

CT and MR imaging in acute stroke to evaluate intra-arterial therapy: a case report

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Section: Interventional radiology

Area of Interest: Head and neck Interventional vascular
Vascular

Procedure: Diagnostic procedure

Procedure: Thrombolysis

Imaging Technique: CT

Imaging Technique: CT-Angiography

Imaging Technique: CT-Quantitative

Imaging Technique: MR

Imaging Technique: Catheter arteriography

Imaging Technique: MR-Angiography

Special Focus: Embolism / Thrombosis Ischaemia /

Infarction Case Type: Clinical Cases

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Patient: 52 years, male

Clinical History:

A 52-years-old man, while in complete well-being, suddenly fell down to the ground unconscious and was transported to the emergency room within 30 minutes. Physical examination was performed noting drowsiness, dysarthria, left facial droop, arm and leg paralysis and a gaze toward the right. These symptoms were suspicious for stroke.

Imaging Findings:

The CT documented an area of decreased attenuation of the right lenticular nuclei, a loss of grey-white matter differentiation in the right hemisphere and a "hyperdense MCA sign", suggestive for intravascular thrombi. In order to evaluate the quantitation of ischaemic involvement, the patient underwent also a CT angiography (CTA) with perfusion (CTP) and a MR with diffusion (DWI). The CTA reported the tandem occlusion of the right ICA and MCA. CTP perfusion maps of mean transit time (MTT), cerebral blood volume (CBV) and cerebral blood flow (CBF) showed an area with decreased blood volume that represented ischaemic core and an area with normal blood volume but decreased blood flow and increased mean transit time that represented penumbra. The MR-DWI showed an area with decreased diffusion and confirmed the extension of the ischaemic core.

Discussion:

Stroke is an acute central nervous system injury with an abrupt onset. 80% of strokes are caused by acute ischaemia. In the past imaging was used to exclude haemorrhage or other mimics of stroke, now diagnostic imaging is fundamental to identify patients who would differentially benefit from different treatment such as intravenous t-PA or endovascular therapy.

Unenhanced CT is the first examination that should be performed when suspecting ischemia because is widely

available [1]. Unenhanced CT in a large vessel occlusion could show hyperdense vessel sign, insular ribbon sign and obscuration of the lentiform nucleus. Angiography CT is a widely available technique for assessment of both intracranial and extracranial circulation and shows thrombi in intracranial vessels [2].

CT perfusion is a new techniques could differentiate between an ischaemic penumbra (region of constrained blood flow in which energy metabolism is preserved) and infarcted tissue.

The presence of an ischaemic penumbra is an indication that thrombolytic therapy may be beneficial.

In “Guidelines and recommendations for perfusion imaging in cerebral ischaemia” the role of perfusion imaging was confirmed [3] in diagnosis and therapy for acute stroke because it may help to determine the relative benefits and risks of a given therapy.

Recanalization of arteries serving tissues that are severely ischaemic or infarcted may increase the risk of oedema and haemorrhage and unfavourable outcome [4].

In our case the diagnosis of right ischaemic stroke with tandem lesions in the right ICA and MCA was made in our department with a 64SL MDCT and a 3.0 T MR device.

In order to restore blood flow, the patient was transported immediately to the angiographic suite and underwent a mechanical thrombectomy with thrombus aspiration. A femoral artery access was obtained with a micropuncture set to minimize potential groin bleeding after the procedure and a 6F guiding sheath was inserted; the left common carotid artery was catheterized in order to evaluate collaterals flow, then the right common carotid artery was catheterized to diagnose the site of proximal occlusion. At this time, a drug-eluting stent was positioned to maintain patency of the right ICA and the simultaneous use of a stent retriever (Revive) and a thrombus aspiration system (Penumbra) permitted to restore blood flow. Finally, the patient was managed in the intensive care unit with frequent neurological evaluations and tight control of blood pressure. A MR after 2 days confirmed the ischaemic lesion previously described and the rescue of penumbra.

