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Acute Ischaemic Stroke – Reperfusion with Thrombectomy and Advanced Multimodal Imaging

A Challenging Case: Endovascular Treatment in a Patient with Large Ischemic Core and Dramatic Recovery

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Keywords
Stroke · Large core · Thrombectomy · Dramatic recovery · Challenging case

Abstract
Uncertainty exists over the efficacy and safety of endovascular treatment in patients with large ischemic cores in anterior circulation. Several trials have shown some potential benefits in selected patients despite their late presentation. In particular, perfusion imaging modalities equipped with automatic software has been proven useful in identifying patients with large ischemic cores that are at risk of infarct core expansion, meaning that this specific patient group could still benefit from reperfusion treatment. We reported a case of late-presenting and progressing acute ischemic stroke who was selected by perfusion imaging with RAPID software and successfully underwent endovascular thrombectomy. On admission, her National Institutes of Health Stroke Scale (NIHSS) score was 7. Computed tomography angiography showed complete occlusion of the proximal right middle cerebral artery. Subsequent advanced perfusion imaging with automatic software showed that the ischemic core was 88 mL, T_{max} >6 s volume was 131 mL, and mismatch volume was 43 mL. She was rapidly transferred to the Cath lab for thrombectomy with a stent retriever. Her NIHSS score was 15 before the

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endovascular procedure. She had a dramatic recovery with an NIHSS score of 4 at 24-h after the procedure. She was discharged on day 9 with a modified Rankin Score of 1. Our findings suggest that endovascular treatment can be beneficial to the patients, particularly younger ones, with large ischemic cores with the aid of perfusion imaging.

Introduction

Multiple studies demonstrated that acute ischemic stroke (AIS) patients with a large core volume (irreversibly damaged tissue), usually ≥70mL, had a low rate of favorable outcomes, ranging from 0 to 21% [1]. A recently Multiple Endovascular Stroke Trials (HERMES) meta-analysis suggests that the rate of symptomatic hemorrhagic transformation is increased in stroke patients with a large core volume who underwent mechanical thrombectomy (MT) [2]. Endovascular intervention (EVT), which has been proven to be the most effective treatment in the acute phase of stroke with large artery occlusion, was deemed futile for patients with large infarct core. A core volume greater than 70 mL was considered to be an exclusion criterion for reperfusion therapy in most clinical trials. However, this concept came from the studies conducted in patients receiving intravenous thrombolysis whereby a higher rate of symptomatic intracerebral hemorrhage and poorer outcomes can be attributable to malignant profile [1]. Recently, there has been some evidence that patients who present within 6 h with a core volume ≥70 mL may still benefit from EVT, which was potentially related to high reperfusion rates observed in these studies [3]. The SELECT study suggests that there are potential benefits for patients with large cores up to 24 h from the time last known to be well, who were selected based on an Alberta Stroke Program Early CT Score (ASPECTS) of less than 6, or a volume with a relative cerebral blood flow <30% of ≥50 cm^3 on CT perfusion scanning [4]. We present a case of MT in a patient with a large ischemic core who showed dramatical recovery [5].

Case Presentation

We reported a case of late-presenting and progressing AIS successfully undergoing endovascular thrombectomy. Our patient is a 55-year-old female presenting at our hospital with left hemiparesis and headache. Upon hospitalization at our center at 15:30, it was more than 16 h since she was last seen well at 23:00 the day before going to sleep. Her admission NIHSS score was 7, with only mild left-sided hemiparesis and paresthesia. Subsequent non-contrast computed tomography (NCCT) revealed a large infarction core and an Alberta stroke program early CT score (ASPECTS) of 5 (Fig. 1a). Her past medical history was uncertain with only unknown valvulopathy noted. A computed tomography angiography was later performed, which revealed an occlusion site at the proximal segment of the right middle cerebral artery. During the imaging procedure, her clinical status worsened with severe left hemiparesis and an increased NIHSS score from 7 to 15. We decided to obtain a perfusion-weighted MRI scan, using RAPID software to determine the salvageable zone. Core volume (as defined by an apparent diffusion coefficient threshold less than 620×10^{-6} mm^2/s) was estimated to be 88 mL and mismatch volume (as defined by a T_{max} >6 s volume subtracted by the core volume) was 43 mL (Fig. 2a). We then decided to perform MT with the consent of her family. During the 2-h

