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Case Report

A 71-year Old Male Patient with 20 Hour Onset of Infarct Stroke that was Performed with Intra-Arterial Thrombolysis, Mechanical Thrombectomy, Balloon Angioplasty, and Carotid Stenting: A Case Report

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Abstract

Background : For above 2 decades, the definitive management for acute ischemic stroke is intravenous or intra-arterial thrombolysis (IAT), using recombinant tissue-type plasminogen activator. Recently mechanical thrombectomy (MT) was developed to overcome the problem that intravenous thrombolysis is only effective in removing large artery occlusions in the range of 10–30%. Early treatment with intra-arterial thrombolysis, permanent stent insertion and clot extraction devices evolved into the stent-retriever device used in most of the important trials and, recently, emerged aspiration tool. This case report presented 71-year-old male patient with infarct stroke who performed with MT.

Case presentation : This case report presented 71-year-old male patient with the main complaint of right limbs weakness. A non-contrast head CT scan found infarction in the cortical-subcortical left parietal lobe, posterior pericornu of the right lateral ventricle and right temporal cornu periventricular; lacunar infarction in the right and left paramedian pons; old lacunar infarction in the left and right centrum semiovale, left corona radiata, right internal capsule, right parietal lobe white matter, left lentiform nucleus, left posterior crus of the internal capsule-thalamus, right thalamus, right lateral ventricular pericornu and left paramedian pons. The patient underwent cerebral digital substraction angiography (DSA), as well as IAT, MT, balloon angioplasty, and carotid stenting with good clinical outcome.

Conclusion : With the overwhelming positive results of studies evaluating the safety, efficiency, and efficacy of mechanical thrombectomy; the standard of care for the treatment of patients with anterior circulation vessel occlusion is becoming clear.

Keywords : balloon angioplasty, carotid stenting, case report, intra-arterial thrombolysis, mechanical thrombectomy.

INTRODUCTION

Every year, there are about 800,000 stroke cases in the United States and 1 million cases in the European Union. Although stroke deaths have declined over the previous 1 decade, they still rank as the most cause of the mortality.[1,2] Additionally, stroke is the most etiology cause of permanent disability and the frequent causes of dementia in developed countries. Stroke patients and their relatives are often burdened with highly cost rehabilitation, financial and productivity difficulties, and limitations in daily activities. Treatment and intervention in golden time period can reduce long-term disability by preserving at-risk penumbra areas and reducing morbidity and mortality.[1]

For above 2 decades, the definitive management for acute ischemic stroke is intravenous or intra-arterial thrombolysis (IAT), using recombinant tissue-type plasminogen activator (rtPA).[1,3] Recently mechanical thrombectomy (MT) was developed to overcome the problem that intravenous thrombolysis is only effective in removing large artery occlusions in the range of 10-30%. Early treatment with intra-arterial thrombolysis, permanent stent insertion and clot extraction devices, such as the Mechanical Embolus Removal in Cerebral Ischaemia (MERCI) device, evolved into the stent-retriever device used in most of the important trials and, recently, emerged aspiration tool.[3,4]

This change in pace in treatment for the large number of people with major stroke requires a sizeable infrastructure to be put in place and will inevitably involve further centralization of services for hyperacute stroke.[3] This case report reports a patient with infarct stroke who underwent intra-arterial thrombolysis, mechanical thrombectomy, balloon angioplasty, and carotid stenting.

CASE PRESENTATION

This case report reports the case of a 71-year-old male patient who came to the emergency room with the main complaint of weakness in the right limbs. Approximately 20 hours before admission to the hospital, the patient was found by his family who had suddenly fallen on the floor, the patient was unconscious, had difficulty communicating, there was weakness in the right side of the limbs, both eyes glanced to the left side all the time. Other complaints such as headaches and seizures were previously denied.

The patient's family brought the patient to the emergency room at the Kariadi General Hospital. While in the emergency room, the patient had opened his eyes spontaneously but there was no eye contact. The patient tended to be restless, eyes only glance to the left side, unable to speak. The left limb looked more active than the right limb, the mouth appeared to droop on the left side.

