. The SARS-CoV-2 was first reported in the Hubei province of the People's Republic of China (PRC), where it grew in large numbers between December 2019 and March 2020 and later became the epicenter for the confirmed number of cases (84% of the total number of cases in the PRC). However, by the end of January 2020, cases of COVID-19 were registered in many countries around the world, mainly related to trips to China. By the end of February 2020, the epidemiological situation for COVID-19 in South Korea, Iran, and Italy became sharply more complicated, which later led to a significant rise in the number of cases in several other countries predominantly connected with a travel history to the former countries. On March 11, 2020, the World Health Organization declared COVID-19 as a pandemic due to the poor epidemiological situation [2]. The main source of

the infection is a sick person, including those in the incubation period of the disease.

Airborne and contact routes transmit the infection. The incubation period of the disease is 2–14 days (on average 5–7 days).

At the time of writing this article, there were approximately 621,000 confirmed cases of COVID-19 in the Russian Federation with 8,781 total deaths. In Saint Petersburg, 23,294 people were registered with laboratory-confirmed infection, and 1,008 of them died. Saint Petersburg ranks third in the Russian Federation after Moscow and the Moscow region in terms of the number of deaths from COVID-19. Worldwide the number of confirmed cases was 9,620,000 and 490,000 people had died [3].

The most common clinical symptoms of COVID-19 are typically similar to those of other acute respiratory viral infections (ARVI), such as:

- (1) increased body temperature (>90%);
- (2) cough – dry or with a small amount of sputum (80%);
- (3) shortness of breath (55%);
- (4) fatigue (44%); and
- (5) feeling of congestion in the chest (>20%).

In addition, a loss of smell and taste (33.9%–68.0%) [4], signs of conjunctivitis (31.6%) [5] and myalgia (11%), confusion (9%), headache (8%), hemoptysis (5%), diarrhea (3%), nausea, vomiting, and palpitations may be among the early symptoms of the patient. Of note, at the initial stage of the infection, these symptoms may be observed even in the absence of an increased body temperature. When the lungs are affected, which typically appears by the sixth or the seventh day the disease onset, the respiratory rate (RR) increases and shortness of breath appears during physical exertion [2].

Moreover, the classification of COVID-19 by degree is based on both the severity of clinical symptoms and the data from pulse oximetry, computed tomography (CT) of the chest which has the fundamental importance in determining the volume of lung damage and their severity, and the level of C-reactive protein in the blood serum. Various prognostic scales are proposed for evaluating the severity of the disease, such as SOFA (after the English Sequential (Sepsis-related) Organ Failure Assessment), which was originally aimed to predict the damage to various organs and systems of patients with sepsis in the intensive care unit. However, in patients with COVID-19, it is more convenient

to use a simplified qSOFA scale (quick-fast) [2] to predict the disease. This tool can be used at an outpatient care, taking into account three parameters: the level of consciousness detected through the Glasgow coma scale (normal rate – 15 points), the RR, and the systolic blood pressure (BP). For instance, if a patient has an impaired consciousness (<15 points), $RR \geq 22/\text{min}$, and systolic BP ≤ 100 mm Hg, the qSOFA score is 3 points. Therefore, as mentioned in the description of this prognostic scale, a patient with COVID-19 may be 3–14 times more likely to die in a hospital due to the threat of sepsis [6] (<https://www.mdcalc.com/qsofa-quick-sofa-score-sepsis>).

Classification of a new coronavirus infection by severity [1]

Easy flow

- Body temperature $< 38.5^\circ\text{C}$, cough, weakness, sore throat, and absence of the symptoms mentioned in the medium and severe courses described below.

Medium-heavy current

- Body temperature $> 38.5^\circ\text{C}$ and $RR > 22/\text{min}$. Shortness of breath during exercise and pneumonia, confirmed by CT of the lungs. Oxygen saturation (S_pO_2) $< 95\%$ and the level of C-reactive protein in blood serum > 10 mg/l.

