Oropharyngeal swab for SARS-CoV-2 test causing atypical internal carotid artery dissection and stroke in a patient after mild COVID-19

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Abstract: We report a patient who had recovered from pneumonia caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) presenting with acute cerebral ischemia due to atypical dissection of the left internal carotid artery immediately after an oropharyngeal swab (OPS) for SARS-CoV-2 RT-PCR testing. The symptoms consisting of right-side hemiparesis and aphasia improved after systemic thrombolysis and the patient recovered completely in the further course. We demonstrate findings from imaging (computed tomography, magnetic resonance imaging, neurovascular ultrasound) among other investigations and discuss coronavirus disease 2019 (COVID-19)-related vessel wall vulnerability as well as tissue injury posed by the swab procedure as underlying causes of the dissection. Individuals performing OPSs during the corona pandemic should be aware of this so far undescribed complication.

Keywords: cervical artery dissection, COVID-19, SARS-CoV-2, stroke, swab

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cerebrospinal fluid findings with negative viral search panel including negative SARS-CoV-2-RT-PCR. There were no signs or symptoms of hereditary tissue disease or migraine; cerebrovascular risk factors (such as smoking, obesity, hypertension) were absent and family history was unremarkable for dissection or stroke. Medical treatment included platelet inhibition with 100 mg/day acetylsalicylic acid and 40 mg/day atorvastatin as lipid lowering therapy. During rehabilitation, symptoms further improved and the patient recovered without sequelae, allowing him to go back to work after 3 months. Follow-up examination in our outpatient clinic including ultrasound and MRI 3 months later confirmed full neurological recovery, albeit with incomplete remission of ICA vessel wall injury (Figure 2d, f).

Discussion

COVID-19 as a predisposing condition for arterial dissections

Ischemic stroke has been described as major cardiovascular complication in patients with coronavirus disease 2019 (COVID-19). Mechanistically, this has been attributed mostly to a higher risk of thrombotic events due to a hypercoagulable state driven by systemic inflammation during the course of COVID-19. Additionally, direct coronavirus-induced endotheliitis has been observed in some patients. It seems plausible that this thrombo-inflammation increases vessel wall vulnerability, which may ultimately lead to dissection even upon mild tissue trauma. In fact, published cases of unusual presentations of arterial dissections in
COVID-19 patients include spontaneous bilateral carotid artery dissection and spontaneous coronary artery dissection.\(^4,5\) Arterial dissections are not specific for SARS-CoV-2, as also other respiratory infections have been shown to present a risk factor for cervical artery dissections (CAD) in the past.\(^6,7\) This risk was shown to be independent from mechanical strain through cough or...
sneeze, hinting at associated vessel pathology. Interestingly, in our case, vessel wall vulnerability seemed to outlast the acute infection phase as the dissection occurred 5 days after clinical recovery from COVID-19.

Role of tissue trauma following OPS
In the present case, the timing of stroke symptoms is highly suggestive for a causal link between the sampling of the OPS and the occurrence of ICA dissection. It is well established that CAD can appear after only minor trauma or even spontaneously.8,9 Hyperextension of the neck can be considered as such a minor trauma and has been described to be associated with CAD in the past, as it probably leads to compression of the ICA against the transverse processes of cervical vertebrae.9 Pressure exerted on the posterolateral wall of the oropharynx by the swab could also have added slight force onto the vessel in this case. The patient had been instructed to recline his head to a maximum position, which he described retrospectively as uncomfortable, and he reported that the swab felt locally painful. Remarkably, the site of dissection at the proximal ICA close to the carotid bulb, about 7 cm from the skull base, is untypical, since most ICA dissections occur adjacent to the skull base or 2–3 cm proximal to it.10,11

Conclusion
Since the beginning of the pandemic, the wide application of OPSs or nasopharyngeal swabs for the detection of SARS-CoV-2-RNA have been indispensable for diagnosis and incidence monitoring.12 Although this procedure can be generally regarded as safe, the present case report underlines the potential risk of rare but severe complications, e.g. dissection of head and neck arteries. Therefore, the manipulation should be performed only by trained personnel and with high caution, particularly in individuals with predisposing risk factors such as existing or currently remitted COVID-19 or a history of arterial dissection. Moreover, swabs testing against SARS-CoV-2 should be restricted to situations reasonable from an infectiological perspective.

Author contributions
LA collected data, wrote the manuscript and created figures. CD and MF supervised and evaluated neuroimaging data. CK supervised diagnosis and treatment. MK collected data and delivered diagnosis and treatment. All authors read, reviewed and approved the final manuscript.

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The patient gave written consent to publication of images and medical information.

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References
1. Ellul MA, Benjamin L, Singh, et al. Neurological associations of COVID-19. Lancet Neurol 2020; 19: 767–783.
2. Varga Z, Flammer AJ, Steiger P, et al. Endothelial cell infection and endotheliitis in COVID-19. Lancet 2020; 395: 1417–1418.
3. Patel P, Khandelwal P, Gupta G, et al. COVID-19 and cervical artery dissection- a causative association?. J Stroke Cerebrovasc Dis 2020; 29: 105047.
4. Kumar K, Vogt JC, Divanji PH, et al. Spontaneous coronary artery dissection of the left anterior descending artery in a patient with COVID-19 infection. Catheter Cardiovasc Interv. Epub ahead of print 7 May 2020. DOI: 10.1002/ccd.28960.
5. Morassi M, Bigni B, Cobelli M, et al. Bilateral carotid artery dissection in a SARS-CoV-2 infected patient: causality or coincidence? J Neurol 2020; 267: 2812–2814.
6. Grau AJ, Brandt T, Buggle F, et al. Association of cervical artery dissection with recent infection. Arch Neurol 1999; 56: 851–856.
7. Hunter MD, Moon YP, Miller EC, et al. Influenza-like illness is associated with increased short-term risk of cervical artery dissection. J Stroke Cerebrovasc Dis 2021; 30: 105490.
8. Engelter ST, Grond-Ginsbach C, Metso TM, et al. Cervical artery dissection: trauma and other
potential mechanical trigger events. Neurology 2013; 80: 1950–1957.

9. Caso V, Paciaroni M and Bogousslavsky J. Environmental factors and cervical artery dissection. Front Neurol Neurosci 2005; 20: 44–53.

10. Downer J, Nadarajah M, Briggs E, et al. The location of origin of spontaneous extracranial internal carotid artery dissection is adjacent to the skull base. J Med Imaging Radiat Oncol 2014; 58: 408–414.

11. Blum CA and Yaghi S. Cervical artery dissection: a review of the epidemiology, pathophysiology, treatment, and outcome. Arch Neurosci 2015; 2: e26670.

12. Velavan TP and Meyer CG. COVID-19: a PCR-defined pandemic. Int J Infect Dis. Epub ahead of print 1 December 2020. DOI: 10.1016/j.ijid.2020.11.189.