

Successful Recanalization and Neurological Restoration in Cancerous Embolic Cerebral Infarction via Endovascular Stent-Retriever Embolectomy

Li-Ying Ko¹, Victor C Kok², Chun-Hao Tang³, Chien-Kuan Lee⁴, Pao-Sheng Yen⁵

¹Department of Neurology, Kuang Tien General Hospital, Taichung, Taiwan; ²Division of Medical Oncology, Cancer Center of Kuang Tien General Hospital, Taichung, Taiwan; ³Department of Family Medicine, Kuang Tien General Hospital, Taichung, Taiwan; ⁴Department of Pathology, Kuang Tien General Hospital, Taichung, Taiwan; ⁵Department of Neuroradiology, Kuang Tien General Hospital, Taichung, Taiwan

Correspondence: Pao-Sheng Yen, Department of Neuroradiology, Kuang Tien General Hospital, Taichung, Taiwan, No. 117, Shatian Road, Shalu District, Taichung, 433401, Taiwan, Tel +886 4-2662-5111, Email bert.yen@gmail.com

Abstract: Mechanical thrombectomy has emerged as a promising treatment for acute ischemic stroke caused by large vessel occlusion. However, cases involving cancerous emboli retrieved during endovascular embolectomy are rare. We present a case of a 65-year-old man with a history of heavily treated rectal cancer, who developed a middle cerebral artery (MCA) infarction due to metastatic adenocarcinoma. The patient presented with sudden onset right-side weakness, right facial palsy, global aphasia, and left gaze deviation, with a National Institutes of Health Stroke Scale (NIHSS) score of 16. Following intravenous thrombolysis, endovascular thrombectomy was performed, achieving nearly complete recanalization. Pathological examination of the retrieved thrombus revealed metastatic adenocarcinoma of rectal origin. The patient's neurological deficits gradually improved, and he was successfully discharged to undergo further palliative therapy. This case underscores the importance of considering mechanical thrombectomy for patients with advanced solid organ malignancy presenting with acute ischemic stroke, even when the etiology could be a tumor embolus. Our findings highlight the potential for mechanical thrombectomy to restore neurological function in such cases, allowing patients to proceed to the next level of care with a reasonably good post-stroke quality of life.

Keywords: mechanical thrombectomy, hematogenous spread, cerebral thrombosis, ischemic stroke, large vessel obstruction, endovascular embolectomy

Introduction

Arterial thromboembolic (ATE) events are much less common in cancer patients than cancer-associated venous thromboembolism.¹ In a Danish registry cohort study, the cumulative incidence of ATE at one year of cancer diagnosis was 2.11 per 1000 patient-years.² In the study, ATE was defined as either myocardial infarction, unspecified or ischemic cerebral infarction, or peripheral arterial embolism, presumably associated with the paraneoplastic hypercoagulable state. In an interesting study to look into the nature of Trousseau's syndrome-related arterial thrombus from patients with cancer-associated stroke using immunohistochemical tests, the thrombus composition in cancer patients contained more platelets and fewer erythrocytes than non-cancer patients.³ Other than cancer procoagulant-related ATE, the other type of tumor-associated intracranial embolism is caused by direct tumor embolism pumped up by the heart, most commonly from a benign tumor such as atrial myxoma, cardiac papillary fibroelastoma, or advanced squamous cell carcinoma of the lung.⁴⁻⁷

Mechanical thrombectomy is a promising treatment for acute ischemic stroke caused by occlusion of a large vessel.^{8,9} Its add-on efficacy over intravenous thrombolysis alone has been proven in multiple trials.^{10,11} However, retrieved thrombi from the endovascular embolectomy that were pathologically proven to be cancerous emboli are rarely reported.

Herein, we report a case of middle cerebral artery (MCA) infarction due to metastatic adenocarcinoma from pre-existing, heavily pre-treated rectal cancer that progressed to lung metastases and cardiac invasion.

