



# **Features of Providing Emergency Medical Care to Patients with Thermal and Chemical Injuries during the Spread of COVID-19: Providing Antiviral Protection for Medical Workers and Developing Practical Treatment Protocols**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

In modern conditions, the burden on the staff of medical institutions has increased many times. This is due to the fact that for more than a year and a half, the planet has been overwhelmed by waves of the coronavirus pandemic. Having come from China, this virus spread like lightning

across the planet, causing an economic crisis, violation of the usual foundations of human life, etc. However, despite the undulating incidence of COVID-19 and a significant number of cases, other diseases and medical emergencies also occur, and doctors need to provide patients with the necessary assistance.

It should be said that, despite the high level of protective measures in medical institutions, the provision of emergency medical care to patients is associated with a certain risk for doctors, since assistance should be provided to such patients immediately, and it is not always possible to quickly assess whether they are carriers of the virus, unfortunately. For this reason, the risk of infection to medical workers providing emergency care to patients, especially surgical ones, is extremely high.

During the epidemic, the treatment of burn patients who have not confirmed the absence or presence of a coronavirus infection, the processes of establishing intravenous access, endotracheal intubation or tracheostomy, wound treatment and surgical intervention are the points of risk of infection. The introduction of an effective, appropriate degree of protection and the development of practical medical procedures will increase the level of protection of the medical worker and reduce the risk of infection with COVID-19.

The aim of the work is to investigate the features of providing antiviral protection for medical workers and to study the existing practical treatment protocols for providing emergency medical care to patients with thermal and chemical injuries during the spread of COVID-19.

*Keywords: Antiviral protection; emergency medical care; coronavirus infection.*

## 1. INTRODUCTION

A new type of coronavirus has been spreading in the world for quite a long time. Worldwide, there are more than 212 million confirmed cases of COVID-19 and 4.5 million deaths.

After initial virus typing tests, World Health Organization officially named the new coronavirus causing the Wuhan pneumonia epidemic as the new coronavirus of 2019 (SARS-CoV-2) on January 12, 2020. And the International Committee on the Systematics of Viruses (ICTV) announced the official nomenclature of the new coronavirus (SARS-CoV-2) as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On the same day, WHO announced that the official name of the disease caused by the virus is coronavirus disease 2019 (COVID-19).

As of April 8, 2020, WHO reported 22,073 cases of COVID-19 infection among medical workers from 52 countries. These data show that COVID-19 has a high contagiousness, a high rate of transmission of infection and can cause serious infections among medical workers [1].

This virus receives a particularly high level of spread when providing emergency care to patients, in particular, for example, those who have received extensive burns. It is known that burns are an acute care condition, and the treatment of patients with extensive burns is a race against time. Therefore, treatment of burns

must begin before the infectious status of COVID-19 can be excluded. The key step is to identify infection risk points, strengthen protection against these risk points, and develop an appropriate diagnostic and treatment process. Insufficient protection can easily lead to medical infections. Therefore, aspects of medical protection and the diagnosis and treatment of burns seem to be particularly important in the prevention and control of COVID-19. In particular, it is necessary to determine the risk points of infection, strengthen protection against these risk points and formulate an appropriate protocol for diagnosis and treatment [2].

Accordingly, the purpose of the work is to investigate the features of providing antiviral protection for medical workers and to study the existing practical treatment protocols for providing emergency medical care during the spread of COVID-19.

## 2. MATERIALS AND METHODS

In the process of writing the work, articles and other various printed materials were studied within the framework of the research topic, as well as analytical and comparative methods were applied. Practical materials reflecting the peculiarities of the organization of the medical workers acting in the burn centers during the spread of coronavirus infection were studied in order to take the necessary safety measures, as well as recommendations of practitioners in this field.

### 3. RESULTS

COVID-19 has a high risk of spreading and is especially dangerous for the reason that there are asymptomatic carriers of this disease, with contact with which people can get sick already in an active form.

It is known that the airborne transmission is the main one in the transmission of infection. It is also possible to spread the virus through aerosols when exposed to high-concentration aerosols for a long time in a relatively closed environment [3].

The incubation period is 1-14 days, and often 3-7 days. The main symptoms are fever, fatigue and dry cough. Some patients have symptoms such as nasal congestion, runny nose, sore throat and diarrhea. Severe patients often develop shortness of breath and/or hypoxemia 1 week after the onset of the disease and quickly progresses to acute respiratory distress syndrome (ARDS), septic shock, refractory metabolic acidosis and coagulopathy. It is noteworthy that the course of severe and seriously ill patients may be marked by a moderate or low temperature, or they may even be afebrile.