Differential Diagnosis List: Acute ischaemia in the region of the right middle cerebral artery, Haemorrhage, Brain neoplasm, Metastases

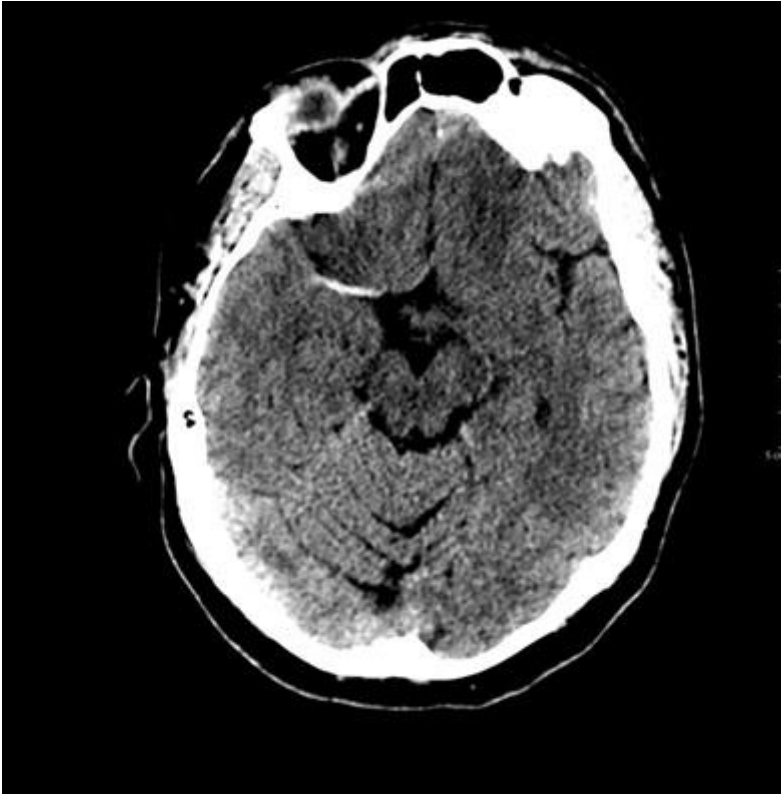
Final Diagnosis: Acute ischaemia in the region of the right middle cerebral artery

References:

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- Kidwell CS, Jahan R, Gornbein J et al (2013) A Trial of Imaging Selection and Endovascular Treatment for Ischemic Stroke. The new england journal of medicine n engl j med nejm.org 1 368(10):914-23 (PMID: [23394476](#))
- Latchaw RE, Yonas H, Hunter GJ et al (2003) Guidelines and recommendations for perfusion imaging in cerebral ischemia: A scientific statement for healthcare professionals by the writing group on perfusion imaging, from the Council on Cardiovascular Radiology of the American Heart Association. Stroke 34(4):1084-104 (PMID: [12677088](#))
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Figure 1

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Description: Unenhanced CT shows hyperdense vessel sign in right middle cerebral artery. **Origin:** università di roma tor vergata

Figure 2

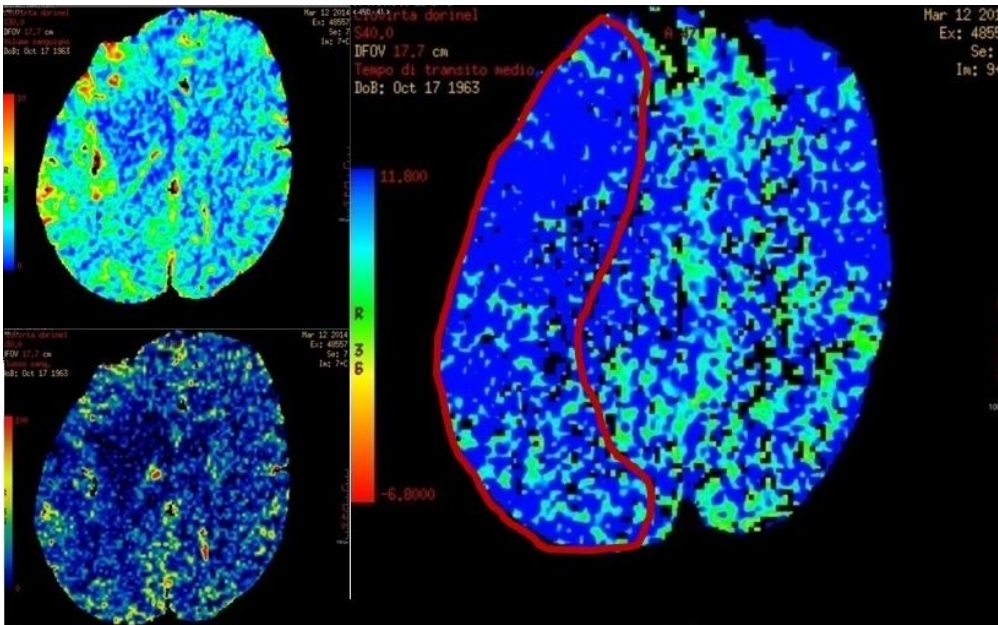
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Description: Angio-CT shows thrombi in right middle cerebral artery and occlusion of right internal carotid. **Origin:** università di roma tor vergata