The patient had hypertension by regularly taking amlodipine 10 mg/24 hours and history of previous stroke in 2020 (mouth drooping, slurred speech, and limb weakness), hospitalization at private hospital in Semarang. The family did not know the patient's history of taking blood thinner drugs. The patient had a history of coronary heart disease in 2000. The patient has a habit of smoking since 20 years ago, in a day can be used up 1-2 packs. The history of diabetes mellitus and dyslipidemia was denied.

The patient then underwent mechanical thrombectomy from the emergency room. In stroke unit, the patient was still sedated by general anesthesia. The patient had no seizures, the limbs on the right side appeared weaker. There was no nausea and vomiting.

In physical examination, the patient's general condition as seriously ill, with GCS scoring E2M5Vguedel (still under sedation after general anesthesia), blood pressure 150/123 mmHg, pulse rate 97x/minute, respiratory rate 20x/minute, temperature 36.5°C, oxygen saturation 96% with nasal cannula 3 liters per minute. The NIHSS score in the emergency room was 18 which was included in severe neurological deficits, while the NIHSS in stroke unit could not be assessed because the patient was still under sedation. Eye examination revealed a 3mm/3mm isochoric spherical pupil, direct light reflex +/+, conjugate deviation to the left. There was no neck stiffness, examination of the cranial nerves revealed right XII nerve parese of the central type. Motor examination of the upper and lower extremities on the right side revealed the impression of hemiparese dextra (could not move spontaneously) and there was hypertonicity. Physiological reflexes within normal limits, pathological reflexes negative such as Babinski, Chaddock and Gondor reflexes positive on the right side, sensibility of both extremities within normal limits.

The supporting examinations in the form of a non-contrast head CT scan on 20 January 2023 found infarction in the cortical-subcortical left parietal lobe, posterior pericornu of the right lateral ventricle and right temporal cornu periventricular; lacunar infarction in the right and left paramedian pons; old lacunar infarction in the left and right centrum semiovale, left corona radiata, right internal capsule, right parietal lobe white matter, left lentiform nucleus, left posterior crus of the internal capsule-thalamus, right thalamus, right lateral ventricular pericornu and left paramedian pons; no bleeding or signs of increased intracranial pressure; aging cerebral atrophy. Examination of thorax plain radiography gives the impression of a normal heart shape and location, calcification of the aortic arch, and no visible pulmo spots. The blood laboratory results could be seen in Table 1.

The patient was diagnosed clinically with decreased consciousness, spastic right hemiparesis,