Severe course

- $RR > 30/\text{min}$, $S_pO_2 \leq 93\%$, and $p_aO_2/FiO_2 \leq 300$ mmHg. Progression of changes in the lungs according to radiography, CT, ultrasound (increase in the volume of changes in the lungs by more than 50% after 24–48 h). Decrease in the level of consciousness, agitation. Unstable hemodynamics (systolic BP < 90 mmHg or diastolic BP < 60 mmHg, diuresis < 20 ml/h), arterial blood lactate content > 2 mmol/l, and qSOFA > 2 points.

Extremely heavy current

- Acute respiratory failure with the need for respiratory support (invasive ventilation).
- Septic shock.
- Multiple organ failure.

Determining the severity of the disease is extremely important particularly because it builds an algorithm for providing care at the pre-hospital stage, including indications for hospitalization.

To stop the spread of COVID-19 in Saint Petersburg, the interdepartmental medical working group under the interdepartmental city coordination council has formulated the following: “Guidelines, algorithms for the actions of medical professionals at various stages of care, checklists and standard documents developed for the period of the presence and the threat of further spread of a new coronavirus infection in St. Petersburg,” 2nd version dated June 10, 2020 [7]; the endexis for hospitalization of people who have been in contact with COVID-19 patients, patients with laboratory-confirmed COVID-19 infection, and people with ARVI (acute respiratory infection) in the absence of a contact but aged >65 years and having risk factors. These factors include:

- patient with a medium or a severe condition;
- body temperature $> 38^\circ\text{C}$, including amnesia if the patient took antipyretic drugs;
- $RR > 22/\text{min}$;
- partial oxygen pressure $< 95\%$ according to pulse oximetry data;
- the impossibility of isolation when living with people at risk;
- pregnancy; and
- children aged 0–3 years.

An additional criterion is the CT data corresponding to the IInd or higher degree of lesion ($>25\%$ of a lung tissue).

Moreover, patients aged <65 years without risk factors, who have not come into a contact with COVID-19 patients, with clinical appearances of ARVI without signs of pneumonia are to be treated outpatiently. However, the document states that indications for hospitalization can be determined by the severity of the patient’s condition on an individual basis.

In other words, hospitalization for patients with a new coronavirus infection is indicated for a medium and severe disease.

Of note, based on the data published by Chinese specialists, 80% of the patients had a mild form of SARS [8]. The average age of patients was 51 years, and the most severe forms developed in the elderly (60 years and older) population. The most common comorbidities were diabetes mellitus (20%), hypertension (15%), and other cardiovascular diseases (15%) which affected the prognosis of the disease. Therefore, only 20% of the confirmed cases reported in the PRC were classified as severe (5% of them were in critical condition). Besides, among severe cases, rapidly progressive pneumonia,

acute respiratory failure, acute respiratory distress syndrome, sepsis, and septic shock were often observed.

Currently, a big bulk of domestic experience in case management of patients with COVID-19 infection has accumulated which will be subjected to a thorough analysis, and so a large number of publications will be seen in the near future. However, our clinical case is particularly interesting because the patient was under a medical supervision in an observatory located in one of the blocks of a hotel-type dormitory. This measure was necessary to counteract the spread of COVID-19 infection among students living in the three dormitories of the Mechnikov North Western State Medical University. These students have been under medical surveillance since mid-March to identify those with fever and other symptoms of ARVI, as their timely isolation is an important anti-epidemic measure. For this purpose, the observatory was opened in accordance with the order of the rector of the university on April 21, 2020. The 24-h medical supervision of students was done by the residents of the departments of family medicine and infectious diseases under the guidance of the head of the center for family medicine and the head of the department of family medicine of the university. Epidemiological activities were made under the supervision of a professor of the department of epidemiology, parasitology, and disinfection. In addition to COVID-19 contact persons, students with clinical appearances typical of a new coronavirus infection were transferred to the observation facility, as well as those who were discharged for an outpatient treatment after their stay in the hospital.

Description of the clinical case

A fourth-year student of the medical faculty of the Mechnikov North Western State Medical University, born in 1999, was transferred to the observation facility on May 25, 2020 due to an increase in body temperature to 39.6°C and complaints of severe weakness. However, no other symptoms were reported.