Figure 3

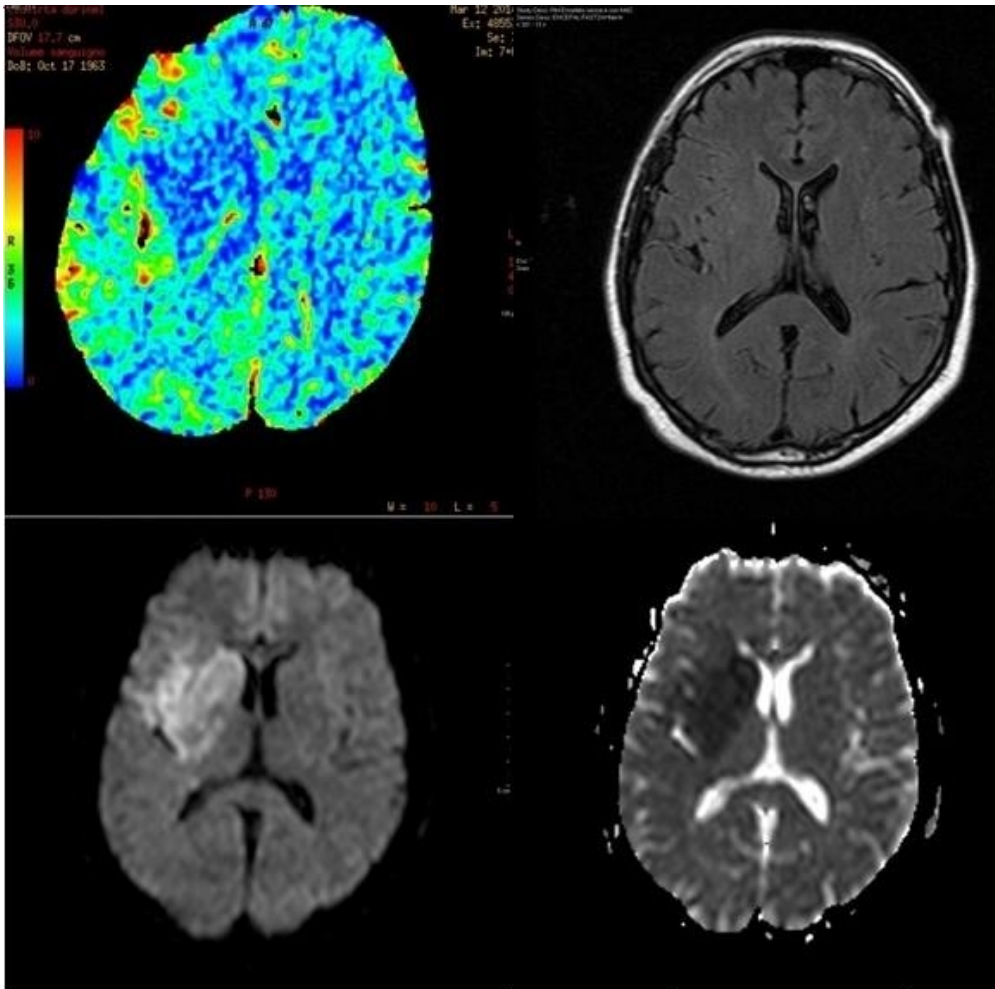
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Description: A larger ischaemic than infarcted area was shown by CTP using the time to peak images and the mean transit time (MTT) and relating them to the cerebral blood volume (CBV) images. **Origin:** università di roma tor vergata

Figure 4

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Description: MR shows diffusion restriction in infarcted area as the map of cerebral blood volume on the perfusion CT. **Origin:** università di roma di tor vergata

