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Case report

A case of acute cerebral infarction with a favorable prognosis after rt-PA administration by a general physician with telestroke support

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Abstract

Objective: Herein, we report a patient with acute cerebral infarction with a favorable prognosis after being managed by a general physician with support from the telestroke program.

Patient and Methods: An 85-year-old man was transferred to a regional hospital due to sudden onset of dysarthria and left hemiparesis. As no neurosurgeons or neurologists were available in that hospital or area, the patient was examined by a general physician who diagnosed him with cardioembolic stroke on the left middle cerebral artery territory. The physician consulted a stroke specialist using the telestroke system; with the support from the telestroke program, the physician administered thrombolytic therapy 4 hours and 10 minutes after the onset of symptoms.

Results: The patient's National Institutes of Health Stroke Scale score improved from 9 to 3 and he was subsequently transferred to the stroke center. However, the occluded left middle cerebral artery had already re-canalized. His hemiparesis completely improved one week after the onset.

Conclusion: A telemedicine system for general physicians is indispensable in areas without accessible stroke specialists as it provides access to a standard of care for hyper-acute stroke patient assessment and management, and helps improve neuroprognosis.

Key words: acute cerebral infarction, rt-PA therapy, neuroprognosis, telestroke, general physician

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Introduction

In Japan, cerebral infarctions account for about 70% of all stroke cases and 18.5% of stroke cases in bed-ridden patients[1, 2]. Therefore, it is important to improve the functional prognosis of patients with acute cerebral infarction (acute ischemic stroke, AIS). The use of thrombolytic therapy with intravenous administration of recombinant tissue plasminogen activator (rt-PA) within 4.5 hours of onset and/or performing endovascular thrombectomy using a stent retriever for patients with middle cerebral artery (MCA) or internal carotid artery (ICA) stroke within 6 hours of onset has been shown to improve prognosis[3–7]. Therefore, to improve the prognosis of patients with AIS, physicians must quickly determine the diagnosis and decide if an indication for rt-PA therapy or endovascular thrombectomy exists. However, some areas in medically depopulated regions, such as Miyazaki Prefecture, have no nearby stroke centers, neurosurgeons, or neurologists. To improve the prognosis of patients with AIS in such areas, general physicians need to administer rt-PA therapy. However, to our knowledge, there has been no telemedicine system intended to support general physicians in performing rt-PA therapy for AIS patients.

To encourage general physicians to administer rt-PA therapy without delays and risks, we established a new type of stroke telemedicine support system, which we reported previously[8]. This program enabled the sharing of images and "face-to-face" discussions of symptoms, diag-

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nosis, and treatment options with stroke specialists using a mobile device with a thin-client viewer system and videophone[8]. In our previous report, we showed the efficacy of this telestroke system in reducing the time to administer intravenous thrombolysis in cases of acute cerebral infarction; however, we could not show its efficacy on improving the prognosis of patients[8].

Herein, we report the case of a patient with AIS who was given rt-PA therapy by a general physician with the support of this telemedicine system resulting in a favorable prognosis. We also discuss the usefulness of this program in rural areas.

Case Report

An 85-year-old man experienced weakness in his left lower leg and had a fall at 8:30 am one day. His family then noticed that he was speaking sluggishly, but as he was able to walk without support at this time, he did not visit the hospital. At 10:30 am on that same day, he noted difficulty in walking and was brought to a nearby hospital. The hospital did not have a neurologist or neurosurgeon; thus, it was a general physician who provided medical care. At the time of admission, the patient was alert and had stable vital signs. However, he was observed to have dysarthria, left-sided facial palsy, and left hemiparesis. He was on medication for hypertension and chronic heart failure. His blood pressure was 151/61 mm Hg. There was no history of convulsions. Blood tests revealed no hypoglycemia, and no coagulopathy or thrombocytopenia (blood glucose, 97 mg/dL; PT-INR, 0.94; platelet count, 16.2 × 10^4/μL). Computed tomography (CT) revealed no intracranial hemorrhagic lesions and magnetic resonance imaging (MRI) revealed no abnormal areas of intensity on diffusion-weighted images (DWIs); however, occlusion or severe stenosis of the right MCA (M1 portion) was suspected (Figure 1). Based on these findings, the patient was diagnosed with an acute cerebral infarction and a request for telemedicine support was sent to the stroke center. During this time, his National Institutes of Health Stroke Scale (NIHSS)[9] score was 9. Since there were no contraindications, the general physician began rt-PA therapy at a dose of 38.4 mg (0.6 mg/kg, body weight 64 kg) under the supervision of a specialist at the stroke center; the patient was then transported to the stroke center in a physician-staffed emergency helicopter. The time from stroke onset to the initiation of rt-PA infusion was 4 hours and 10 minutes, and the time from the patient's arrival at the regional hospital to the initiation of rt-PA therapy was 1 hour and 20 minutes. After the administration of rt-PA at the regional hospital, his NIHSS score improved to 3 points. An MRI at the stroke center revealed a decrease in cerebral blood flow in the right MCA region; however, the right MCA had already recanalized and there were no infarcted areas on DWIs (Figure 2). A week after the onset of symptoms, the patient's hemiparesis had completely resolved and he was discharged from the stroke center on foot. Had this

