

## TCD in use with COVID-19 Early detection and therapy determination



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*„COVID-19 is a  
systemic vascular disease“*

Prof. F. Ruschitzka, Zurich

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*„COVID-19 promotes the  
development of strokes“*

Prof.Dr. Goetz Thomalla, Hamburg

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*„COVID-19 patients often  
die from thrombosis and  
pulmonary embolism“*

Prof. Klaus Pueschel, Hamburg-Eppendorf



# COVID-19

The disease COVID-19, which is triggered by the coronavirus, was initially referred to as a novel lung disease, which sometimes causes severe clinical courses and intensive care. The course of the disease is nonspecific, diverse and varies worldwide - from asymptomatic courses to severe pneumonia with lung failure and death. That is why there is currently a lot of research and publications on the coronavirus, the disease COVID-19 and their treatment opportunities in international medical databases and important medical journals.

## Research results say: COVID-19 is a systemic vascular disease

Currently multiple research results describe COVID-19 as less of a lung disease and more of a systemic vascular disease that may lead to strokes.

The research question of whether COVID-19 is a systematic vascular disease is based on the fact that - despite aggressive incubation to save COVID-19 patients - there were high death rates. Research studies were able to prove the hypothesis that COVID-19 can affect not only the lungs but also the vessels of all organs. Accordingly, the coronavirus affects not only the respiratory tract, but also the neurovascular unit, which supplies vital organs - the brain, kidneys and lungs.

SARS-CoV-2 infection can be particularly dangerous in patients whose vascular function is already impaired by pre-existing conditions. This explains the typical clinical picture in which **circulatory disorders in the heart**, as well as **pulmonary embolism** and **vascular occlusions in the brain** and kidneys could result. These can eventually lead to fatal multi-organ failure.

For the researchers, this has consequences for the decision on treatment and therapy of COVID-19 patients.

## Research results say: COVID-19 promotes the development of strokes

In a recent study from Wuhan<sup>1</sup>, 40 out of 88 patients with severe COVID-19 progression showed neurological symptoms. Five of them alone had suffered a stroke. This raised the research question of whether a stroke is a direct result of the severe SARS-CoV-2 infection or the result of the fact that patients with severe COVID-19 progression are also cerebrovascular risk patients at the same time.

The scientists emphasize that it is mainly multi morbid patients with **cardiovascular risk factors** such as high blood pressure, high blood lipids (Hypercholesterolaemia), high blood sugar levels (Diabetes mellitus) and patent foramen ovale (PFO) who are seriously affected by COVID-19. The higher stroke rate could therefore be due to a selection bias and not a direct consequence of infection.

*"D-dimers increase with sepsis, but can also indicate an activation of the coagulation system, as is also known for other serious viral infections. SARS-CoV-2 could lead to strokes. It is interesting that vasculitis (inflammation of the vascular system) was histologically proven in myopathies as part of the SARS infection. Given the high affinity - also of the current pathogen to the AT 2 receptor - vasculitis appears to be conceivable as a cause of stroke."*

(Prof. Peter Berlit,  
Secretary General of the German Society of Neurology (DGN))

## Research results say: COVID-19 causes vascular inflammation, heart attack, stroke

If COVID-19 leads to **vasculitis** and the arterial walls are inflamed, then the oxygen in the blood could not be released into the tissue and the patient "suffocates" anyway, even if the blood has been oxygenated with a ventilator.

Furthermore, even in the acute phase of COVID-19, the insufficient blood supply to the cardiovascular system can lead to a **heart attack** or the poor blood supply to the arteries supplying the brain to a **stroke**.

# TCD in use with COVID-19 for early detection and therapy determination

With vasculitis, the inflammatory reaction leads to vascular narrowing with relevant cerebral blood flow velocities (CBFV) changes. An **intracranial routine examination** can assist in diagnosis of vasculitis by following proximal cerebral vascular abnormalities.

**Emboli detection** and a **TCD-based PFO test** can indicate an increased risk of thrombosis and stroke in COVID-19 patients. Therefore, a therapy can be determined more precisely and the patient can be protected against possible consequential damage with appropriate measures. Automatic Emboli Detection distinguishes emboli from artefacts. In Doppler M-mode, the embolisms can be observed, counted and documented whilst passing through the various depths.

