



Case Report

Brain abscess – A rare complication of endovascular treatment for acute ischemic stroke

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ABSTRACT

Background: Brain abscess is a neurosurgical emergency, which can arise through direct bacterial seeding or hematogenous spread. Rarely, brain abscess formation has been reported following ischemic stroke. An increasingly utilized therapy for stroke is mechanical thrombectomy, and within this report, we present a case of brain abscess formation following this procedure.

Case Description: A 78-year-old female presented to our center with a right total anterior circulation stroke (TACS) secondary to terminal internal carotid artery occlusion. An emergent mechanical thrombectomy was performed and the patient's initial postoperative recovery was good. In the 3rd week after the procedure, however, the patient became more confused and following the onset of fever, an MRI brain was performed, which demonstrated an extensive multiloculated right-sided brain abscess. Burr hole drainage of the abscess was subsequently undertaken and pus samples obtained grew *Proteus mirabilis*, presumed secondary to a urinary tract infection, and the patient was started on prolonged antibiotic therapy. To date, the infection has been eradicated and the patient survives albeit with persistent neurological deficits.

Conclusion: To the best of our knowledge, this is the first reported UK case of brain abscess following mechanical thrombectomy for stroke. Endovascular interventions can lead to increased incidence of ischemia-reperfusion injury in stroke with increased blood-brain barrier damage and risk of microbial seeding. This case highlights the need for rigorous asepsis and proactive treatment of systemic infections in the acute phase following endovascular treatment and consideration of brain abscess in all patients who present with new-onset confusion and unexplained fever following stroke.

Keywords: Brain Abscess, Stroke, Thrombectomy

INTRODUCTION

Brain abscess is a rare but potentially life-threatening condition, which is caused by bacterial seeding into the brain parenchyma.^[17] This seeding can occur through direct or indirect inoculation.^[6,15,26] Whereas nearly half of cases are due to local spread from bacterial infection in contiguous structures such as middle ear or dental infections, up to a quarter of cases are thought to arise secondary to hematogenous spread from a remote infected site (e.g., lung abscess).^[6,15,26] In recent years, evidence has also emerged from numerous case reports that abscess formation can also occur as a rare complication following both ischemic and hemorrhagic stroke, and to date, there have been three previous reports of intracranial abscess formation following endovascular therapy (mechanical thrombectomy or intra-arterial thrombolysis) for stroke^[10,22,27] [Table 1]. The

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pathophysiological basis for this association is not, however, fully understood.^[3,6,12,16] Lack of normal blood flow to both the infarcted stroke core and ischemic penumbra may limit the ability of innate and adaptive immune cells to target invading bacterial pathogens.^[5] In addition, it is known that following ischemia or infarction, there is a loss of blood–brain barrier (BBB) integrity within the affected brain region, which may make the area vulnerable to hematogenous microbial seeding during bacteremia.^[22,27] Revascularization techniques such as thrombolysis with tissue plasminogen activator (tPA) and mechanical thrombectomy may increase this risk of bacterial translocation through further blood–brain barrier disruption and secondary ischemia-reperfusion injury.^[3,6,21]

CASE DESCRIPTION

A 78-year-old previously fit and independent lady presented to our center 3½ hours after witnessed onset of left-sided weakness and difficulty in speaking following a fall. Relevant medical history included atrial fibrillation for which she was taking apixaban and mild cognitive impairment; premorbid modified Rankin scale was 1. On admission, the patient was seen by the specialist stroke service and diagnosed with a right total anterior circulation stroke (TACS); NIHSS score was 21. Noncontrast CT head and intracranial CT angiography demonstrated an extensive right MCA territory infarction with occlusion of the right terminal internal carotid artery (ICA) and right proximal M1 segment middle cerebral artery (MCA) [Figure 1]. ASPECT score was 6. Due to the presenting history of fall, concurrent apixaban usage, and concern about potential neck of femur fracture, thrombolysis was contraindicated and the patient was taken to the angiography suite for mechanical thrombectomy using a stent retriever device and aspiration (Synchro System[®], Stryker, Fremont, CA). Successful recanalization was achieved at 5.5 h from symptom onset. Thrombolysis in cerebral infarction score pre- and postintervention was 0 and 3, respectively, and total procedure time was <1 h. At the end of the procedure,

an Angio-Seal™ device (Abbott, Illinois, USA) was placed in the femoral artery.

Following the thrombectomy procedure, the patient initially made a good postoperative recovery, recovering to Medical Research Council Grade 3 in arm and leg, and the patient was repatriated back to her local hospital. In the 3rd week after repatriation, however, the patient developed progressive confusion. Repeat CT head at 4 weeks postthrombectomy was initially reported as demonstrating possible hemorrhagic transformation with surrounding edema and midline shift.