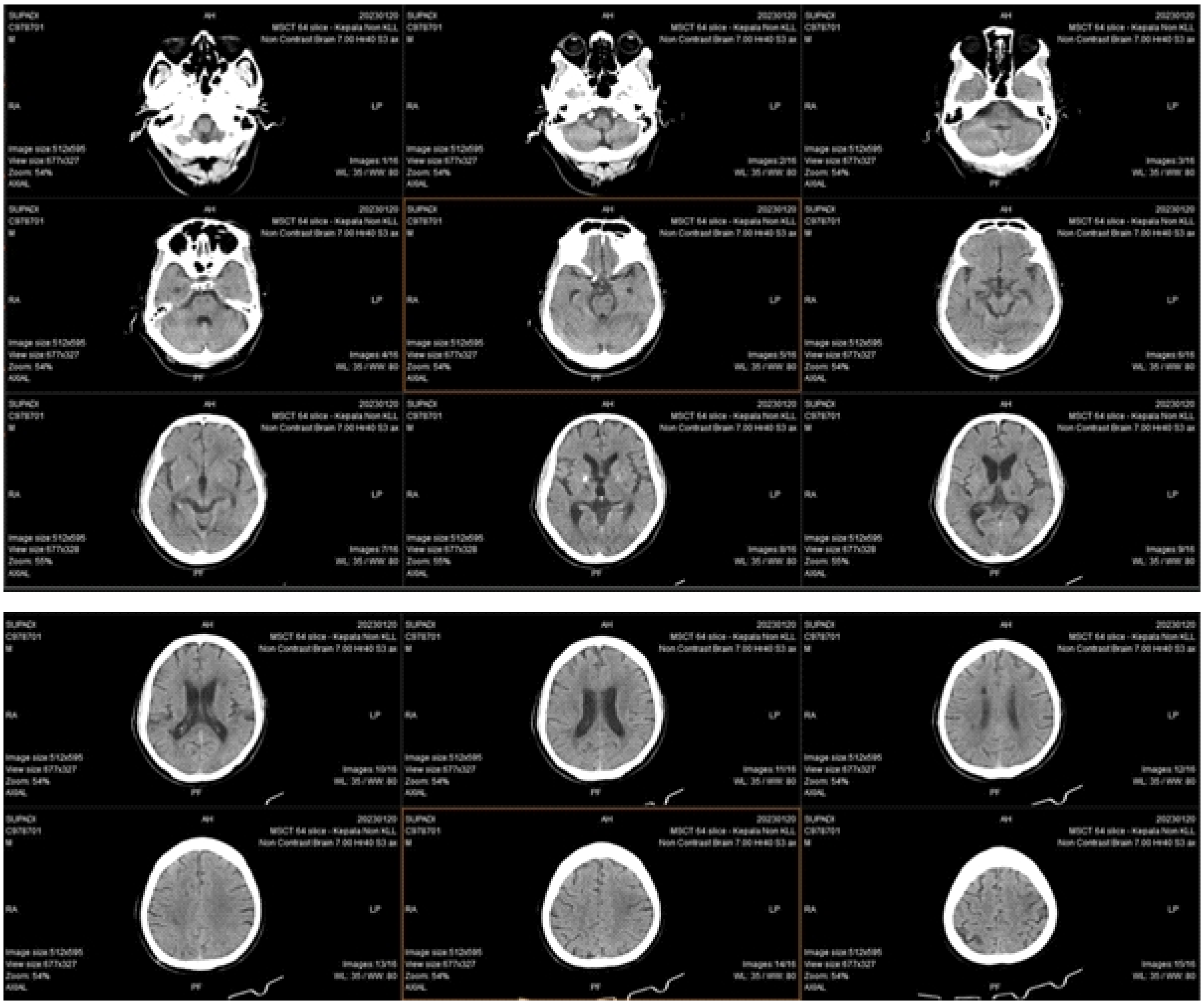

Figure 1. Non-Contrast Head CT Scan from the patient

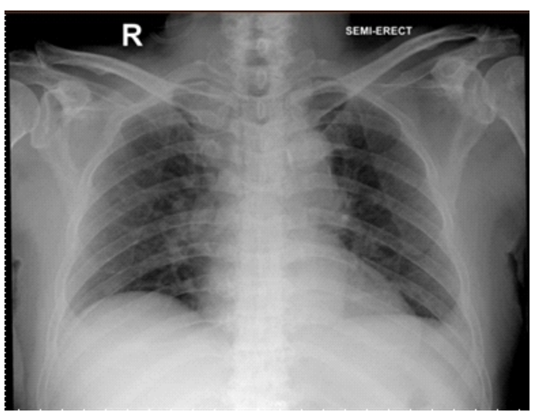

Figure 2. Thorax Plain Radiography from the patient

global aphasia, paresis of right facialis nerve. The topically diagnostic in centralcortical-subcortical left parietal lobe, etiologically due to infarct stroke and hypertension. Then the patient underwent cerebral digital substraction angiography (DSA), as well as intra-arterial thrombolysis, mechanical thrombectomy, balloon angioplasty, and carotid stenting. In this case the DSA procedure was carried out through branchial access.

The procedure went well, after the procedure the patient had an improvement in consciousness, the patient

TABLE 1
Blood laboratory results

Laboratorium	Normal Range	Results (20/01/2023)
Hemoglobin	13.2–17.3	15.6
Hematocrite	32–62	46.8
Erytrochyte	4.4–5.9	5.15
Leukocyte	3.800–10.600	7.100
Thrombocyte	150.000–400.000	417.000
Blood glucose	80–160	102
Urerum	15–39	24
Creatinin	0.6–1.3	1.2
Calsium	2.12–2.52	2.4
Natrium	136–145	141
Kalium	3.5–5.0	4.0
Chlorida	95–105	105

