doi: 10.2176/nmccrj.cr.2020-0311

NMC Case Report Journal 8, 355–358, 2021

Successful Endovascular Thrombectomy for Acute M1 Occlusion in a Patient with Situs Inversus: A Case Report

Tomohide YOSHIE,[1] Yu SUZUKI,[1] Kentaro TATSUNO,[1] and Toshihiro UEDA[1]

[1]*Department of Neurology and Endovascular Treatment Service, St. Marianna University Toyoko Hospital, Kawasaki, Kanagawa, Japan*

Abstract

Situs inversus is a rare congenital anomaly which has the mirror image of systemic organs and vessels from their normal position. We report a case of endovascular thrombectomy for acute middle cerebral artery (MCA) M1 occlusion in a patient with complete situs inversus. A right-handed man in his 70s presented to our hospital with loss of consciousness, right-sided hemiplegia, and total aphasia. Endovascular thrombectomy was undertaken for left M1 occlusion. Guide catheter advanced through right aortic arch and injection showed innominate artery was on the left side. Left common carotid artery arose from left innominate artery. Using aspiration catheter and stent retriever, successful recanalization was achieved after three passes. For treatment of acute stroke with large vessel occlusion in patients with situs inversus, understanding anatomy and clinical features of situs inversus is important.

Keywords: situs inversus, thrombectomy, ischemic stroke

Introduction

Situs inversus is a rare congenital anomaly which has the mirror image of systemic organs and vessels from their normal position. It has been estimated that situs inversus occurs with an incidence of 1/8000–1/25000 live births.[1)] Aorta and branches of aortic arch, which catheters go through in endovascular thrombectomy for acute stroke, are also converted. We report a case of endovascular thrombectomy for acute middle cerebral artery (MCA) M1 occlusion in a patient with complete situs inversus.

Case Report

A right-handed man in his 70s presented to our hospital with loss of consciousness, right-sided hemiplegia, and total aphasia. Symptoms last known well to door time was 124 min and symptom recognition to door time was 18 min. His admission National Institutes of Health Stroke Scale (NIHSS) score was 36. His past medical history was unclear because of total aphasia.

Twelve-lead electrocardiogram showed arterial fibrillation and right bundle branch block. Lead I demonstrated a largely negative QRS complex and inverted T waves. The QRS complexes in leads aVR and aVL were reversed. There was a loss of amplitude in the precordial leads toward V6 (Fig. 1a). Magnetic resonance (MR) diffusion-weighted images showed cerebral infarction in left MCA area. MR angiography demonstrated left M1 segment occlusion; thus, endovascular thrombectomy was undertaken. He did not receive intravenous recombinant tissue plasminogen activator (rt-PA) prior to the procedure because of severe symptoms (NIHSS >25).

The procedure was performed awake with minimal sedation. Right common femoral artery was punctured and 9 Fr sheath was placed. Guidewire and 6 Fr JB2 catheter (Medikit, Tokyo, Japan) through 9 Fr Branchor balloon guide catheter (ASAHI INTECC, Aichi, Japan) were advanced. Abdominal aorta was on the mid of spine, however guide catheter advanced through thoracic aorta to the right side of spine (Fig. 2a). Fluoroscopy showed the cardiac apex was on the right side. A 6 Fr catheter was advanced through aortic arch on the right side, then selected left branch of aortic arch. Injection showed innominate