Patients who are slightly affected by the virus have only a low temperature and mild fatigue without symptoms of pneumonia. Judging by the current cases, most patients have a good prognosis, but some of the patients have a hard time tolerating this disease.

The prognosis for the elderly and patients with a chronic underlying disease is unfavorable.

In a laboratory study of patients with COVID-19, it was found that the number of leukocytes and lymphocytes in the peripheral blood of patients with early onset of the disease was normal or reduced, some patients had elevated liver enzymes, muscle enzymes and myoglobin; some critically ill patients had elevated troponin levels.

The majority of patients had increased C-reactive protein and erythrocyte sedimentation rate (ESR), and the level of procalcitonin was normal. In some patients, the d-dimer increased, and peripheral blood lymphocytes progressively decreased. The majority of severe and seriously ill patients had an increased level of inflammatory factors [4].

COVID-19 is detected by reverse transcription polymerase chain reaction (RT-PCR) and/or next-generation sequencing (NGS) in nasopharyngeal smears, sputum and other lower respiratory tract secretions, blood and feces.

Upon admission to the hospital for treatment, all patients should be tested for the presence of a coronavirus infection and, if the disease is suspected, placed in quarantine. However, the provision of emergency care to certain categories of patients is urgent, for this reason, even taking into account the emergency testing for the presence of coronavirus infection, doctors who provide care to such patients should apply high anti-virus protection measures.

Every doctor providing emergency medical care must comply with standard protocols within the framework of antiviral protection. In particular, the standard protocol for the protection of medical personnel providing assistance to emergency burn patients is presented in Table 1.

### 4. DISCUSSION

The COVID-19 virus is very contagious and pathogenic. This is a new and sudden acute infectious disease that can be transmitted from person to person. After the virus enters the human body, it mainly destroys the respiratory tract and causes pneumonia, which can lead to respiratory failure and endanger life.

Employees of hospitals, especially departments providing emergency medical care, are at high risk of infection. In particular, doctors who provide assistance to emergency burn patients are in a high risk group [5].

It is known that patients with extensive burns need resuscitation with a large amount of fluid after hospitalization. Accordingly, they need a quick installation of a central venous catheter. At the same time, patients with burns cannot quickly pass screening for COVID-19 infection. When performing peripheral or central venopuncture to establish a fluid replacement channel, the medical worker must have close contact with the patient. In fact, close contact is one of the main ways of transmitting COVID-19. Therefore, the process of establishing venous access channels is the earliest point of exposure to COVID-19 infection in the early treatment of burn patients.

Patients with extensive burns are prone to systemic edema, and swelling of the neck

**Table 1. Standard protocol for the protection of medical personnel providing assistance to emergency burn patients**

The degree of protection, taking into account the specifics of the environment	Means of protection											
	Hand hygiene	Bouffant cap	Respiratory protection			Face Mask/ Safety Glasses	Medical Rubber Gloves	Body protection			Protection of the lower extremities	
			Medical face mask	Face mask N95	Respirator			Hospital work clothes	Insulating clothing	Protective Clothing	Ordinary shoe covers	High shoe covers
Requirements for daily professional hygiene measures of health care personnel	+	-	+	-	-	-	±	+	-	-	-	-
Primary protection (Stay in the ward of patients with fever (without contact with patients))	+	+	!!!	-	-	-	+	+	+	-	±	-
Secondary protection (General diagnosis and treatment of potentially infected or sick patients)	+	+	!	+	-	±	+	+	!!!		!!!	
Tertiary protection (Aerosol generation procedures for potentially infectious or sick patients)	+	+	!	!!!		+	Double rubber gloves	+	!	+	!	+

+ - required; - not required (except in exceptional circumstances); ± - use as needed; ! - insufficient protection; !!! - protective equipment for selective or simultaneous use in accordance with the actual conditions of medical institution

causes narrowing of the trachea. With a combination of burns of the respiratory tract, the mucous membrane of the respiratory tract is damaged, and swelling of the throat increases the likelihood of asphyxia. Early treatment often requires endotracheal intubation or tracheotomy, and, if necessary, artificial respiration. During endotracheal intubation or tracheotomy, the medical professional should be in close contact with the patient. It is known that the main method of transmission of COVID-19 is drip transmission. After endotracheal intubation or tracheal intubation, sputum aspiration and other related operations are easy ways to contact aerosols.

Since most patients with severe burns are treated in the intensive care unit, a more complex tracheotomy is performed at the patient's bedside. Compared to operating conditions and equipment in the operating room, bedside procedures are insufficient in terms of safety protocols, and patients' necks often have tissue edema, which requires a longer tracheostomy time than with conventional procedures. Thus, the risk of infection increases. Therefore, the establishment of endotracheal intubation or tracheotomy is the highest risk point for COVID-19 infection in the early treatment of burn patients.