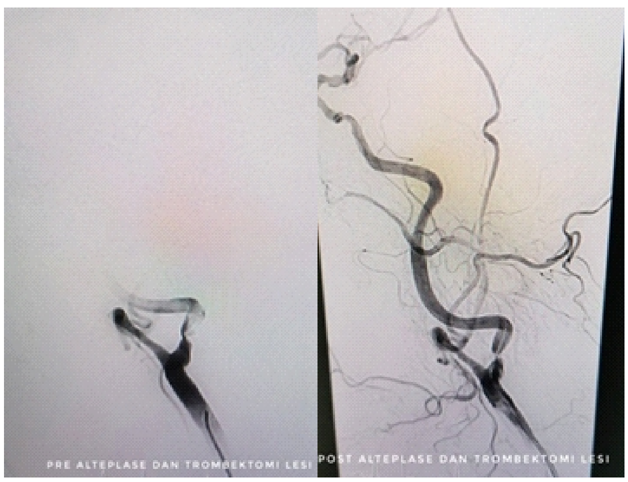

Figure 3. Results of cerebral DSA pre and post IA thrombolysis + mechanical thrombectomy

opened his eyes spontaneously but had not made maximum contact, the limbs on the right side could be moved. 1 day after the procedure, the right limb began to be lifted and awareness slowly improved. After the procedure, the patient was given therapy 30-degree head up position, oxygen via nasal canule 3 liters per minute, ringer lactate infusion 20 drops per minute, Diltiazem intravenously 5–20 mcg/kgBW/minute through syringe pump, injection of ranitidine 50 mg/12 hours intravenously, vitamin B12 500 mcg/12 hours intravenously, clopidogrel 75 mg/24 hours per oral. The patient was programmed to sleep on lying position, placed a sand pillow over the puncture site (right brachial) for 6 hours, the right arm must straight and couldn't move for 6 hours on the arm that was punctured, and within 24 hours it couldn't get out of bed. Patients are monitored every hour for 6 hours in the form of monitoring of general condition, vital sign, GCS, neurological deficits, signs of bleeding, and artery brachialis pulsation.

DISCUSSION

Intravenous tissue plasminogen activator (tPA) is the only recanalization therapy approved for the treatment of acute ischemic stroke but because of the narrow

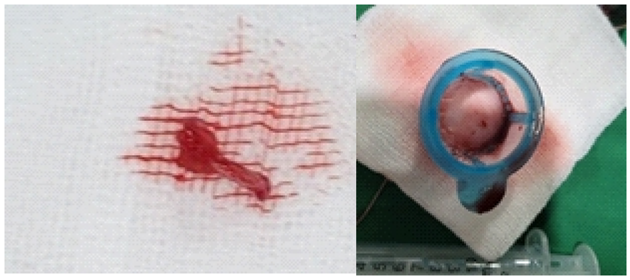

Figure 4. Evacuated thrombus

treatment time of 3 to 4.5 hours, it is used in a minority of acute ischemic stroke patients.[1] Moreover, its benefit is limited, with respect to clinical efficacy and recanalization, especially for great vessel occlusion, the most common cause of severe and fatal acute ischemic stroke. The traditional time window for intra-arterial thrombolysis is less than 6 hours and 8 hours for mechanical embolectomy. Duration of ischemia is a major predictor of neurologic outcome but with modern penumbra imaging, patient selection for intra-arterial thrombolysis (IAT) may be time dependent.[1,5]

IAT, once the first-line therapy for large vessel occlusion before the advent of mechanical thrombectomy (MT), has reemerged with a new potential role in the modern endovascular era. Recent studies have shown promising results of IAT recombinant tissue plasminogen activator (rtPA) in the context of MT.[3,5,6]

Findings from a number of studies suggest that IAT may be a plausible alternative to intravenous thrombolysis (IVT). In some studies, IAT is associated with a higher rate of recanalization than IVT.[7] There are several potential advantages to IAT, such as planning angiography to tailor therapy, locoregional injections, and the ability to use mechanical devices to accelerate the rate of recanalization. Delays in treatment with IAT and delays may reduce the benefits of this procedure, because time to treatment is a major predictor of acute stroke outcome.[5,7]

One of the risks of IAT is intracranial hemorrhage; Another is the risk of procedural complications such as anaphylaxis and systemic bleeding.[5,7] In one of the early clinical trials of IAT, the prevalence of intracranial hemorrhage (ICH) at 24 hours and death at 90 days was 42% and 27%, respectively. Trials and subsequent studies report mortality rates of 7% to 29%, and bleeding rates ranging from 0% to 33%. In a study of patients receiving IAT (along with other endovascular treatment) after ≥8 hours documented an estimated rate of 33% for death at 90 days and imminent bleeding (subarachnoid and intracranial.[7]