procedure, we managed to remove multiple small thrombi after five attempts using the Solitaire stent retriever and eventually achieved TICI-3 recanalization. NCCT was repeated the next day which showed cerebral hemorrhage of parenchymal hematoma type 1 (PH1). At 24-h check-up, her neurological functions recovered remarkably with an NIHSS score of 4. On day 4, perfusion imaging was repeated to estimate the final infarct core volume (Fig. 2b). On day 6, NCCT was repeated showing extended infarct and a quick absorption of cerebral hemorrhage (Fig. 1b). The etiology of her stroke remains uncertain in the absence of large vessel atherosclerosis on vascular imaging, though an embolism was suspected. We decided to start clopidogrel, rosuvastatin, and perindopril. On day 9, she was discharged with an NIHSS score of 3.

Discussion

Currently, there is no evidence on the treatment of AIS patients with large ischemic cores, often defined as an ASPECTS <6 or an ischemic core volume greater than 50–70 mL. A recent meta-analysis of individual participant data of five major thrombectomy trials did not observe treatment benefits in patients with an ASPECTS of 5 or less [2]. However, with advanced imaging selection, EVT may be beneficial in patients with large infarct core on MRI-DWI or perfusion CT [6]. Although the patient was not fulfilling inclusion criteria of both DAWN and DEFUSE 3 (ASPECTS <6, cores >70 mL, mismatch ratio <1.8), she did have a relatively large penumbra. Her absolute mismatch volume was 43 ml, which was larger than the minimum 15 mL required by DEFUSE 3, and fulfilled mismatch criteria of other trials (e.g., EXTEND-IA which required a mismatch >10 mL and mismatch ratio >1.2) [7–9]. Proper patient selection is therefore critical, and advanced imaging techniques have been developed to identify those who can benefit from reperfusion treatment [6]. There was no significant difference in major intracranial hemorrhage in the SELECT study. Moreover, hemicraniectomy and 90-day mortality rates were lower in the endovascular treatment group [10]. They suggested EVT was relatively safe. Other studies showed that young acute stroke patients who have a large ischemic core and large mismatch imaging profile might still benefit from EVT [6, 11]. On the contrary, patients older than 75 years have a higher risk of poor outcomes with EVT [6]. Although the follow-up NCCT and MRP (perfusion-weighted MRI) showed extended infarct, saving 15–20 mL of the penumbra can make an important effect in improving outcomes. Therefore, this case suggests that in young large-vessel occlusion patients presenting in a late time window with a large infarct core, endovascular therapy could still be considered on a case-by-case basis. Our decision was based on the patient's large mismatch volume (43 mL) and younger age (<60 years old).

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Dr. Tra S.V. Le interpreted the images, treated the patient, and provided patient data.

Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Trung Q. Nguyen was a major contributor in writing the manuscript and performing the literature review. Tinh Q. Dang and Hoang T. Phan made major contributions to the interpretation and revision of the manuscript. Thang H. Nguyen supervised the study, interpreted the patient data, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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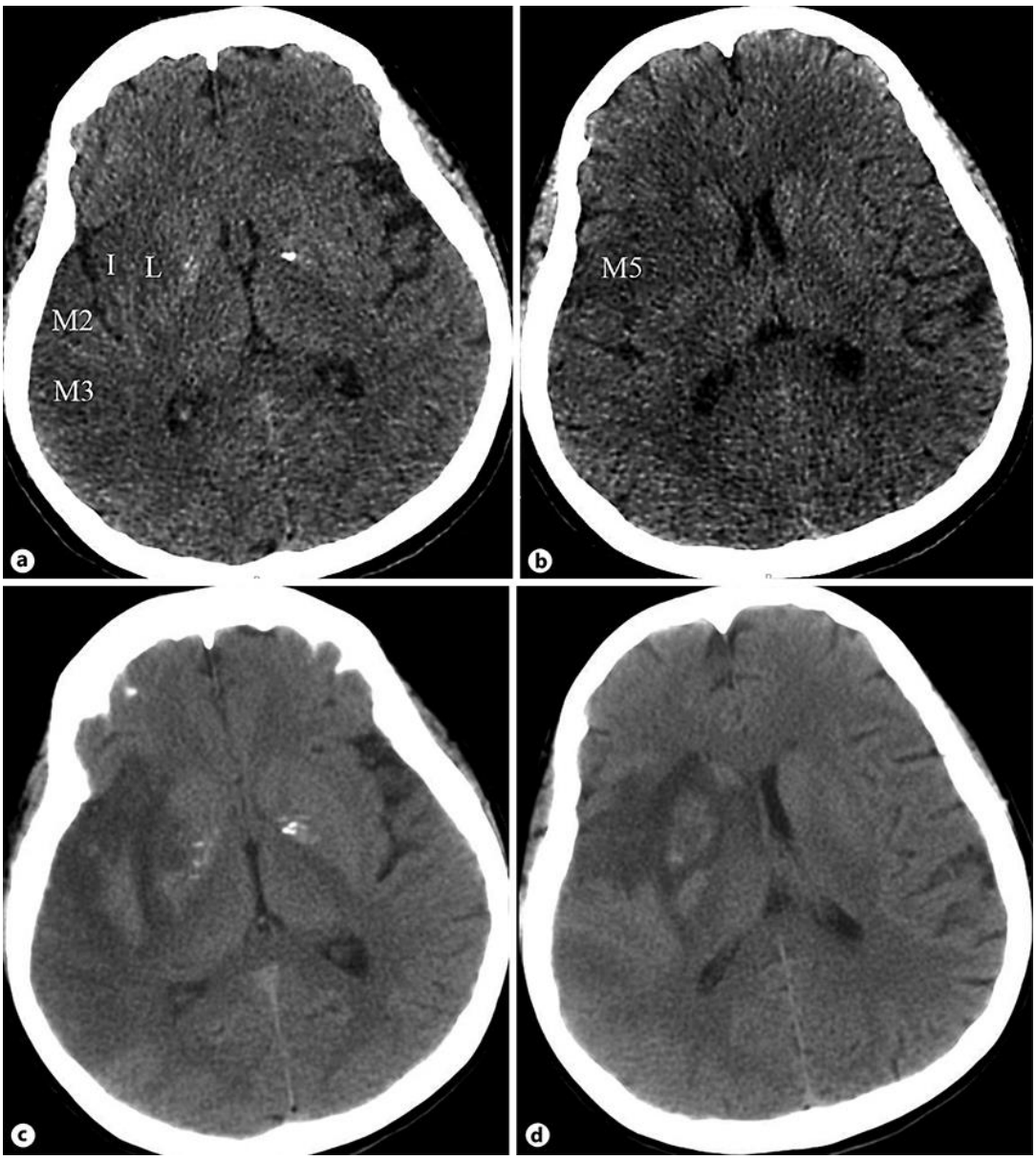

Fig. 1. The initial NCCT showed a low ASPECTS score of 5 (**a**, **b**). On day 6, NCCT was repeated showing a change in infarct size after EVT and a quick absorption of cerebral hemorrhage (**c**, **d**). L, lentiform nucleus; I, insular cortex.