Received September 3, 2020; Accepted October 28, 2020

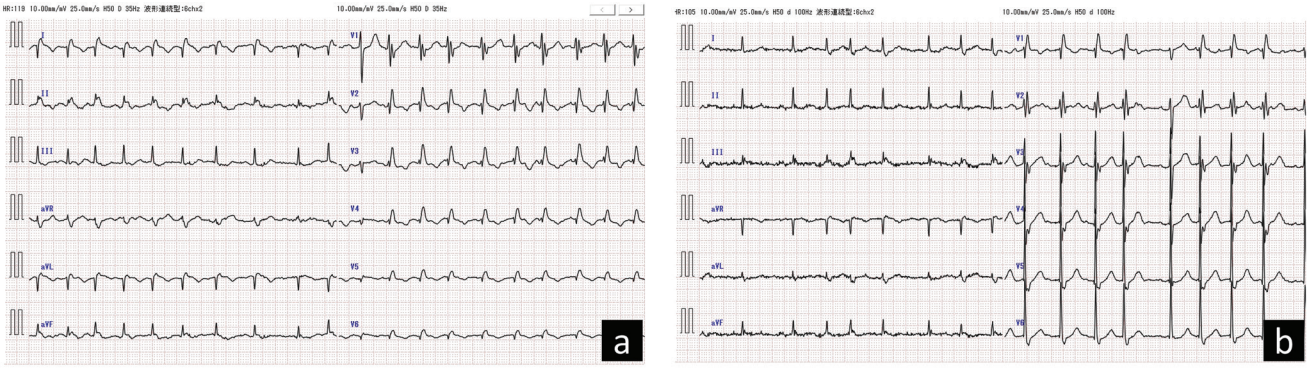

Fig. 1 Twelve-lead electrocardiogram. (a) Standard position electrocardiogram showed arterial fibrillation, right bundle branch block. Lead I demonstrates a largely negative QRS complex and inverted T waves. The QRS complexes in leads aVR and aVL are reversed. There is a loss of amplitude in the precordial leads toward V6. (b) Mirror image position electrocardiogram. Chest electrodes were placed in a mirror image position on the right side of the chest. Left and right limb leads were reversed.