The risk of ICH with IAT can be related not only to the thrombolytic dose used during IAT, but also to the severity of the stroke.[8] Regarding other complications, the PROACT II trial reported that 1% of patients receiving IAT with recombinant prourokinase developed anaphylaxis and 7% experienced systemic bleeding. Several studies have found that there are no significant differences between treatments in the proportion of patients who live without disability, have bleeding symptoms, or die. Another study found that IAT showed clinical benefit over venous thrombolysis for some of these outcomes.[7,8]

Since January 2015, 11 RCTs on mechanical thrombectomy in the anterior circulation have been published, which have led to a revolution in the care of patients with large artery occlusion.[9] Patients with significant deficits as manifested by a National Institutes of Health Stroke Scale (NIHSS) score between 8 and 20 have better outcome with endovascular treatment (EVT) reperfusion.[9,10]

Based on the current trial, American Heart Association guidelines provide evidence of a level of 1A for EVT candidates with NIHSS score ≥6.[8] However, there is a significant proportion of patients with acute ischemic stroke and great vessel occlusion who may present mild stroke severity (NIHSS score <8). EVT appears to be effective and safe in individuals with mild to moderate stroke severity and proximal great vessel blockage, despite the lack of relevant RCT evidence.[8,11]

The time window for EVT plays a significant part in clinical outcome, as demonstrated that its efficacy is time dependent: in anterior circulation stroke, the role of successful thrombectomy is beneficial in the first 3 to 4.5 hours after stroke compared to the treatment after 5 to 8 hours.[9] Although thrombolysis is the treatment option ≤4.5 hours after stroke onset, additional or primary EVT can be performed over a longer timeframe: in a recent RCT, only a few patients were unable to puncture within 6 hours. Therefore, the positive results of the trial were affected mostly by individuals admitted within 6 hours of symptom onset.[9,11]

A meta-analysis of recent RCTs demonstrated that in subjects who got substantial reperfusion with EVT, every 1-hour delay to reperfusion was related with adverse rates of disability and reduced functional impairment, but mortality rates remained unchanged.[7] Posterior circulation and brainstem stroke caused by vertebral or basilar artery occlusion may be less susceptible to hemorrhagic complications than reperfusion therapy. Safe recanalization of occluded posterior circulation vessels has been reported ≤24 hours after brainstem infarction.[7,11]

In subjects with clinical features suggestive of great vessel occlusion and who may be candidates for EVT, a comprehensive examination should be performed using multimodal computed tomography (CT) or multimodal magnetic resonance imaging (MRI) techniques.[9] The main advantage of CT over MRI is that it is widely available and stroke imaging protocols consisting of non-contrast CT and CT angiography (CTA) can be performed in only a few minutes. Brain parenchymal imaging, preferably by noncontracting CT or alternatively by MRI, should be used to diagnose intracranial hemorrhage (ICH) or stroke mimics such as tumors, infections, etc.[9,12]

The Alberta Stroke Program Early CT Score (ASPECTS) is a systematic scoring to detect early CT signs such as an insular ribbon sign or obscuring lentiform nuclei.[13] An independent meta-analysis demonstrated that EVT improved outcomes in both patients based on ASPECTS 8 to 10 (ie, minimal ischemic damage) and 5 to 7 (ie, moderate ischemic damage). In contrast, patients with ASPECTS low from 0 to 4 showed no benefit of treatment with EVT, suggesting that EVT has little or no efficacy in patients with large ischemic nuclei. However, the interpretation of ASPECTS is still debated even among stroke experts. Standardized and automated assessment of ischemic damage may be useful in future clinical practice.[12,13]

Arterial imaging of the cerebral circulation, preferably by CTA or alternatively by magnetic resonance angiography, is essential for assessing a patient's eligibility for EVT. CTA is widely available, with fast, thin-section, volumetric spiral CT images obtained during bolus injections of time-optimized contrast material for vascular opacities.[9] The entire region from the aortic arch to the circle of Willis can be covered in one data acquisition. CTA confirms the presence of great vessel occlusion, allows localization of occluded vessels, and may facilitate intervention by obviating the need for non-targeted vessel cerebral angiography. In addition, it can identify collateral circulation and clot length. Collateral circulation may improve stroke outcomes by limiting the rate of cerebral infarction.[9,12,13]