Since inflammation on the vascular system has a serious influence of the blood flow velocities, the course of the disease and therapy of a patient affected by COVID-19 can be controlled and optimized using the **Neuromonitoring Analysis (NMA®)**. The TCD analysis software NMA® enables the distinction between pathological and non-pathological findings. The use of this new type of screening software enables the transcranial blood flow velocities in COVID-19 patients to be interpreted quickly and reliably, thus providing valuable information for further assessment in the course of the disease and for therapy control.

Automatic **Emboli Detection** and **Neuromonitoring Analysis (NMA®)** screening software can be easily installed on the **DWL Doppler systems Doppler-Box® X, Multi-Dop® T and Multi-Dop® X** and is quickly ready for use.



Doppler-Box® X



Multi-Dop® T



Multi-Dop® X

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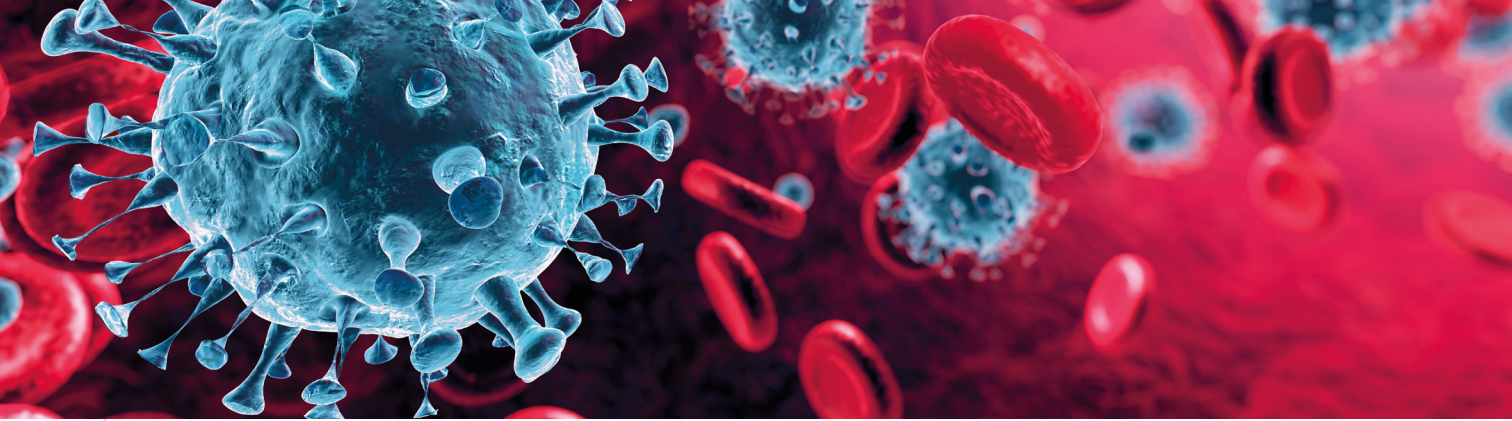
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## The advantage of TCD in use with COVID-19

With the help of non-invasive transcranial Doppler sonography, the risk of vascular diseases can be identified in COVID-19 patients and a targeted decision about their therapy and treatment can be made. TCD can thus prevent costly and possibly traumatic care for COVID-19 patients in an intensive care unit.

### Systemic vascular disease

Due to vascular inflammatory processes, oxygen exchange in the tissue can be impeded and acute respiratory distress syndrome can develop. **Differential diagnostics with TCD** can provide valuable information as to whether treatment with a ventilator is actually effective.

### Vascular inflammation (vasculitis)

Vascular inflammation (vasculitis) can lead to changes of narrowing in the blood vessels, as a result of which ischemic strokes occur. An intracranial **routine examination** can diagnose cerebral vasculitis.

### Organ damage

If inflammatory processes of the neurovascular system are set in motion, serious organ damage can occur in the further course. **NMA screening** offers the possibility in the early stages of the disease to estimate how difficult the course of the disease could be. This offers the opportunity to prevent serious consequential damage through immediate interventions. In addition, the course of the disease and therapy can be controlled and optimized through NMA screening.

### Strokes and heart attacks

In viral coagulation disorders and thrombosis, increased embolism can be observed. **Emboli detection** in patients with mild or even no symptoms can be used to determine whether there is an increased risk of stroke or heart attack in the early stages of the disease.

### Significantly increased risk of stroke with PFO

In patients with a PFO (patent foramen ovale), the risk of stroke is increased many times over, since the thrombi occurring in the veins due to the virus can thereby pass into the arterial vascular system. A right-left shunt can be detected with a **PFO test**.



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