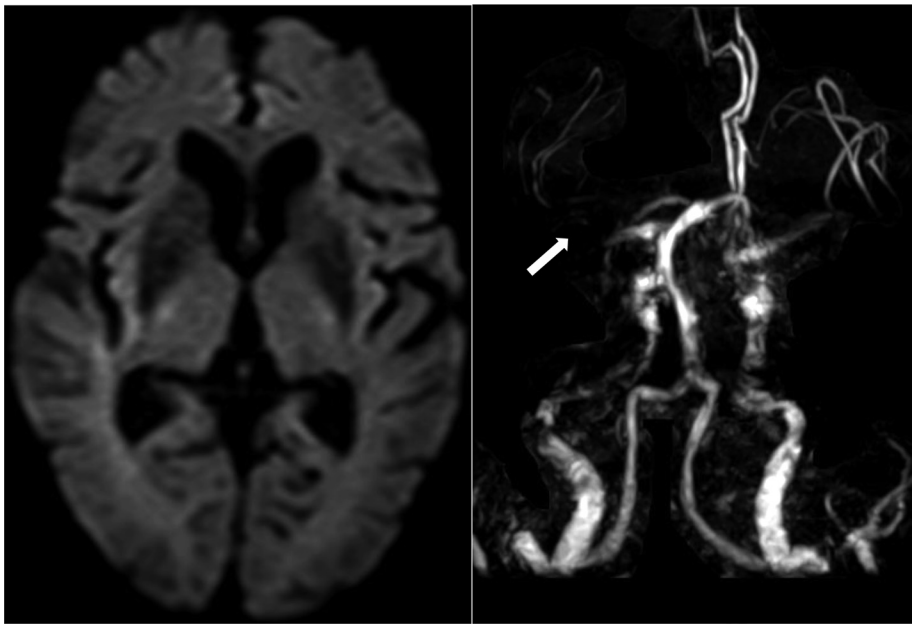

Figure 1 Magnetic resonance imaging (MRI) scan results at the first hospital.
Left: Diffusion-weighted axial image. Right: Magnetic resonance angiography. MRI revealed no abnormal intensities on diffusion-weighted imaging (DWI); however, occlusion or severe stenosis of the right middle cerebral artery (M1 portion) was suspected (arrow).