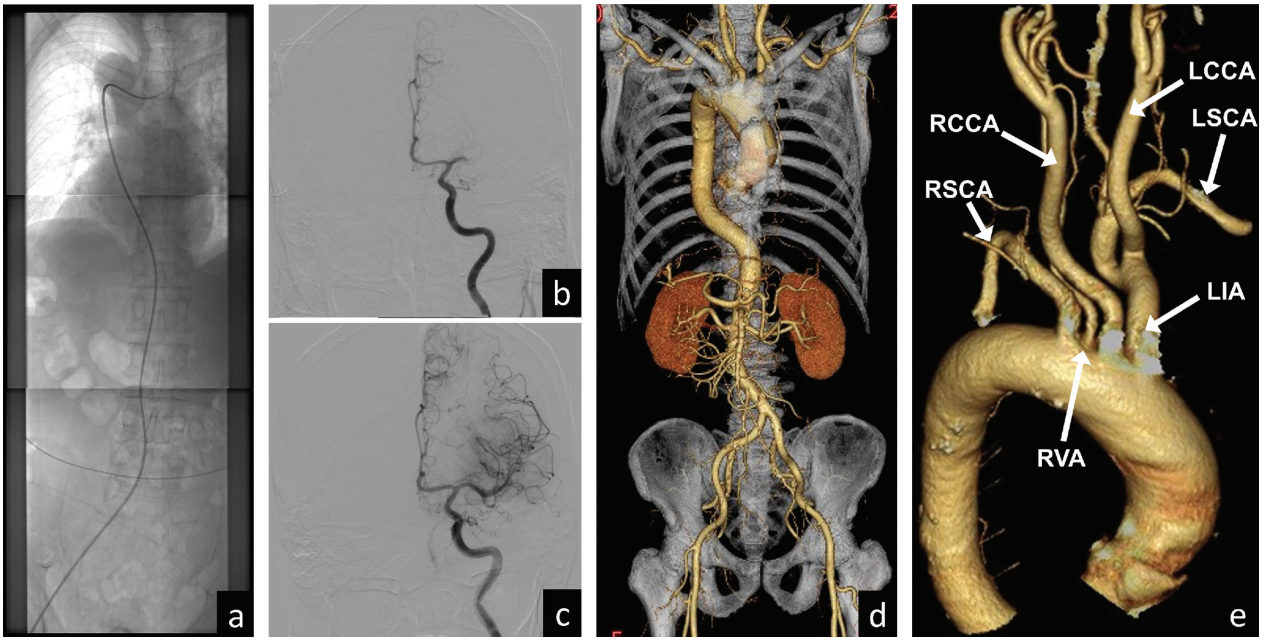

Fig. 2 Catheter navigation, thrombectomy, and CT angiography. (a) Balloon guiding catheter navigation on anteroposterior images. (b and c) Anteroposterior internal carotid artery injection (b) before and (c) after the thrombectomy. Final injection shows TICI 2B recanalization. (d and e) CT angiography on the day after procedure shows right-sided arch with mirror-image branching pattern. Innominate artery is on the left side and left common carotid artery arises from left innominate artery. Right vertebral artery directly arises from aortic arch. CT: computed tomography, LCCA: left common carotid artery, LIA: left innominate artery, LSCA: left subclavian artery, RCCA: right common carotid artery, RSCA: right subclavian artery, RVA: right vertebral artery, TICI: thrombolysis in cerebral infarction.

artery was on the left side and left common carotid artery arose from left innominate artery. A 6 Fr catheter was taken up over wire from left innominate artery to internal carotid artery, then balloon guide catheter was placed in left internal carotid artery. Left internal carotid artery injection showed left M1 occlusion (Fig. 2b). Using aspiration via Catalyst 6 (Stryker, Fremont, CA, USA) and TREVO devices (Stryker), thrombolysis in cerebral infarction (TICI) 2B recanalization was achieved after three passes (Fig. 2c). The time from puncture to recanalization was 66 min. There were no technical complications.

Whole body computed tomography (CT) the day after procedure showed complete situs inversus.

The cardiac apex, stomach, and spleen were on the right side. The liver, gallbladder, and inferior vena cava were on the left side. CT angiography showed right-sided aortic arch with mirror-image branching pattern (Fig. 2d and 2e). Mirror image position electrocardiogram, which left and right limb leads were reversed and chest electrodes were placed in a mirror image position on the right side of the chest, showed usual electrocardiogram with arterial fibrillation and right bundle branch block (Fig. 1b).

The patient had improved remarkably. After anticoagulant therapy for atrial fibrillation, he was discharged on day 27 of his admission having NIHSS 5 with modified Rankin Scale 3. His modified Rankin Scale at 3 months was 2.

Discussion

To the best of our knowledge, this is the first report of endovascular thrombectomy for acute intracranial large vessel occlusion in a patient with complete situs inversus. Situs inversus is an anatomic arrangement that is the mirror images of organs and vessels within the body. These anatomic converted structures may be noticed by chest X-ray and CT imaging. Because time to treatment has a powerful impact on outcome in acute stroke patients, chest X-ray is often skipped before endovascular thrombectomy. In our case, chest X-ray was not done before treatment, in addition, he could not declare situs inversus because of total aphagia; thus, we realized situs inversus while we proceeded a guide catheter. Since most of patients with acute ischemic stroke have baseline electrocardiogram before thrombectomy, electrocardiogram also help to diagnosis of situs inversus. In patients with dextrocardia, the standard 12-lead electrocardiogram shows specific features such as inverted P and T waves and loss of amplitude in the precordial leads toward V6 with reversed QRS complex.[2] In our case, we could not diagnose situs inversus because of lack of the knowledge about these details. Without noticing these details, a devastating diagnosis such as ST-elevation myocardial infarction may potentially be missed.[3]

