



Dear Premium Customers,

The coronavirus can cause severe lung problems in some people. The Salvagene SARS-CoV-2 Task Force explains how the virus affects the breathing organ and assesses the current situation regarding the availability of ventilators in different countries.

Severe cases of Covid-19 mainly affect people with underlying health conditions. If the lungs fail to function properly, artificial respiration must be provided in an intensive care unit (ICU). But how exactly does the virus affect the lungs and what can individuals who need treatment and ventilation in hospital expect? The Salvagene SARS-CoV-2 Task Force answers the key questions:

What happens in the lungs during a severe bout of Covid-19?

First, the virus proliferates in the airways and lungs triggering a general inflammatory reaction. The main problem is that, at some point, not enough oxygen can pass through the pulmonary alveoli (air sacs). Each alveolus also has a blood vessel, without which oxygen transfer cannot take place. In severe cases, these vessels develop small fissures which allow fluid to seep into the alveoli and complicate the uptake of oxygen.

Can the lungs recover from such damage?

We are familiar with the course taken by other respiratory diseases. Fortunately, the lung can recover completely, even after a very severe case of the disease. The self-healing processes and supportive therapy are usually so efficient that the lung function normalizes within a few weeks and months. However, there are exceptional cases in which the body's own repair mechanisms either do not function properly or else overreact so strongly that the lung virtually rigidifies. But such cases are relatively rare.

What complications can occur during therapy?

In some cases, a superinfection can occur. This means that a bacterial infection takes place over and above the viral infection. The worst-case complication here is septic shock, which can prove fatal. However, according to the data from China and discussions we have had with Italian colleagues, I must reiterate that this is absolutely not the norm. Other complications can arise if ventilation is not carried out exactly as prescribed, leading for example to scarring in the lungs and potentially death.

Who is particularly susceptible to severe progression requiring intensive medical care?

Cardiovascular diseases are a major factor – this expressly includes high blood pressure. Chinese data also show that people with diabetes are a high-risk group. We must assume that patients with chronic lung diseases such as COPD are also at greater risk. However, there is no reliable data on this as yet.

On average, how long do critical patients need to be ventilated, and how long do they have to stay in hospital?

If it comes to the point where a patient actually has to be ventilated, the clinical picture is already somewhat gloomier, with critical patients having on average to be ventilated for two weeks. Depending on the individual case, however, the range is from one to five weeks or longer. After a stay of this duration in intensive care, the patient will usually not be in top shape and will need a few more days or weeks on a normal ward. The best outcome in such cases would be that continuing care is provided in a convalescent facility.

What do Covid-19 patients die of?

A patient's oxygen supply can almost always be maintained nowadays – that is not the biggest problem. In extreme cases, the disease is too severe overall and the patient then dies of so-called secondary complications, for example from a resultant bacterial infection.

What are the various stages and levels of ventilation?

As a first measure, additional oxygen is given through a face mask or a so-called nasal cannula; these are the small tubes that are inserted into the nose. The second stage is non-invasive

ventilation, in which oxygen is administered through a mask at a slight positive pressure. If even this proves insufficient, completely artificial ventilation can be performed under general anesthesia, in which oxygen is delivered directly to the lungs via a tube.

There has much talk about ExtraCorporeal Membrane Oxygenation (ECMO). What does this involve?

In this technique, blood is taken from the body and saturated with oxygen via a membrane. It has the carbon dioxide content removed and is then returned to the body. This is a well-established method that has been in existence for many years. However, it only helps to maintain oxygen saturation – it does not treat the underlying disease.

This method is considered to be a last resort, not least because of possible complications...

In staged therapy for lung failure, the vast majority of patients can be treated effectively with well-structured and guideline-compliant ventilation. If, in exceptional cases, ECMO must nevertheless be used, the complication rate is still less than ten percent. However, it requires highly specialized staffing. And therein lies the problem: the very complex nature of the treatment calls for a large team of specialists whose services may be required elsewhere.

What is your assessment of the current availability of ventilators?

The current discussion is a little too one-sided for us, centering on the equipment, whereas the main bottleneck will be in the

availability of trained staff. According to the official data, we have 28,000 intensive care beds in Germany. I would discount between ten and fifteen percent of these because of the shortage of trained staff. I would roughly estimate that 60 to 70 percent of these beds are equipped with ventilators. However, we still have a hidden reserve of ventilators in private clinics. These include older equipment that still works perfectly and equipment that can be temporarily removed from operating theatres. As I said before, however, the crucial question is whether we have enough people qualified to operate these ventilators; for this you need specially trained nursing staff.

In Italy there have been cases where the doctor has had to decide which patients can be put on a ventilator and which cannot. Is that what we are facing?

The situation varies from country to country. In Germany, for example, there are three times as many fully equipped intensive care beds per inhabitant as in the UK and – perhaps surprisingly – 4.5 times as many as in the USA, but at the same time only half as many as in Switzerland or Scandinavia. But all OECD countries have more or less the same problem of too few nursing and specialist staff. This is what necessitates the route of triage, the so-called corona triage, which will probably become a sad reality in many countries.

The individual regions help each other with different strategies and rely on their respective strengths: China with unprecedented organizational ability to build entire hospitals in a few days; Europe with solidarity, Italian patients are cared for in Austria, Switzerland and Germany, French patients in Belgium and Germany. In the USA, the immense military resources, for example in the form of ship hospitals, will more than compensate for the deficits in the health system. Each country and region must therefore concentrate on its own strength and try to act in an internationally coordinated manner.

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