Case Report

A 65-year-old man was admitted to our hospital due to a sudden onset of right-side weakness. On arrival, he was found to have right facial palsy, right hemiparesis, global aphasia, and left gaze deviation. His National Institutes of Health Stroke Scale (NIHSS) score was 16. Initial laboratory investigations with complete blood count, electrolytes, and renal and liver function were unremarkable. An electrocardiogram revealed normal sinus rhythm. He was a patient with rectal cancer treated with low anterior resection, adjuvant radiotherapy, and chemotherapy seven years ago. Fourteen months earlier, he developed left parieto-occipital region brain metastasis, for which he underwent craniotomy with safe maximal tumor excision and consolidative whole brain radiotherapy with a total radiation dose of 3000 cGy. No mutations were detected in any of the RAS and B-RAF hotspots. Subsequently, 17 cycles of bevacizumab plus FOLFIRI-type biochemotherapy were administered. He also had a medical history of hypertension but had no diabetes mellitus, dyslipidemia, or coronary heart disease. The reported baseline modified Rankin Score (mRS) is 0.

Computerized tomography (CT) brain scan showed postoperative hypodensity in the left parietal lobe resulted from previous brain surgery and a faint hypodensity in the left frontotemporoparietal lobe. There was no definite ischemic change or hemorrhage (Figure 1A). Low-dose intravenous recombinant tissue plasminogen activator (rt-PA, alteplase, dose at 0.6 mg/kg) was administered 210 minutes after symptom onset. CT angiography (CTA) showed complete occlusion of the left proximal M1 (Figure 1B). Computed tomography perfusion (CTP), RAPID map (IschemaView), showing a perfusion deficit ($T_{max} > 6$ seconds) 143 mL and ischemic core (CBF < 30%) of 76 mL at left MCA territory (Figure 1C).

Endovascular thrombectomy was then performed under general anesthesia. The onset to puncture time is 280 minutes. Digital subtraction angiography (DSA) with left internal carotid artery (ICA) injection revealed left proximal M1 thrombosis (Figure 2A). Stent-retriever (SR) thrombectomy was subsequently performed by placement of a 4 mm x 40 mm Solitaire X (Medtronic) stent across the thrombus (Figure 2B). After intrathrombus deployment of the SR two times, near-complete recanalization (by the thrombolysis in cerebral infarction (TICI) classification 2b) was achieved (Figure 2C). Large amounts of reddish-brown thrombus were found in the SR (Figure 3A). The neurological deficits improved gradually, but right-sided sensory disturbance remained. Pathological examination of the retrieved thrombus revealed metastatic adenocarcinoma of rectal origin (Figure 3B and C). On a contrast-enhanced CT and a PET/CT of the chest, a mass in the left hilar region was revealed, infiltrating the pulmonary vein and left atrium (Figure 4A and B). The patient was successfully discharged and underwent cetuximab-based palliative therapy. He succumbed to cancer progression four months after intracranial tumor embolectomy.

Discussion

Clinicians in the fields of emergency medicine, neurology, and oncology often possess a conservative or even annihilistic attitude towards a patient with advanced metastatic solid malignancy who developed a large cerebral vessel occlusion causing a massive cerebral infarct. A large Korean study estimated that among patients who underwent reperfusion therapy from the Korean national registry for such therapy, only 4.6% and 5.8% had active and nonactive cancer, respectively.¹² Another extensive national registry analysis demonstrated that out of 40,537 patients with large vessel occlusion who underwent mechanical thrombectomy, only 2.3% were also a patient with metastatic cancer.¹³ The very low proportion of cancer patients in the statistics might suggest that much fewer patients with pre-existing cancer would be arranged to undergo the procedure even in need of it. The debate about the safety issue and effectiveness of mechanical thrombectomy for patients with active solid tumor cancer can be put to rest because recent multiple studies have all demonstrated comparable efficacy and safety attained in patients with no cancer.^{7,12–20}