Patients with complete situs inversus have mirror image reversal of all asymmetrical structures within the body. In the patient with mirror image vessels, aorta is on the right side of the spine. In our case, abdominal aorta was on the mid to right of the spine and descending thoracic aorta to aortic arch was on the right. The estimated prevalence of right aortic arch with/without situs inversus is about 0.05–0.1% in the general population.[4] Right aortic arch with aberrant left subclavian artery is the most common variation arch and mirror-image branching is the second most common form of a right aortic.[5] Left common carotid artery arises from aortic arch in right aortic arch with aberrant left subclavian artery; on the other hand, mirror-image branching has left innominate artery and left common carotid artery arises from left innominate artery. In individuals with situs inversus, right aortic arch with mirror-image branching is the most common variation.[4]

In situs inversus cases with pure mirror-image branching pattern, it is technically possible to place guiding catheter via trans-femoral approach using a general guiding catheter device. Our case had mirror-image branching pattern without any other anatomic variation, thus we could place a guiding catheter using a usual guiding catheter device. However, if patients have not only mirror-image branching but some other anatomical variations, it may be difficult to advance guiding catheter into target vessels. Ohtani et al.[6] reported a carotid artery stenting case for left internal carotid artery stenosis with right aortic arch. In that report, a 4 Fr modified Simmons catheter via trans-femoral approach could not be advanced into left common carotid artery because left common carotid artery was originated from the low part of ascending aorta. Subsequently, they changed to right trans-brachial arterial access and successfully placed guiding catheter. Changing to other approach access may be better if trans-femoral approach is failed to advance guiding catheter in right aortic arch cases.

It is well known that human brain has structural and functional asymmetry between the right and left hemispheres. Most of the right-handed individuals have left hemisphere dominant of language. Some previous studies showed individuals with situs inversus had inverted structural asymmetry in some part of cortical surface; however, complete situs inversus had no effect on the lateralization of brain structural and functional asymmetries associated with language.[7,8] Since our patient had total aphagia caused by left MCA occlusion, this situs inversus case had left hemisphere dominance of language.

Conclusions

Situs inversus is a rare congenital anomaly; however, if patients have acute intracranial large vessel occlusion, they need endovascular thrombectomy. Electrocardiogram and dextrocardia can help diagnosis of situs inversus. Aorta, aortic arch, and these branches are mirror image shape in most of the patients with situs inversus.

Conflicts of Interest Disclosure

All authors report no conflicts of interest concerning this article.

References

1) Casey B: Two rights make a wrong: human left-right malformations. *Hum Mol Genet* 7: 1565–1571, 1998
2) Mozayan C, Levis JT. ECG diagnosis: Dextrocardia. *Perm J* 23, 18–244, 2019
3) Hamam MS, Klausner H: Situs inversus: inferior-lateral ST-elevation myocardial infarction on right-sided electrocardiogram. *Clin Pract Cases Emerg Med* 3: 307–309, 2019
4) Sobh DM, Batouty NM, Abdelwahab RM, El-Badrawy A, Tawfik AM: Ductus arteriosus location in relation to aortic arch position, branching pattern, and viscero-atrial situs. *Clin Radiol* 74: 732.e731–732.e738, 2019
5) Hanneman K, Newman B, Chan F: Congenital variants and anomalies of the aortic arch. *Radiographics* 37: 32–51, 2017
6) Ohtani T, Yamazaki T, Ohtaki H, et al.: Carotid artery stenting in right-sided aortic arch: a case report. *NMC Case Rep J* 3: 9–12, 2016
7) Vingerhoets G, Li X, Hou L, et al.: Brain structural and functional asymmetry in human situs inversus totalis. *Brain Struct Funct* 223: 1937–1952, 2018
8) Ihara A, Hirata M, Fujimaki N, et al.: Neuroimaging study on brain asymmetries in situs inversus totalis. *J Neurol Sci* 288: 72–78, 2010

Corresponding author: Tomohide Yoshie, MD, PhD
Department of Neurology and Endovascular Treatment Service, St. Marianna University Toyoko Hospital, 3-435 Kosugimachi, Nakahara-ku, Kawasaki, Kanagawa 211-0063, Japan.
e-mail: tomohide.yoshie.1215@marianna-u.ac.jp