The function of the skin barrier is destroyed in patients with extensive burns, which leads to wound exposure and wound exudate. Early treatment requires local medications and dressings. This procedure should be performed every 2-3 days until the wound is completely closed. Moreover, the time of wound treatment positively correlates with the size of burn wounds.

Early skin grafting is also a common operation for burn patients. If general anesthesia with tracheal intubation is necessary, medical personnel come into contact not only with patients, but also with respiratory drops and aerosols of patients.

In the process of providing assistance to a burn patient, a medical worker not only works in a relatively closed environment, but also comes into close contact with liquids, drops and aerosols of the patient's body [5]. Both intimate contact with patient's body fluids and prolonged exposure to high concentrations of aerosols in a relatively closed environment are ways of transmitting COVID-19. Thus, the process of wound treatment and surgical intervention is the

highest point of risk of infection with COVID-19 infection in the early treatment of burn patients.

Patients with extensive burns often have fever. In combination with burns of the respiratory tract, the patient may develop trauma to the lungs and bronchi. Due to the syndrome of a systemic inflammatory reaction and a large amount of rehydration treatment, burn patients are prone to pulmonary edema. X-ray examination of both lungs in burn patients showed multiple, small, spotty and interstitial changes. This is very similar to the early results of COVID-19 chest imaging. Therefore, it is not easy to differentiate and diagnose these two conditions clinically [6].

Quickly complete lung CT scans and routine blood tests for new patients entering the emergency department, and screening based on a new diagnosis and treatment plan for COVID-19 infected pneumonia should be combined with clinical symptoms and an epidemiological history. The medical professional should establish secondary protective measures [7]. Since all new patients are regularly admitted to the emergency department or intensive care unit for regional isolation, the departmental medical worker must take primary protective measures.

If it is necessary to perform invasive procedures in these patients, the medical professional should take additional protection. For suspected or confirmed COVID-19 patients, the medical professional must strictly follow the emergency plan, and immediately seek advice from an infectious diseases specialist, change the treatment plan and transfer the patient to an infectious diseases specialized department [8]. In cases where patients need treatment in close contact with a medical professional, it is necessary to use a high degree of protection.

Patients with extensive burns are prone to swelling of the neck, leading to compression stenosis of the trachea. When combined with burns of the respiratory tract, damage to the mucous membrane of the respiratory tract and edema of the trachea, the probability of asphyxia increases. Intubation or tracheostomy is often necessary for early treatment in these patients.

Research suggests that medical procedures such as endotracheal intubation, tracheotomy, artificial ventilation and fiberoptic bronchoscopy can increase the risk of transmission of the disease. Therefore, in accordance with the requirements of the WHO Interim Guidelines, if a

new coronavirus infection is suspected and there is a conclusion of a clinical expert commission, a medical worker must perform tertiary protection (including hand hygiene, use of personal protective equipment, respiratory hygiene, prevention of needle injections, cleaning of medical supplies, treatment of medical waste, etc.). Contact isolation is required for suspected or confirmed patients with COVID-19, and air isolation measures must be taken for medical procedures that can generate aerosols.

For patients whose diagnosis is not confirmed, medical procedures can be performed in a negative pressure ward; alternatively, these procedures can be performed in a well-ventilated ward to avoid operations in a positive pressure ward.

For emergency surgery, it is necessary to conduct a complete CT scan of the lungs and routine blood tests immediately before surgery, and COVID-19 screening should be carried out on the basis of clinical symptoms and epidemiology [9]. After that, strict compliance with emergency protocols should be ensured for patients with suspected or confirmed COVID-19. Appropriate protective measures should be carried out in the perioperative period and intraoperatively, and all objects and surfaces should be disinfected and sterilized in strict accordance with the disinfection protocol.

During hospitalization, patients should be isolated in one ward. While changing clothes and going around the wards, it is necessary to pay attention to the implementation of a number of protective measures against nosocomial infections. For patients who have not confirmed the absence of COVID-19 infection, emergency procedures, such as general anesthesia of endotracheal intubation, should be performed in the operating room with negative pressure, and the medical professional should establish tertiary protective measures [10].

## 5. CONCLUSION

In general, COVID-19 is an acute respiratory disease with a variety of transmission routes and a high transmission rate. During the epidemic, the treatment of burn patients who have not confirmed the absence or presence of a coronavirus infection, the processes of establishing intravenous access, endotracheal intubation or tracheostomy, wound treatment and surgical intervention are the points of risk of

infection. The introduction of an effective, appropriate degree of protection and the development of practical medical procedures will increase the level of protection of the medical worker and reduce the risk of infection with COVID-19.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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