The post-embolectomy pathological report of the thrombus revealed blood admixed with metastatic adenocarcinomas, such as that in our case is extremely rare.^{3,18} All the large studies reported no cancerous cells in the embolectomy-retrieved thrombus. Studies that have looked into the composition of the thrombus mainly reported thrombi mixed with fibrin platelet components.^{3,21} For patients with cerebral cancerous embolism causing large vessel occlusion, intravenous thrombolysis as for cryptogenic ischemic infarction could be less effective than direct endovascular thrombectomy to

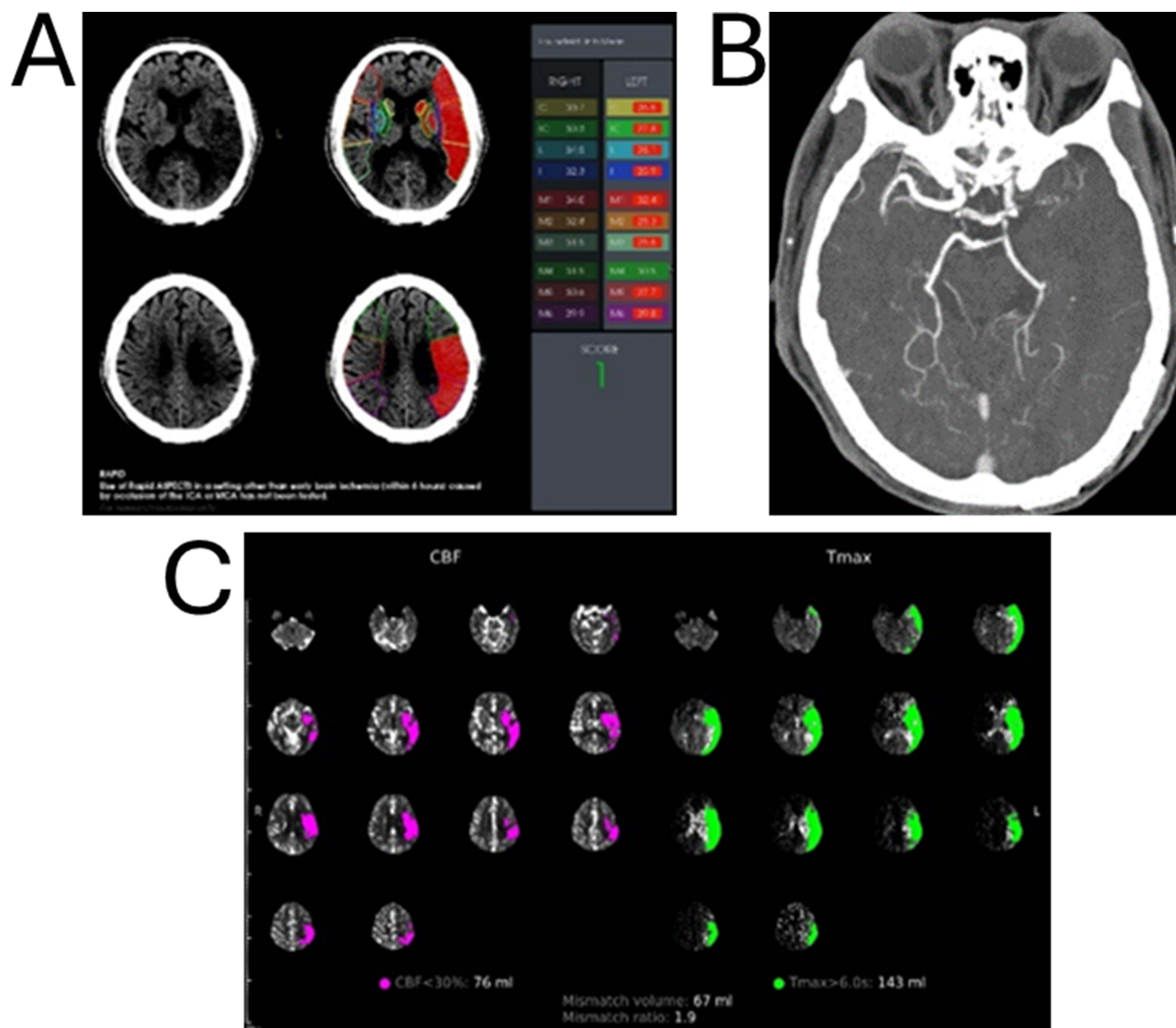


Figure 1 (A) Baseline axial CT performed 360 min after the symptom onset showing a faint hypodensity in the left frontotemporoparietal lobe with a RAPID-ASPECTS of score 1. (B) CTA showed a complete occlusion of the left M1. (C) The RAPID-CTP analysis demonstrated a complete infarct volume of 76 milliliters (mL), entailing a small infarcted core within a large volume of penumbra in the right internal carotid artery vascular territory. The configured Tmax > 6-second volume representing the combination of the infarcted core volume and hypoperfused brain was 143 mL in the left cerebral hemisphere, deriving a mismatch ratio of 1.9.

remove the tumor clots. In addition, the first-line clinicians in the field of hyperacute stroke care often hesitate to administer intravenous alteplase, regarding it as relatively contraindicated in patients with advanced malignancy.

Mattingly et al from a North American stroke center reported their single-center experience of carrying out endovascular embolectomy in patients with active cancer. The results were encouraging, showing comparable recanalization grade and post-procedure hemorrhage rate with the larger pool of counterparts who did not have cancer.