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Acute Ischemic Stroke Due to Basilar Artery Occlusion with Coronavirus Disease 2019: A Case Report

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Abstract

Although it is increasingly recognized that coronavirus disease 2019 (COVID-19) can cause multi-organ disease, including acute ischemic stroke, the incidence of coagulation disorder is reported to be lower in Asian countries. We report a case of a 47-year-old Asian man with mild COVID-19 respiratory symptoms who had acute basilar artery occlusion. Despite successful recanalization with mechanical thrombectomy, the patient developed extensive cerebral infarction in the posterior circulation, necessitating decompressive craniotomy. Our findings suggest that severe large vessel occlusion (LVO) can occur even in young Asian patients with mild COVID-19 respiratory symptoms and that its outcome can be extremely severe despite successful recanalization. The management of COVID-19-related LVO can be very challenging, as both the prevention of possible nosocomial infection and early recanalization are required simultaneously.

Keywords: COVID-19, basilar artery occlusion, mechanical thrombectomy, SARS-CoV-2

Introduction

It is increasingly recognized that coronavirus disease 2019 (COVID-19) can cause multiple organ diseases, including pulmonary embolism and cerebral infarction due to coagulation disorders.[1)] However, the incidence of such coagulative complications is reported to be higher in North America and Europe,[2)] and to the best of our knowledge, there are few reports of COVID-19-related large vessel occlusion (LVO) in Asian people.[3)] Herein, we report a case of acute ischemic stroke (AIS) due to basilar artery occlusion in a young Japanese patient with confirmed COVID-19, who had mild respiratory symptoms before developing AIS. Our case followed a severe course despite the maximal treatment including mechanical thrombectomy, thus alerting us that the management of COVID-19-related LVO is very challenging.

Case Report

A 47-year-old Asian man with a past medical history of hypertension and diabetes developed general fatigue and fever 2 weeks before admission. Eight days before admission, his son was diagnosed with COVID-19. Six days before admission, he and his wife were also confirmed to have COVID-19 by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) polymerase chain reaction (PCR) tests. His symptoms of general fatigue continued until the day of admission, but there was no demand for additional oxygen. Following the guidance of the local healthcare center, he had stayed at home for 2 days before admission. On the day of admission, he suddenly noticed slurred speech and right-sided weakness. After the consecutive refusals by more than 30 hospitals, the patient was finally transferred to our hospital 280 min after symptom onset. He tested positive for SARS-CoV-2 PCR test on admission.

On arrival, he had mild consciousness disturbance (Glasgow Coma Scale E2V4M6), left hemiplegia (manual muscle test 3/5), and moderate dysarthria. His National Institutes of Health Stroke Scale score was 14. On plain head-CT scan images, hyperdensity of the basilar artery tip was noted, but global ischemia of the posterior circulation was not evident (PC-ASPECTS 9/10). On brain MRI, taken 360 min after symptom onset (80 min after his arrival), occlusion of the basilar artery tip was confirmed (Fig. 1). Since the patient's consciousness gradually decreased (GCS E2V2M3) after the imaging, general