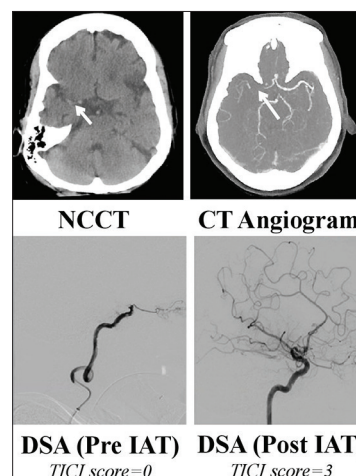


Figure 1: Top: admission noncontrast CT (NCCT) head demonstrated extensive right MCA territory infarction with hyperdense right MCA M1 segment (short arrow). ASPECT score was 6. CT angiogram confirmed occlusion of the terminal right ICA and right M1 segment (long arrow). Note retrograde flow within the A1 vessel from the contralateral side. Bottom: catheter angiography images (arterial phase) pre and post intra-arterial thrombectomy showing successful recanalization of the terminal ICA and right MCA. TICI score pre- and postintervention was 0 and 3, respectively. ASPECT: Alberta stroke program early CT score; DSA: Digital subtraction angiography, ICA: Internal carotid artery, MCA: Middle cerebral artery, NCCT: Noncontrast CT, TICI: Thrombolysis in cerebral infarction.

Table 1: Previously reported cases of brain abscess formation after endovascular therapy for stroke. Microorganism identified from abscess pus samples taken intraoperatively.

Author	Year	Age, sex	Abscess location	Endovascular treatment	Suspected information source	Microorganism	Symptoms	Time interval (stroke–abscess diagnosis)
Yamanaka et al. ^[27]	2011	75, Male	Left frontal lobe	Intra-arterial thrombolysis	Unknown	<i>Staphylococcus epidermidis</i>	Asymptomatic	3 months
Guenego et al. ^[10]	2017	66, Female	Left caudate nucleus	Mechanical thrombectomy	Unknown	Methicillin-sensitive <i>Staphylococcus aureus</i>	Worsened right hemiplegia	2 weeks
Rao et al. ^[22]	2018	32, Female	Right basal ganglia	Mechanical thrombectomy	Skin/central venous catheter (CVC)	<i>Fusobacterium necrophorum</i>	Severe headaches	4 weeks

Due to ongoing confusion and the development of pyrexia, further imaging with both contrast-enhanced CT and MRI was undertaken at 7 weeks posttreatment. MR imaging demonstrated an extensive right frontal cerebral abscess with mass effect and midline shift [Figure 2]. Diagnostic work-up for the infective source of this abscess was undertaken, but the only evidence suggestive of an external infective source was raised leukocytes and mixed bacterial growth in a midstream urine sample. There was no evidence of infective endocarditis on either transthoracic echocardiogram or serial blood cultures. Based on the MRI appearances, the patient was transferred under the care of the neurosurgical team at our center and subsequently underwent ultrasound-guided burr hole drainage of the brain abscess, with 95 mls of frank pus aspirated. Microbial pus samples grew *Proteus mirabilis*, sensitive to ceftriaxone and the patient was started on a 6-week course of antibiotics. Following surgery, the patient was transferred back to her local hospital for ongoing neurorehabilitation, and to date, the infection has been eradicated.

DISCUSSION

Mechanical thrombectomy has an established and growing role in the management of ischemic stroke and similar

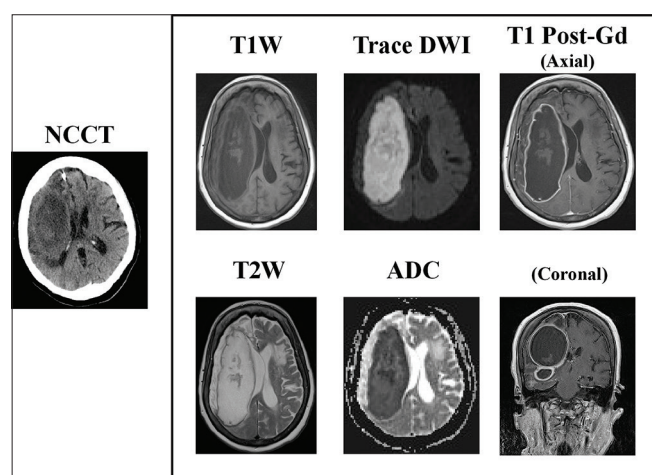


Figure 2: Noncontrast computed tomography (NCCT) and contrast-enhanced MR imaging performed 7 weeks postthrombectomy. T1- and T2-weighted images demonstrate an extensive right-sided multiloculated fluid-filled cavity extending into the right middle cranial fossa, right temporal pole, and right inferior frontal lobe. Trace DWI/ADC images demonstrate prominent diffusion restriction consistent with abscess formation and on post-Gd T1W images there is marked enhancement of the abscess capsule peripherally. Note the high T2-weighted signal change within the surrounding right frontoparietal lobes, and the associated mass effect from the abscess with partial effacement of the right lateral ventricle and midline shift. ADC: Apparent diffusion coefficient; DWI: Diffusion-weighted imaging, T1W: T1 weighted, T2W: T2 weighted.