¹⁹ Although individual patients were considered on a case-by-case basis, mechanical thrombectomy, when the capacity facilitates, should be strongly recommended to the patient in order to restore immediate recanalization and hopefully good neurological functional outcome. A recent meta-analysis performed by the investigators of the Mayo Clinic assimilating rare cases of cancer-associated cerebral embolism reveals some vital information about the long-term outcomes in patients who underwent mechanical thrombectomy with or without intravenous thrombolysis. Successful reperfusion, defined as TICI 2b–3, was achieved in nearly 90% of the patients; of them, approximately 60% achieved TICI 3. At follow-up, functional independence was observed in 30% of the treated cohort.⁷ However, patients with active



Figure 2 (A) Digital subtraction angiography (DSA), left internal carotid artery injection, anteroposterior (AP) view, showing proximal left middle cerebral artery (MCA) M1 occlusion with intraluminal filling defect due to thrombosis. (B) DSA, AP view, showing a 4-mm × 40-mm Solitaire X (Medtronic) stent-retriever (SR) un-sheathed in the affected MCA with reopening of the vessel. (C) DSA, AP view, post-thrombectomy, showing successful recanalization and restoration of blood flow.

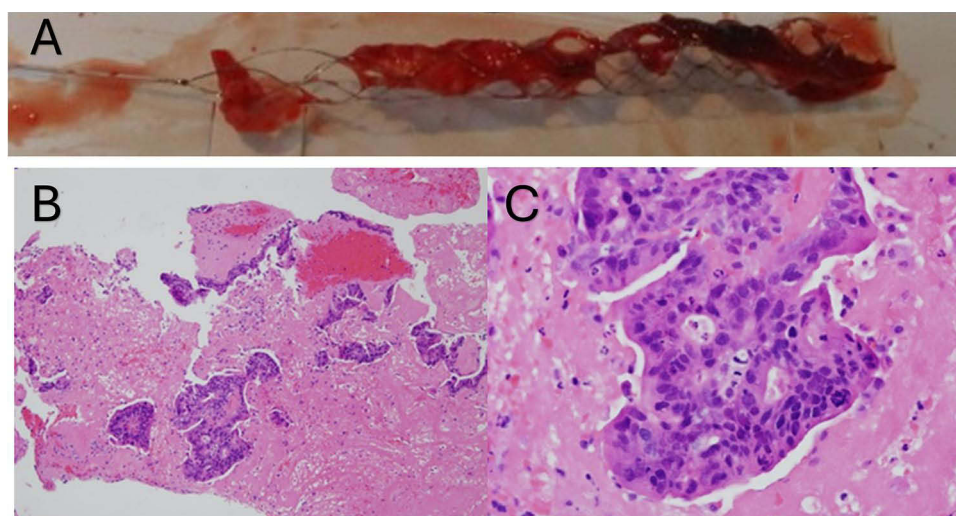


Figure 3 (A) Photograph showing a reddish brown gelatinous thrombus extracted by the stent-retriever. Panels B and C. Photomicrographs of the retrieved thrombi, Hematoxylin and eosin stain, × 100 (B) and × 400 (C), showing fibrin and blood admixed with metastatic adenocarcinoma, which is composed of tubular or fused glands, with pseudostratified epithelium, consistent with colorectal origin. Immunohistochemical stains showed CK7-negative, CD20-positive, and CDX-2-positive.