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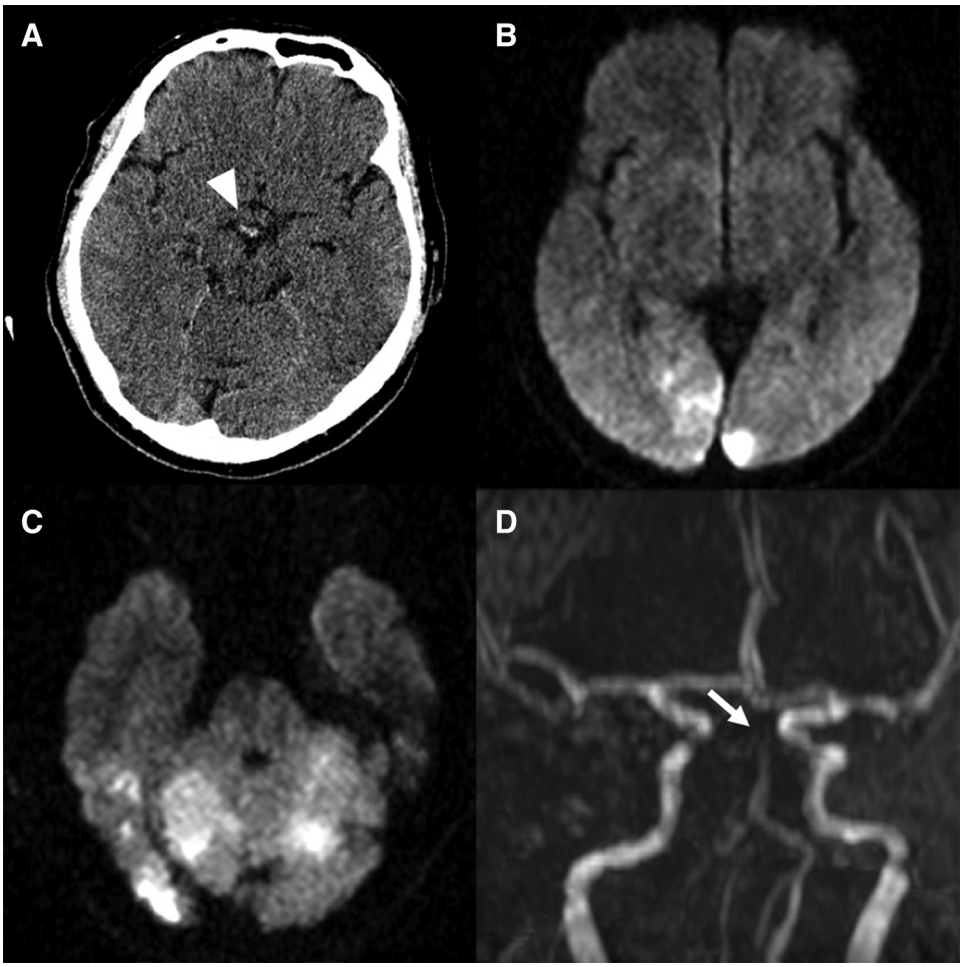

Fig. 1 Imaging studies on the patients' arrival. (A) CT scan showing hyper-density of basilar artery tip (white arrowhead); however, the global ischemia of the posterior circulation is not evident. (B and C) On the MRI diffusion-weighted image, acute ischemic lesion was mainly located in the bilateral cerebellar hemisphere, and the bilateral thalamus and the brainstem were spared. (D) The occlusion of basilar artery tip was confirmed by time-of-flight MRA (white arrow). Comparison with the high intensity lesion in the diffusion-weighted image suggested that some ischemic penumbra remained.

anesthesia was introduced. The cerebellar infarction was evident on the MRI scan; however, there was no diffusion-weighted high intensity area in the basilar tip perforator area. We speculated that the brainstem ischemia was reversible and the consciousness disturbance could be recovered by recanalization. Following the judgment that the patient still had ischemic penumbra, mechanical thrombectomy was performed.

According to the predetermined protocol for emergency intervention in patients with possible COVID-19, the angiosuite was prepared before the patient entered the room. Only the minimum devices required for the procedure were kept in the room. To avoid contamination from virus-containing droplets, the wall of the room was completely covered with disposable papers and vinyl (Fig. 2A). To minimize contamination, all movements of the medical staff and patients were controlled under the zoning concept (Fig. 2B). All the medical staff in the contaminated environment protected themselves with maximal barrier protection, including N95 masks and face shields (Fig. 2C). All preparations were performed while the patient was intubated in the emergency room (Fig. 2D).

Femoral puncture was performed 458 min after symptom onset (98 min after MRI). Left vertebral angiogram revealed basilar tip occlusion (Fig. 3A). Initially we attempted a direct aspiration first pass technique (ADAPT) two times with an ACE60 aspiration catheter (Penumbra Inc., Alameda, CA, USA), but only tiny clots were retrieved and recanalization