Endovascular diagnostic and therapeutic procedures are generally performed via the femoral artery. Some of the reasons for this common approach are its location, easy approach to puncture and hemostasis, and low complication rate.[12,13] The femoral puncture also allows access to almost any area of the artery and provides the operator with favorable ergonomics in most cases. However, in some situations, femoral access may be difficult or even contraindicated, such as absence of a palpable femoral pulse, severe generalized femoral occlusion disease, recent femoral intervention or surgery, femoral aneurysm/pseudoaneurysm, and in some cases, presence of prosthetics. Access via other vessels, such as the brachial, radial, and ulnar, has been used when femoral access is not available. Many studies have noted that this approach has excellent technical results and a low incidence of complications.[13]

However, the use of brachial artery access for non-coronary interventions has received little attention.[12–14] Despite its utility as an adjunct technique and sometimes mandatory, some endovascular surgeons are reluctant to expand its use for fear of an increased complication rate. Several series have documented complication rates as high as 11%.[14]

A development in the interventional management of acute stroke was performed in 2008 with the use of a stent-like thrombectomy device now called a stent retriever. The aspiration technique can be performed as an alternative treatment to stent retriever devices.[8] The stent retriever technique allows a high recanalization rate with reduced recanalization time and a low complication rate. Retractable stents are self-expanding stent-like devices that are completely retractable. Therefore, this device combines the benefits of fast flow recovery and mechanical thrombectomy. Excellent recanalization results can be achieved with this technique with Thrombolysis rates in Grade 2a/b or 3 flow Cerebral Infarction (TICI) as high as 90%. The results of this prospective study show a high rate of clinical outcome within 3 months.[8,12,13]

The better clinical outcome with the restorative appliance is due to the rapid and effective removal of the clot and the possibility of temporary flow restoration. In addition, the use of a stent retriever device is related with a lower rate of ICH symptoms and a lower rate of death.[9] The low mortality rate reflects the low rate of ICH symptoms and demonstrates the safety of flow restoration devices compared to thrombectomy devices in the past. This was confirmed in all RCTs. In the stent retriever technique, the target vessel is inserted with a 0.014-inch guide wire and a suitable microcatheter between 0.018 and 0.027 inches. The thrombus is crossed with a guidewire, and a microcatheter is placed distal to the thrombus. The stent retriever is advanced to the distal end of the microcatheter. Then, the microcatheter is removed to spread the device under fluoroscopy. A control angiogram is performed after the device opens successfully. Stent retriever device sizes range from 3.0×15 mm to 6.0×30 mm; however, usually 6.0 mm devices are used. After a while, the device is withdrawn with continuous aspiration. This procedure is repeated until a TICI level of 2b or 3 is reached.[9,12,13]

Clinical experience has exhibited situations that are resistant to recanalization of stent retrievers. These situations include occlusions located at the terminal internal carotid artery (ICA) and bifurcation of the middle cerebral artery and trifurcation thrombi, as well as hard thrombus configurations.[13] The aspiration technique was an early feature in the history of mechanical thrombectomy, and its use has been demonstrated in a large number of trials and clinical experience. During the last few years, new aspiration devices were developed including internal distal diameter change of the distal catheter; therefore, the aspiration technique in some centers is used as the primary treatment for intracranial artery occlusion.[9,12,13]

Recent studies, included in 1 randomized trial, demonstrated that the primary aspiration technique is a safe and effective EVT method with clinical outcomes comparable to stent retriever devices.[8] The main advantages of the aspiration technique are the quick procedure time and the high rate of favorable clinical outcome. When the aspiration technique is used, the thrombus is passed with a microwire and microcatheter, and the aspiration catheter is placed directly proximal to the thrombus. The microwire and microcatheter were removed. The catheter is then removed under constant negative pressure to avoid loss of the thrombus. After each removal of the clot fragment, the procedure is repeated until a TICI level of ≥2 or 3 is reached.[8,9,12,13]

A tandem occlusion is a combination of the extracranial segments of the ICA occlusion with the concomitant occlusion of the intracranial segments. Tandem occlusions are uncommon but show a challenging therapeutic setting in the setting of acute ischemic stroke.[13] Only a small number of patients with tandem occlusions were included in the recent EVT RCT. The HERMES (Highly Effective Reperfusion Evaluated in Multiple Endovascular Stroke Trials Collaboration) meta-analysis showed that EVT may also be beneficial in this subgroup of patients. Acute occlusion of extracranial ICA segments resulting in ischemic stroke is different from other forms of acute occlusion of cerebral vessels.[9,12,13]