cancer would harbor a four-fold increase in the risk of death during six months' follow-up, with approximately 46% of the patients dying when compared with patients who did not have cancer.¹²

The uniqueness of this case analysis is not only its rarity. The patient regained the level of neurological function status prior to the massive stroke, which had helped him and the caregivers find adequate time to move on to the next level of care with reasonably good post-stroke quality of life. Successful reperfusion and restoring neurologic function will allow the patient and family more quality time together and a better quality of life, which is particularly important in patients with limited life expectancy. The main limitation noted in this case was that there was no adequate time to study the etiology of the ischemic stroke before the thrombectomy. Nevertheless, the potential risks of mechanical thrombectomy for such a subgroup of patients are similar to patients without cancer in terms of dissection, perforation, vessel spasm,

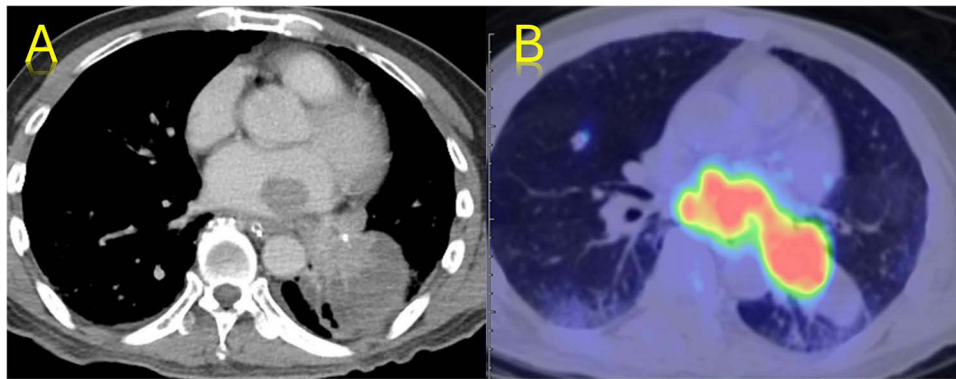


Figure 4 (A) Contrast-enhanced axial CT and (B) PET/CT fusion images of the thorax showing a left lung mass invading the left atrium and pulmonary vein.

emboli to distal branch, reocclusion, parenchymal hemorrhage, and symptomatic intracerebral hemorrhage, as revealed by a large retrospective cohort analysis.¹²

Conclusion

In conclusion, this case presents a compelling example involving advanced rectal cancer with brain metastasis and a rare instance of stroke caused by metastatic adenocarcinoma arising from a metastatic lung tumor with left atrial invasion. It reminds us that the medical community in the arena of hyperacute stroke care needs to recommend mechanical thrombectomy in the first place, even the etiology of the acute ischemic stroke could be a tumor embolus in patients with advanced solid organ malignancy. Mechanical thrombectomy can be highly effective for acute ischemic stroke in cancer patients, offering significant improvements in neurological function and quality of life, even with advanced malignancy. Despite similar procedural risks to non-cancer patients, careful patient selection, and a multidisciplinary approach can optimize outcomes and provide meaningful palliative benefits.

Ethics Statement

The patient is deceased; therefore, we sought permission and obtained written consent for publication from the patient's next of kin. A copy of the signed consent form has been submitted along with the manuscript to the journal. Institutional approval was not required to publish this case report. We wrote this case report adhering to the CARE guidelines to ensure all key details about the case were reported and submitted the checklist with the report.

Disclosure

The authors report no conflicts of interest in this work.

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