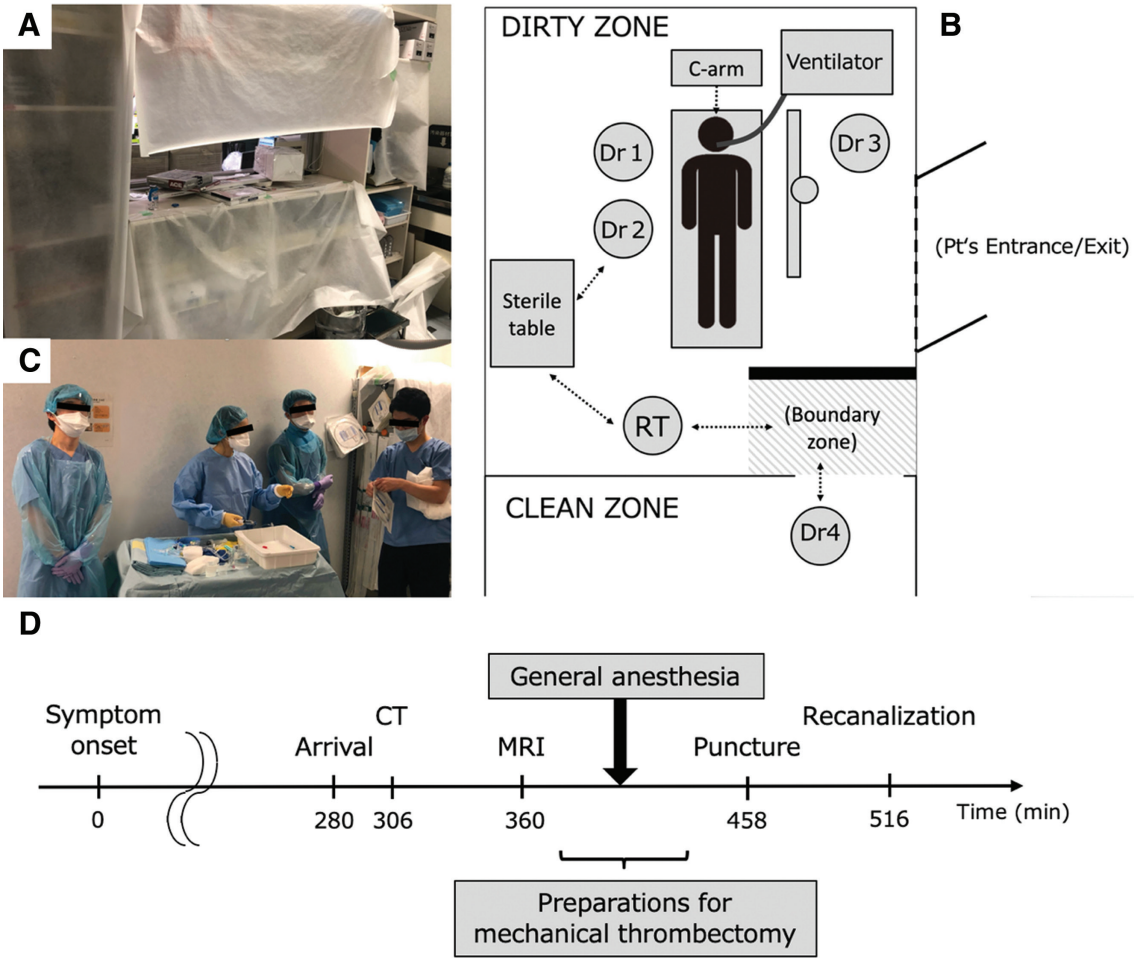

Fig. 2 Infection control methods during mechanical thrombectomy. (A) To avoid the virus-containing droplets, the wall of the room was completely covered with disposable papers and vinyl. (B) To minimize contamination, all movements of medical staff and patients were controlled under the zoning concept (Dr.: doctor, RT: radiologic technician). Drs. 1 and 2 (operator and main assistant, respectively) completed sterilization procedure and remained in the dirty zone during the procedure. Dr. 3 (anesthesiologist) also stayed in the room. The radiation technician stayed mainly in the dirty zone, but if necessary, entered the boundary zone to provide Dr. 4 (who remained in the clean zone) with (the minimally required) devices and medicines. (C) All medical staff in the contaminated environment used maximal barrier protection, including N95 mask and face-shield. (D) The schema summarizing the time course of the case. The patient was transferred to our hospital 280 min after symptom onset. The overall time from symptom onset to recanalization was 516 min.

was not successful. In the third pass, the combination of a stent retriever (Solitaire Platinum 4 × 20 mm; Medtronic, Minneapolis, MN, USA) and ACE60 (Penumbra Inc.) (Fig. 2B) was used during the recanalization of the basilar tip, but the distal occlusion of the right posterior cerebral artery and the left superior cerebellar artery remained. After the unsuccessful fourth attempt of recanalizing the right posterior cerebral artery with ACE60 ADAPT, we stopped the procedure. The final recanalization status was TICI 2b and the onset to recanalization time was 516 min (puncture to recanalization time was 58 min) (Fig. 3C). The postoperative CT scan showed slight subarachnoid hemorrhage at the left ambient cistern, but intracranial hemorrhage was not observed.