During the examination, the patient complained of severe weakness, drowsiness, and an increase in body temperature to 39.6°C. After taking paracetamol, the temperature dropped to 38.3°C. The patient was of right build, 165 cm tall, weighing 68 kg, normal-colored skin, clean, heart rate: 72/min, BP: 110/70 mm

Hg, RR: 17/min, with auscultation of the lungs, vesicular breathing, no wheezing, with percussion clear pulmonary sound, and oxygen saturation: 98% (normal). The abdomen was symmetrical, soft, and painless. There were no peritoneal symptoms. The liver and spleen were not palpable. The tongue was moist and clean. Stool, urination were normal (according to the patient). The symptom of pounding on the lower back was negative on both sides. The kidneys were not palpable. It is known from the anamnesis that in childhood she had chicken pox and scabies. In 2017, during a preventive examination at the clinic of the Mechnikov North Western State Medical University, hypochromic anemia of mild severity (hemoglobin – 119 g/l) was first detected in the patient, and during a subsequent examination in 2018, blood parameters were within the normal range; however, in February 2020, the blood level was not high, a decrease in hemoglobin levels to 111 g/l was again detected, and although additional tests and treatment were prescribed, no treatment was undertaken by the patient. Further, in 2019, she did not get a flu vaccination.

When collecting an epidemiological history, it was established that the student received a referral for a summer internship in one of the city hospitals, partially re-purposed for the treatment of patients with COVID-19 infection in accordance with the application of this medical organization. She went to a department where, according to the administration, there were no patients with confirmed COVID-19 infection. The student was given a disposable cap, mask, and gloves (one set for the entire shift) to work with patients. The student worked a one-day shift on May 13, 2020 and a daily shift from May 22–23, 2020 at the department, where, according to her, there were also patients with COVID-19. On the morning of May 23, 2020 after her shift, she felt extreme weakness and her body temperature rose to 38.5°C. Thus, in this case, the incubation period could be from 1 to 10 days. She lived alone in the hostel room that allowed her to follow the conditions of isolation. In addition to studying at the university, she worked as a night sales consultant in a pharmacy from March to May 2020 (the last working day was May 12). According to the patient, during the night, she served an average of 15 people, worked wearing a mask and gloves, and that all customers visited the pharmacy wearing masks.

Besides, at the observation facility, during the observation period May 25–26, 2020, hyperthermia up to 38°C–39°C was persistently maintained, which was not stopped by paracetamol, weakness increased in the absence of any changes on the part of RR and oxygen saturation, which remained within normal values. Vitamin C was prescribed at a dose of 500 mg twice a day and vitamin D at a dose of 4000 IU once a day as a treatment in accordance with the report based on the experience of American doctors [9]. To stop the fever in the evening on May 26, 2020, a lytic mixture was intramuscularly administered – 2 ml solution of sodium Metamizole (analgin) 50%, 2 ml solution of drotaverine 2% (No-Shpa®), 1 ml solution of Dimedrol® 1%, which eventually lowered the body temperature to 38.6°C.

In addition, for dry cough, azithromycin was prescribed at a dose of 500 mg once as an antibacterial drug that has an anti-inflammatory effect [10]. On May 27, 2020, a smear was taken from the nasopharynx and oropharynx for the laboratory testing on COVID-19 in the laboratory of the Kashkin Research Institute of Mycology (the response was received May 29, 2020 – COVID+).

Despite the therapy, on May 27, 2020, the weakness and headache increased in the patient, and on May 28, 2020, the patient developed anorexia (lack of appetite and refusal to eat). Changes in the condition were regarded as increasing intoxication due to COVID-19 infection, possibly with the development of viral pneumonia. At the same time, RR did not increase, oxygen saturation indicators did not decrease, on the basis of which the severity of the disease was estimated and the question of hospitalization was decided. The patient's condition could be interpreted as medium; however, due

to the absence of shortness of breath and a decrease in oxygen saturation, its clinical appearances did not fit into the picture of a moderate course of COVID-19 infection [5]. Nevertheless, while an ambulance was called in the morning of May 28, 2020, the patient could not be hospitalized for 12 h due to the overload of the city's ambulance service. The ambulance team arrived only after personal negotiations with a representative of the city health committee, as a result of which the patient was hospitalized in the Almazov National Medical Research Center to the Department No. 6 for infectious patients.