The pathophysiological processes in acute extracranial ICA occlusion, are close to those observed in acute coronary artery occlusion, most of which are ruptured atherosclerotic plaques and overlapping thrombus.[14] Therefore, in these subjects, acute extracranial ICA stenting should be performed for vessel recanalization. Intervention in a patient with a tandem occlusion consists of 2 steps: the first step is revascularization of the extracranial ICA segment with stent implantation, as in the management of atherosclerotic stenosis. The second step is mechanical recanalization of the occluded intracranial arteries by stent retriever or aspiration techniques.[11,14]

All RCTs reported an increased recanalization success rate, which was explained as a TICI level of 2b or 3 and varied between 59% and 88%.[11,15] Most significantly, these technical successes translate into clinical improvements as it appears that the probability of a good outcome increases with better recanalization. Recently, the long-term results of 2 RCTs exhibited that the positive effects of EVT at 1 to 2 years were similar to those reported at 3 months without any difference in mortality.[15]

The consensus conference on intracranial atherosclerotic disease concluded that there are no clear data available to support the efficacy of primary angioplasty over stent placement for the treatment of intracranial atherosclerotic stenosis.[16] Both primary angioplasty alone and angioplasty with self-expanding stents have been evaluated in nonrandom trials with satisfactory results and with recurrent ischemic events no worse than lesions treated by medical management alone. But the current treatment paradigm is based on operator preference and experience. In most practice, reports of dissection, vessel rupture, recoil of the lesion, and restenosis observed with angioplasty using balloon catheters designed for use in coronary arteries have undermined the role of primary angioplasty as the treatment of choice for intracranial atherosclerotic disease.[16–18]

Traditionally, carotid endarterectomy (CEA) has been the main method of treating asymptomatic and symptomatic carotid artery stenosis. Carotid endarterectomy involves exposure of the carotid artery and removal of plaque, usually from the carotid bulb and proximal internal carotid artery, through a neck incision. However, in vascular surgery, like many other surgical specialties, minimally invasive techniques have evolved over the years.[16] Carotid artery stenting (CAS) is one such technique, which can be performed via a transfemoral approach or a transcarotid approach. CAS is a reasonable alternative to CEA in selected patients with high-grade asymptomatic (greater than 70%) or symptomatic carotid artery stenosis. Indications for CAS include a patient's high risk of surgery, such as severe pulmonary disease, recent myocardial infarction, unstable angina, or severe congestive heart failure; previous history of neck radiation making open surgical dissection difficult; history of damage to the contralateral vocal cords; presence of tracheostomy, contralateral carotid occlusion; and previous CEA with recurrent stenosis.[16,19,20]

In a recent study, balloon angioplasty was associated with periprocedural stroke, a mortality rate of 5% and a technical success of up to 92%. In patients with hemodynamic compromise as a mechanism of ischemia, a marginal opening of 10% or 20% of the lesion in intracranial atherosclerotic disease may be thought to be beneficial because a small increase in vessel diameter can result in a large increase in perfusion. These patients should demonstrate post-procedure symptom improvement and future prospective studies should evaluate this hypothesis.[15,20]

Ultimately compared with medical therapy and intracranial stenting, endovascular treatment of intracranial atherosclerotic disease with balloon angioplasty is relatively safe with periprocedural morbidity and mortality estimated at 5% in this study. A randomized controlled study to evaluate between the 3 treatment modalities is needed to understand the optimal treatment for patients with symptomatic intracranial atherosclerotic disease.[20,21]

CONCLUSION

With the overwhelming positive results of studies evaluating the safety, efficiency, and efficacy of mechanical thrombectomy; the standard of care for the treatment of patients with anterior circulation vessel occlusion is becoming clear. However, these benefits should not be limited to certain patients. Patients with occlusion of the posterior circulation and distal vessels have been shown to benefit from mechanical thrombectomy. The future of this field is bright and the exploration of endovascular recanalization is uncharted, to push the boundaries of current therapy in a sensibly and systematic manner.

CONFLICT OF INTEREST

No conflict of interest to declare.

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