The retracted clot was 35 mm in length and had a red appearance (Supplementary Fig. 1A; All Supplementary figures are available online). Microscopically, the clot was composed largely of fibrin and red blood cells, and neutrocyte infiltration was also present; resembling a normal clot, the type usually found following mechanical thrombectomy (Supplementary Fig. 1B). The clot tested negative for both SARS-Cov-2 PCR test and bacterial culture. As cerebellar edema and hydrocephalus were observed

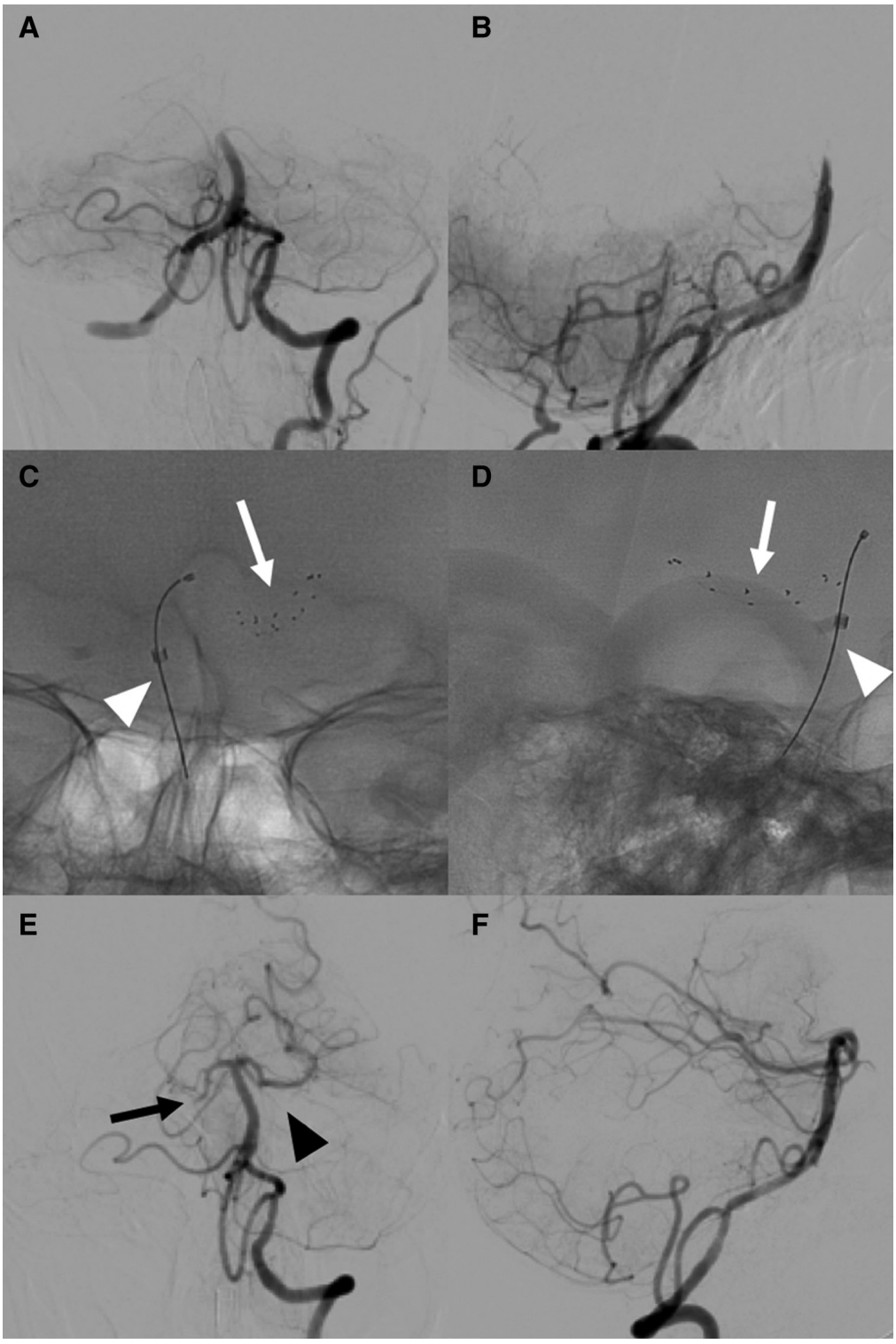

Fig. 3 Mechanical thrombectomy. (A and B) Left vertebral angiogram (A: anteroposterior [AP] view, B: lateral view) after guiding catheter navigation revealed basilar tip occlusion. (C and D) In