to other endovascular techniques is generally considered to be a clean procedure.^[10] High rates of bacteremia (up to 30%) have, however, been reported in procedures lasting longer than 2 h and brain abscess formation after other endovascular procedures such as arteriovenous malformation embolization and aneurysm coiling has been reported.^[2,7,10,13,15,19,27,28] Long procedure length, multiple skin punctures, and repeated catheter handling have all been suggested as risk factors for infection during endovascular procedures, but in the present case, the procedure was uncomplicated with a total procedure time of <1 h.^[10] Similarly, while infection has been reported following usage of a vascular closure device such as Angio-Seal, this is rare, and there was no clinical suggestion that this was a source of infection in this patient.^[18,24] Given the absence of any other external infective source and the presence of *Proteus* species in pus samples from the abscess itself, one possible cause of infection in the present case was a posttreatment urinary tract infection with transient bacteremia. *Proteus* can, however, also enter blood stream through wounds, accounting for up to 4% of surgical site infections in neurosurgical case series.^[25] As such periprocedural infection in this case cannot be excluded and this case highlights the need for rigorous asepsis and proactive treatment of systemic infections in the periprocedural and acute phase following endovascular stroke therapy.^[27]

In two of the three previously reported cases of abscess formation following endovascular treatment [Table 1], staphylococcal species were identified but the source of the bacteremia or relationship to the procedure itself was not clear, in the third case, *Fusobacterium* bacteremia secondary to either endotracheal intubation or central venous catheter insertion was suspected but not proven.^[10,22,27] Alongside prolonged procedure length and periprocedural infection, older age and immunocompromised status are also thought to be predisposing risk factors for brain abscess formation.^[1,3,4] While in the presented case, there was no evidence to suggest a history of prior immunodeficiency or immunomodulatory agent use, the patients advanced age and an acquired immunocompromised status poststroke cannot be ruled out as predisposing risk factors for brain abscess formation in this patient.^[1,8,11]

The classic presentation of brain abscess is with fever, headache, and focal neurological deficit but in only 20% of cases is this classic triad of symptoms seen.^[14] Seizures may also be a presenting symptom.^[22] A salient feature of the presented case is that symptoms and signs were initially subtle, manifest only as confusion and then later pyrexia. In only one of the three previously reported cases shown in [Table 1] was worsened neurological deficit a presenting feature and in a recent case series review of brain abscess after stroke, only 5/14 cases had new or

worsening focal neurological deficits, with the remainder of patients either remaining asymptomatic or presenting with headache and/or new-onset confusion.^[22] In the present case, it was not until 7 weeks following treatment that the diagnosis of abscess was confirmed and previous case series of brain abscess formation poststroke, with or without endovascular intervention, have demonstrated similar times to presentation.^[10,20,22,26,27] In the case series by Rao *et al.*, for example, a time interval of 2 weeks–4 months between stroke onset and abscess diagnosis was reported,^[22] and abscess formation at 58 weeks following the initial stroke has been reported in one case.^[20]

The above case and the included literature review highlight that brain abscess should be considered in the differential diagnosis in any poststroke patient who presents with severe headache, fever, or new-onset confusion, irrespective of whether any endovascular or surgical intervention has been undertaken.^[5,26] Because by their nature, these abscesses develop at previous sites of ischemic infarction, new or progressive neurologic deficits may be absent or delayed in onset and are, therefore, of limited positive and negative predictive value.^[5,22] Previous case series have shown that most patients who developed brain abscess had negative systemic cultures, and in recent case, serial blood cultures were negative.^[5,22,26] Irrespective of culture results, therefore, stroke patients with unexplained headache or new symptomatology should undergo additional imaging.^[26] As in the present case, CT imaging may be difficult to interpret in isolation in the poststroke setting and if clinical suspicion remains MR imaging and where required consultation with specialist neuroradiology services should be undertaken.^[9,10,23]

CONCLUSION

To the best of our knowledge, this is one of only four reported cases of brain abscess following endovascular therapy for stroke and the first such reported case in the UK. Our case highlights the need for rigorous asepsis and proactive treatment of systemic infections in the periprocedural and acute phase following endovascular stroke therapy and the requirement to consider this rare, but potentially life-threatening complication in all patients who present with unexplained fever, severe headache, or new-onset confusion following stroke.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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