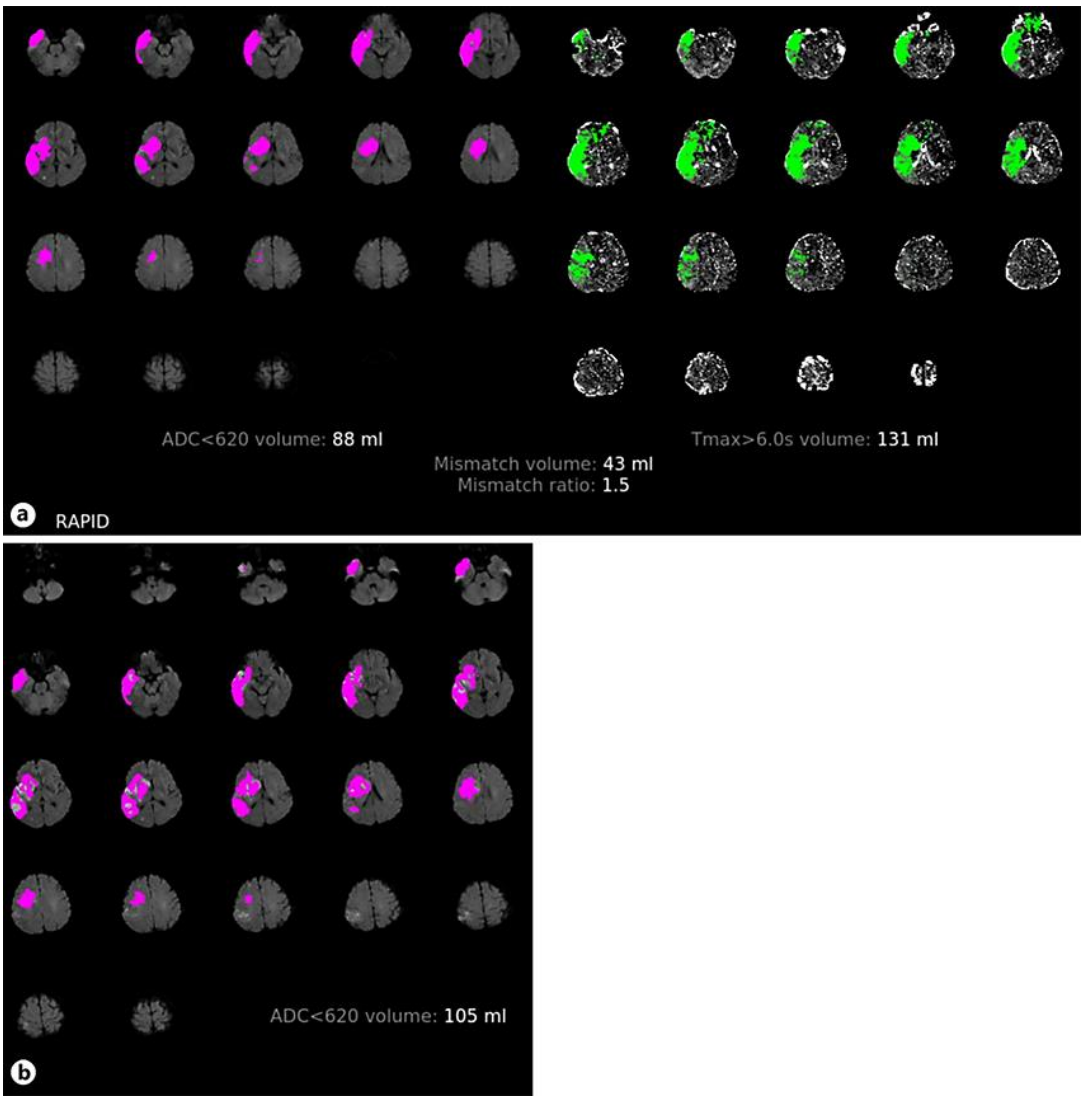

Fig. 2. Perfusion magnetic resonance imaging with RAPID software showed a large mismatch volume (**a**). Perfusion imaging was repeated to estimate the final infarct core volume (**b**), demonstrating that 26 mL of the penumbra was saved.