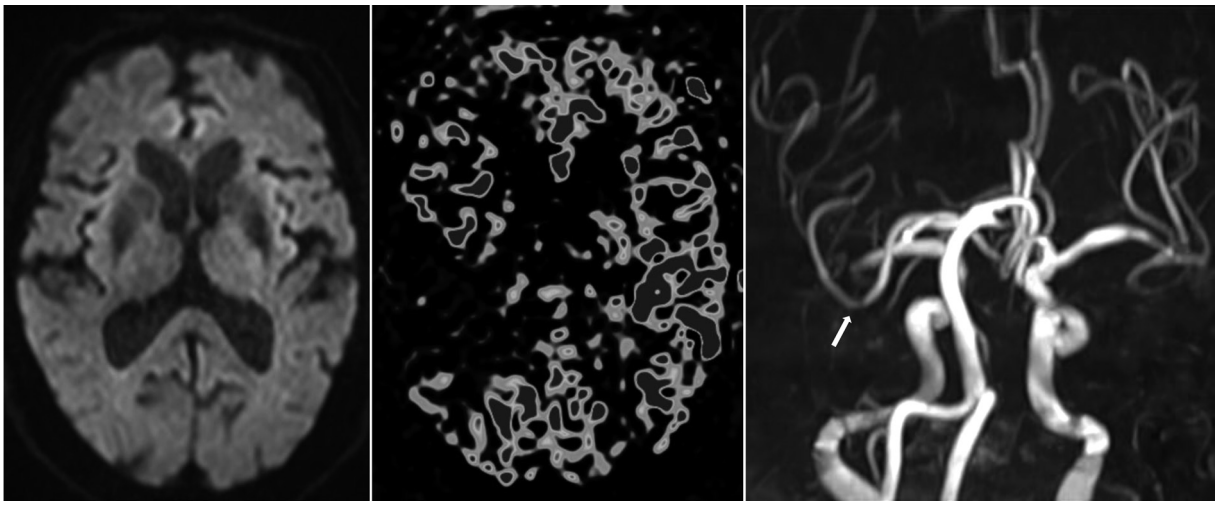

Figure 2 Magnetic resonance imaging (MRI) scan results at the stroke center after intravenous administration of recombinant tissue plasminogen activator at the first hospital.
Left: Diffusion-weighted axial image. Middle: Arterial spin labeling imaging. Right: Magnetic resonance angiography. The MRI at the stroke center revealed a decrease in the cerebral blood flow in the right middle cerebral artery (MCA) territory; however, the right MCA had already recanalized (arrow) and there were no infarcted areas on diffusion-weighted imaging.

patient been transported directly from the regional hospital to the nearest stroke center when he first arrived, it would have taken him an additional 44 minutes, and rt-PA therapy would not have been possible.

Approval of the research protocol

This case report was approved by a suitably comprised institutional ethics committee. (University of Miyazaki, Approval No. C-0109).

Informed consent

Written informed consent was obtained from the patient.

Discussion

The patient we report here was from Kushima City, which is the southernmost part of Miyazaki Prefecture. In Kushima City, there are no neurosurgeons or neurologists. It would have taken approximately 44 minutes to transport the patient by ground ambulance to the nearest stroke center after his diagnosis in the first hospital. If the patient had been transported by a physician-staffed helicopter from the base hospital to the nearby stroke center, it would have taken 35 minutes. It is necessary to initiate rt-PA therapy as soon as possible to improve prognosis after AIS in an area where there are no nearby stroke centers, neurosurgeons, or neurologists, such as in our case. In these situations, general physicians are expected to administer rt-PA with telestroke support to shorten the time between the onset of symptoms and the initiation of rt-PA therapy[8, 10, 11]. Most telestroke systems in recent years were intended for neurosurgeons or neurologists to provide consultations in hospitals without a stroke specialist regarding the indications for endovascular mechanical thrombectomy[12, 13]. However, in sparsely populated areas where there are no neurosurgeons or neurologists, it is necessary to establish a system that responds to lower level queries. In other words, it is necessary to establish a telemedicine system that encourages all physicians who are in charge of the initial examination to administer rt-PA therapy regardless of their specialty. However, to mitigate errors, assistance is required during the assessment of neurological symptoms, calculation of the NIHSS scores, and double-checking the dose of rt-PA. For these reasons, we established a new type of stroke telemedicine support system that enabled the sharing of images and "face-to-face" discussions with stroke specialists about the patient's symptoms, diagnosis, and treatment using a mobile device with a thin-client viewer system and videophone[8].

In this case, although the patient had a favorable prognosis with rt-PA therapy under telestroke, it took 80 minutes from the time of presentation to administer rt-PA. This was due to inadequate manpower; the general physician had to treat this patient while examining a general outpatient.

There are concerns regarding the possibility of determining the NIHSS score through telemedicine consultations within an appropriate time. Isahaya et al. reported that there was no difference in the accuracy of evaluating the NIHSS score regardless of whether a video transmission system was used or if a "face-to-face" examination of the patient was performed[14]. Another concern is the potential difference in the therapeutic effect and the rate of complications between a general physician administering rt-PA ther-

apy with telemedicine support and a specialist infusing it at a stroke center. Pervez et al. compared the effectiveness and safety of rt-PA therapy in patients with AIS administered at stroke centers and at non-stroke centers via a stroke telemedicine system. They concluded that there were no significant differences in treatment efficacy, complication rates, or effectiveness[15]. Therefore, in areas where there are no accessible stroke centers, neurosurgeons, or neurologists, we believe that the establishment of telestroke for the guidance of general physicians is indispensable to obtain a favorable prognosis in AIS patients.

Finally, we performed a simulation of the actual procedure, from patient acceptance in the ambulance to the initiation of rt-PA therapy with telestroke support, just before this experience, which might have led to the favorable prognosis of this patient. Therefore, to improve the prognosis of patients with AIS in unpopulated areas, it is critical not only to introduce telestroke devices but also to conduct daily simulation exercises with the medical staff.

Conclusion

Herein, we reported a patient with AIS who had a favorable prognosis after being managed by a general physician who administered rt-PA therapy with telemedicine support. We also established its usefulness in rural areas. This case reiterates the necessity to establish a telemedicine system that enables the physician in charge of the initial diagnosis to start rt-PA therapy regardless of the specialty.

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