Figure 5

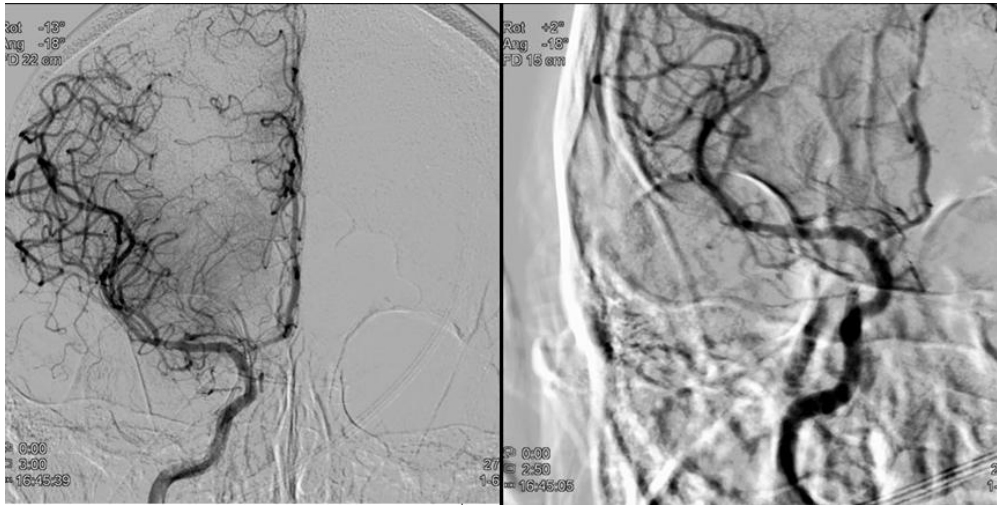
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Description: Angiographic image shows occlusion of middle cerebral artery. **Origin:** università di roma tor vergata

Figure 6

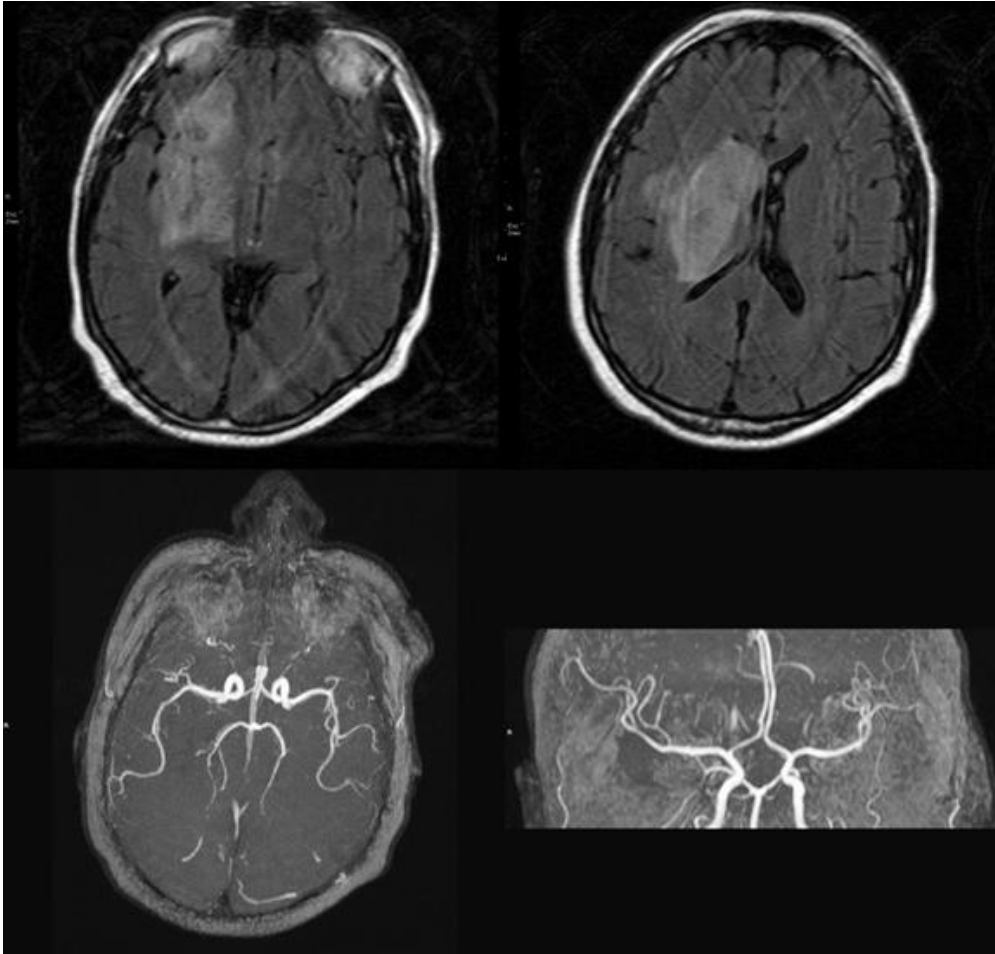
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Description: Angiographic controls after the use of thrombus aspiration system (Penumbra). **Origin:** università di roma tor vergata

Figure 7

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Description: MR and angio-MR after endovascular thrombolysis. **Origin:** università di roma tor vergata