the third pass, a combination of a stent retriever (Solitaire Platinum 4 × 20 mm) (white arrow) and an aspiration catheter ACE60 (white arrowhead) lead to the recanalization of basilar tip (C: AP view, D: lateral view). (E and F) After a total of four passes, TICI 2b recanalization was achieved (E: AP view, F: lateral view). Onset to recanalization time was 516 min (puncture to recanalization time was 58 min). Note the residual occlusion of right PCA (black arrow) and left SCA (black arrowhead).

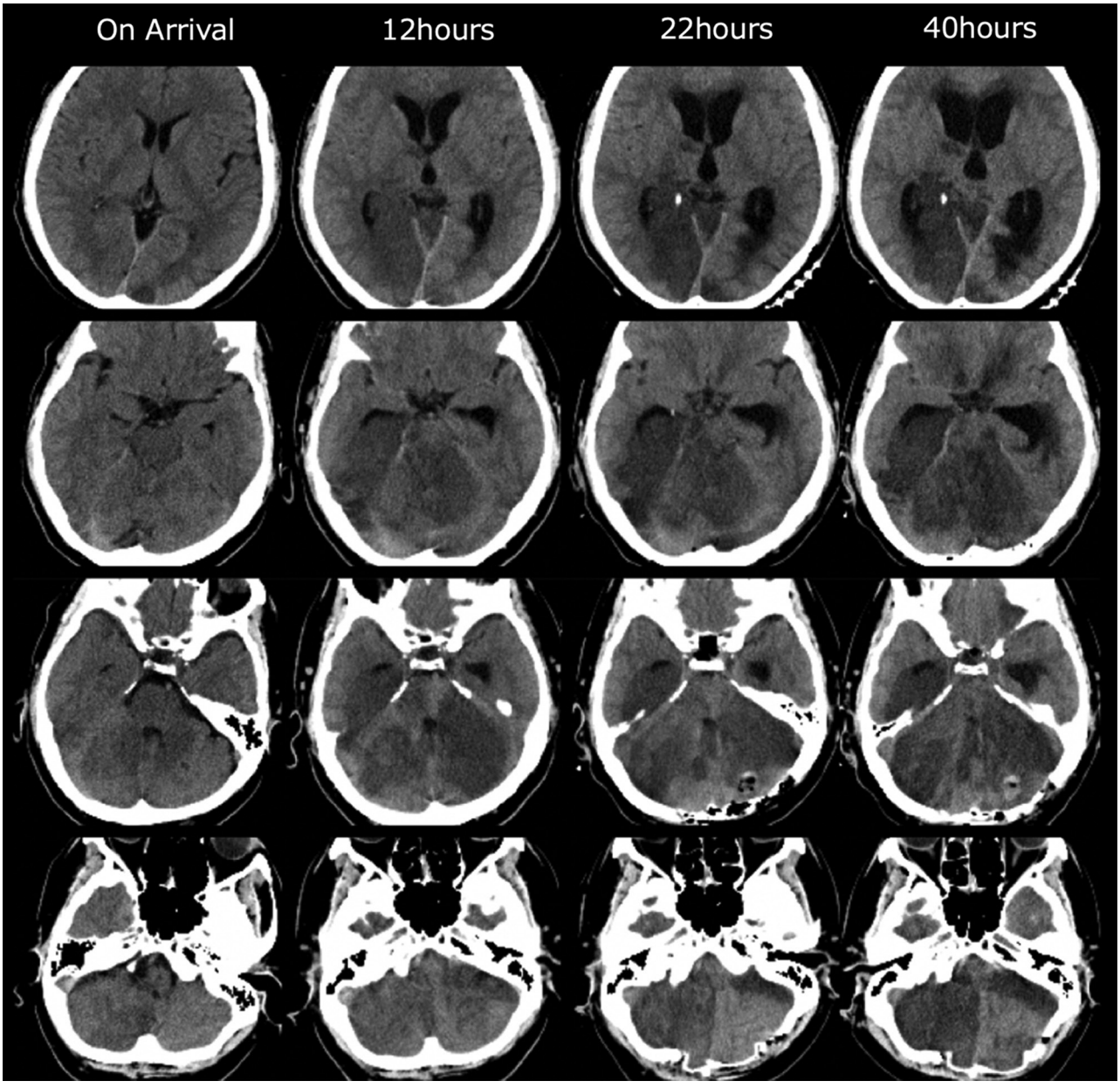

Fig. 4 Follow-up images of CT scans over time. Because cerebellar edema and hydrocephalus were observed on follow-up CT scans, a decompressive craniectomy was performed 18 h after arrival.

