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The virtual ESO-WSO 2020 Conference, jointly organized by the European Stroke Organisation and the World Stroke Organization, presents latest stroke research results and developments.

COVID-19

The COVID-19 disease can trigger a whole series of health problems. On the one hand, it raises the risk of stroke; on the other, the circumstances arising from the pandemic create a situation where stroke patients may avoid seeking and receive insufficient medical care. Raul Nogueira, Director of the Endovascular Service at the Grady Memorial Hospital in Atlanta, USA, explained at the ESO-WSO 2020 Conference, that emergency rooms and hospitals recorded a decline in admissions of stroke victims during the first phase of the pandemic, with a subsequent decrease of acute revascularization treatments.

Relationship between COVID-19 and stroke: current knowledge

Patrik Michel from the Stroke Centre at Lausanne University Hospital in Switzerland, member of the ESO-WSO-conference PR committee who participated in the Global COVID-19 Stroke Registry (Ntaios G, Michel P, et al, Stroke 2020), explains that the risk of having an *ischaemic* stroke, appears to be higher with COVID-19. Whereas the relative risk of stroke rises by a factor of 2.9 if a patient has influenza (Boeme et al, Ann Clin Transl Neurol 2018); this risk for COVID-19 patients increases by an additional factor of 7.7 when compared to influenza (Merkler et al, JAMA Neurol 2020). There are also publications indicating a larger number of *haemorrhagic strokes* (intracerebral haemorrhages). These can partially be caused by anticoagulation used in COVID patients, for example during ECMO therapy where a machine replaces lung functions. In addition, damage to small capillaries (microangiopathy, see below) may cause leakage of blood into the brain and cause small and large haemorrhages. Thirdly, the rate of cerebral *venous thromboses* might also be increased by a COVID-19 illness.

According to the Swiss expert, most stroke patients with COVID-19 exhibit classic cerebrovascular risk factors (Fridman et al, Neurology 2020; Nannoni et al, Int J Stroke 2020); however, younger patients with few or no risk factors are sometimes also affected by a COVID-19-related stroke (Fifi et al, Lancet 2020). In addition, strokes COVID-19 patients are usually more severe, exhibit a greater number of vascular occlusions and often affect the brain in multiple areas, both for ischemic (Nannoni et al, Int J Stroke 2020; Katz et al, Stroke 2020) and for haemorrhagic strokes (Nicholson et al, AJNR 2020).

Several reasons may explain the higher stroke risk in COVID-19 patients, mostly mediated by inflammation or by the virus itself:

- a prothrombotic state (tendency to have blood clotting) with a thrombotic microangiopathy (damage to the small capillaries) and a thrombotic macroangiopathy (activation of atherosclerotic plaques)

- damage to the endothelial layer of the blood vessels caused directly or indirectly by SARS-CoV-2, causing blood to clot or to leak through vessel walls
- damage to the heart due to SARS-CoV-2 (increase in heart enzymes, virus invasion, lymphocytes in the heart muscle, etc.) which then could malfunction or send clots to the brain

Still, as usual stroke risk factors and mechanisms appear to play an important role (Fridman et al, Neurology 2020; Nannoni et al, Int J Stroke 2020), and COVID is probably just a trigger in many stroke patients who are already predisposed for it.

Collateral damage caused by COVID-19

According to Raul Nogueira, the COVID-19 pandemic has given rise to collateral damage, too: in the United States (Lange et al, MMWR 2020; Baum et al, JAMA 2020), Europe (Hoyer et al, Stroke 2020, Montaner et al, Stroke 2020), and globally (Nguyen T, Nogueira RG et al, manuscript submitted), emergency room visits, use of acute stroke imaging (Kansegra et al, New Engl J Med 2020, Nogueira RG et al, manuscript submitted), and hospital admissions for strokes have declined by 10% to 50%. The consequence may cumulate in insufficient care and treatment of stroke victims leading to higher long-term disability, stroke recurrences, and death.

But what are the possible explanations for such a drop of acute stroke presentations? According to Patrik Michel, many people have fewer social contacts owing to the anti-COVID-19 measures, so minor or transient strokes may be less detected. Further explanations could be a fear of utilising health services and emergency rooms for fear of being infected there, or in order to “protect” the health system in these times of COVID-19. Finally, reorganisation of health care has in fact lead to a reduction of specific services, in particular of diagnostic facilities and outpatient clinics.

According to Raul Nogueira, numbers of thrombolysis and thrombectomy for ischaemic strokes fell by about 12% in their global registry (Nguyen T, Nogueira R et al, manuscript submitted), and even by 20-30% in specific regions (Hajdu et al, Stroke 2020; Kerleroux et al, Stroke 2020; Montaner et al, Stroke 2020). Also, the time interval between the onset of symptoms and acute treatment, crucial to the treatment success, became longer in many cases for thrombolysis (Montaner Stroke 2020, Tejada Eur J Neurol 2020) and thrombectomy (Hajdu et al, Stroke 2020; Kerleroux et al, Stroke 2020). Notably, an analysis encompassing 95,453 stroke hospitalizations across 145 US hospitals demonstrated a 41% increase in in-hospital mortality in relation to the pandemic (Nogueira RG et al, manuscript submitted). Raul Nogueira stressed that despite additional hygiene and safety measures required for proven or suspected COVID-19 patients, it is imperative that the public understands that effective and potentially life-saving revascularization therapy can still be delivered in a timely fashion.

Finally, Patrik Michel relates that COVID-related strokes have a more severe course, result in poorer outcome and lead to higher mortality than other strokes (Ntaios et al, Stroke 2020; Tejada et al, Eur J Neurol 2020; Nannoni et al, Int J Stroke 2020). This can be attributed to, on the one hand, the greater severity of COVID-19 strokes, and on the other, the pneumonia and complications associated with severe COVID-19.

The two experts urgently recommended that the usual, scientifically proven treatment methods are used to maintain the stroke chain of care (Markus and Brainin, Int J Stroke 2020; Qureshi et al, Int J Stroke 2020). After all, the "time is brain" rule still applies, and the message to convey to potentially affected individuals and their loved ones must be this: "COVID or no COVID – we continue to be here, ready to provide you with professional medical care."

You can find the recording of press conferences on the media portal: https://eso-wso-conference.org/media-portal/

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Many thanks in advance!