On the day of admission, the patient underwent a chest CT scan (on the fifth day from the onset of the disease), which revealed moderate bilateral polysegmental viral pneumonia (IInd degree of severity – 39% of the lesion), which confirmed the need for hospitalization. The patient was prescribed the following treatment: azithromycin, a solution of nadroparin of calcium 0.6 ml subcutaneously (low molecular weight heparin), hydroxychloroquine at a dose of 200 mg two tablets twice a day on May 28, 2020 and one tablet twice a day under the control of an electrocardiogram from May 29–June 03, 2020 (the drug has been included in the guidelines of the Ministry of Health of the Russian Federation from May 28, 2020 as an etiotropic therapy for COVID-19) [7]. Despite the ongoing therapy, on May 30, 2020, the patient's condition worsened: an increase in RR to 28/min and a decrease in oxygen saturation to 93% was noted. Repeated CT revealed an increase in the volume of a lung damage up to 56% within 48 h (IIIrd degree of CT severity). Due to the clinical deterioration of dynamics according to the CT data, increased respiratory failure, high levels of C-reactive protein (58 mg/l), changes in the blood in the form of

Dynamics of indicators of blood and C-reactive protein analysis during a hospital stay according to discharge documents

| Characteristic | 28.05.20 | 02.06.20 | 04.06.20 | 05.06.20 |
|---------------------------------------|----------|----------|----------|----------|
| Hemoglobin, g/l | 103.1 | 113 | 111.5 | 112.1 |
| Hematocrit, % | 28.4 | 32.9 | 34.8 | 35.9 |
| MCH (mean corpuscular hemoglobin), pg | 26.4 | 25.2 | 24.3 | 23.9 |
| Lymphocytes, % | 24.3 | 39.7 | 39.0 | 31.9 |
| White blood cells, $\times 10^9/l$ | 2.6 | 2.4 | 3.3 | 4.4 |
| C-reactive protein, mg/l | 24.46 | 49.89 | 4.54 | 3.11 |

neutropenia, indicating the development of hyper-reactive syndrome (the so-called cytokine storm), the patient was prescribed levilimab at a dose of 324 mg subcutaneously for three days as part of clinical trials. At the background of a treatment, there was a persistent decrease in the temperature, an exemption of respiratory failure, positive X-ray dynamics, and normalization of indicators of “acute phase” activity (see the Table).

Finally, after an improvement in her condition, the patient was discharged for outpatient treatment and monitoring on June 09, 2020 with U07.1 COVID-19, virus identified (PCR+ from June 01, 2020); severe course complications included: community-acquired polysegmental pneumonia of viral etiology, severe course dated May 28, 2020 (CT: 2%–39% of the lesion), progression dated May 30, 2020 (CT: 3%–56% of the lesion), and resolution dated June 08, 2020. Respiratory failure of the second degree from May 30, 2020 and resolution dated June 08, 2020. Hyperinflammatory syndrome was noted from May 30, 2020, neutropenia of the IIIrd degree from June 03, 2020, and anemia of inflammation of the Ist degree from June 04, 2020.

After the release from the hospital, the patient was admitted to the observation facility

for monitoring for 14 days. From the admission to the discharge from the facility, there were no complaints; she felt satisfied, received vitamin therapy (vitamins C and D), and performed recommended respiratory exercises. The planned CT scan of the chest organs was scheduled for 30 days after the first study.

Conclusion

COVID-19 can lead to rapid health deterioration in young patients, which is not associated with indicators of a lung damage on the fifth day of the disease. Persistent hyperthermia and severe weakness with anorexia may be indicators of a complicated course of the disease, including the development of a hyperactive inflammatory syndrome. Hypochromic anemia can become another disease that forms an unfavorable background for the development of COVID-19. Owing to the peculiarities of the course of a novel coronaviral infection in young patients, a further study is necessary. Full-fledged individual protection plays an important role in the prevention of infection of medical workers who work in medical organizations that are not fully repurposed for the treatment of patients with COVID-19.

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