on follow-up CT scans, a decompressive craniectomy was performed 18 h after arrival (Fig. 4). To prevent possible worsening of the patient's respiratory status, low-dose dexamethasone (6.6 mg/day) was administered after decompressive craniectomy. Although the patient was kept intubated and managed with a ventilator during hospitalization, there was little demand for oxygen, and no signs of severe COVID-19 pneumonia were observed during the postoperative management. As the patient's level of consciousness did not improve, a tracheostomy was performed and transfer to another hospital is currently planned.

Discussion

We encountered a case of AIS due to basilar artery occlusion in a confirmed COVID-19 patient. To the best of our knowledge, this is the first report of an LVO associated with COVID-19 in Japan. In the current COVID-19 pandemic situation, it is possible that the simple coincidence of COVID-19 and the LVO occurred in this patient. However, the patient was quite young, and he did not show any arrhythmia or other sign of embolic stroke sauce during the hospitalization after thrombectomy. The cause of

the LVO can therefore be attributed to COVID-19 in this case.

AIS due to LVO in COVID-19 patients has been reported more frequently in young men, which is consistent with the present case.[4–6] As reported in the literature, patients are often asymptomatic or have mild symptoms of COVID-19 at the time of stroke onset, which is also consistent with this case.[6] In a Japanese survey, the incidence of venous thromboembolism and pulmonary embolism was reported to be quite low compared to that in Europe and North America.[7] From a genetic point of view, it is speculated that differences in patients' angiotensin-converting enzyme-related genes can influence the clinical severity of COVID-19.[8] Although we do not know the exact incidence of COVID-19-related LVO in Asian people, all healthcare professionals, including clinicians and administration staff, should be aware that such severe complications can occur even in asymptomatic or mild COVID-19 patients.

COVID-19 patients with LVO have been reported to have a poor prognosis,[4–6] which is also consistent with the present case. The main reason is the time delay in the management of COVID-19 patients. In our case, the time from symptom onset to patient admission, from admission to MRI imaging, and from MRI to puncture was significantly longer than in our normal clinical practice (data not shown). In a previous study, it was also reported that these time metrics became longer in the COVID-19 pandemic era than in the pre-COVID-19 era.[9] This time delay may be attributed to the time taken for infection control and the time taken to select a suitable medical institution for transport. Moreover, even after early recanalization is achieved with successful thrombectomy, it is reported that there is a high risk of multiple distal artery occlusion and reocclusion of the recanalized vessel.[7,9] Accordingly, the reported mortality of COVID-19-related LVO is miserably high (29.8%–60%).[4,6] Coagulation disorders related to COVID-19 are believed to play a major role in such severe outcomes.[10]

In the scenario of COVID-19 pandemic, the management of AIS in the real-world has also dramatically changed.[11] Some of these changes are aimed at protecting medical staff from nosocomial infections, and various protocols have been rapidly prepared.[12,13] However, our case suggested that the real-world clinical practice was more complex. For example, Japan Stroke Society Protected Code Stroke for COVID-19 states that AIS should be evaluated by CT and CTA.[14] It is true that the MRI scan might delay the treatment and increase the risk of nosocomial infection, but there has been no high-level evidence of mechanical thrombectomy in posterior circulation LVO.[15] That was why we judged that MRI was necessary before performing thrombectomy in our case. In summary, the management of COVID-19-related LVO is very challenging. It is warranted that clinicians and healthcare administration staff cooperate to achieve both the prevention of possible nosocomial infection and early recanalization at the same time.

Conclusion

We encountered a case of AIS due to basilar artery occlusion in a young Japanese patient with confirmed COVID-19, who had minimal symptoms before developing AIS. Our case followed a severe course despite maximal treatment including mechanical thrombectomy. Due to the simultaneous requirements of preventing nosocomial infection and early recanalization, the management of COVID-19-related LVO is very challenging.

Conflicts of Interest Disclosure

None.

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