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Diagnostic Imaging Pathways - Transient Ischaemic Attack

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients presenting with a history of suspected transient ischaemic attack.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

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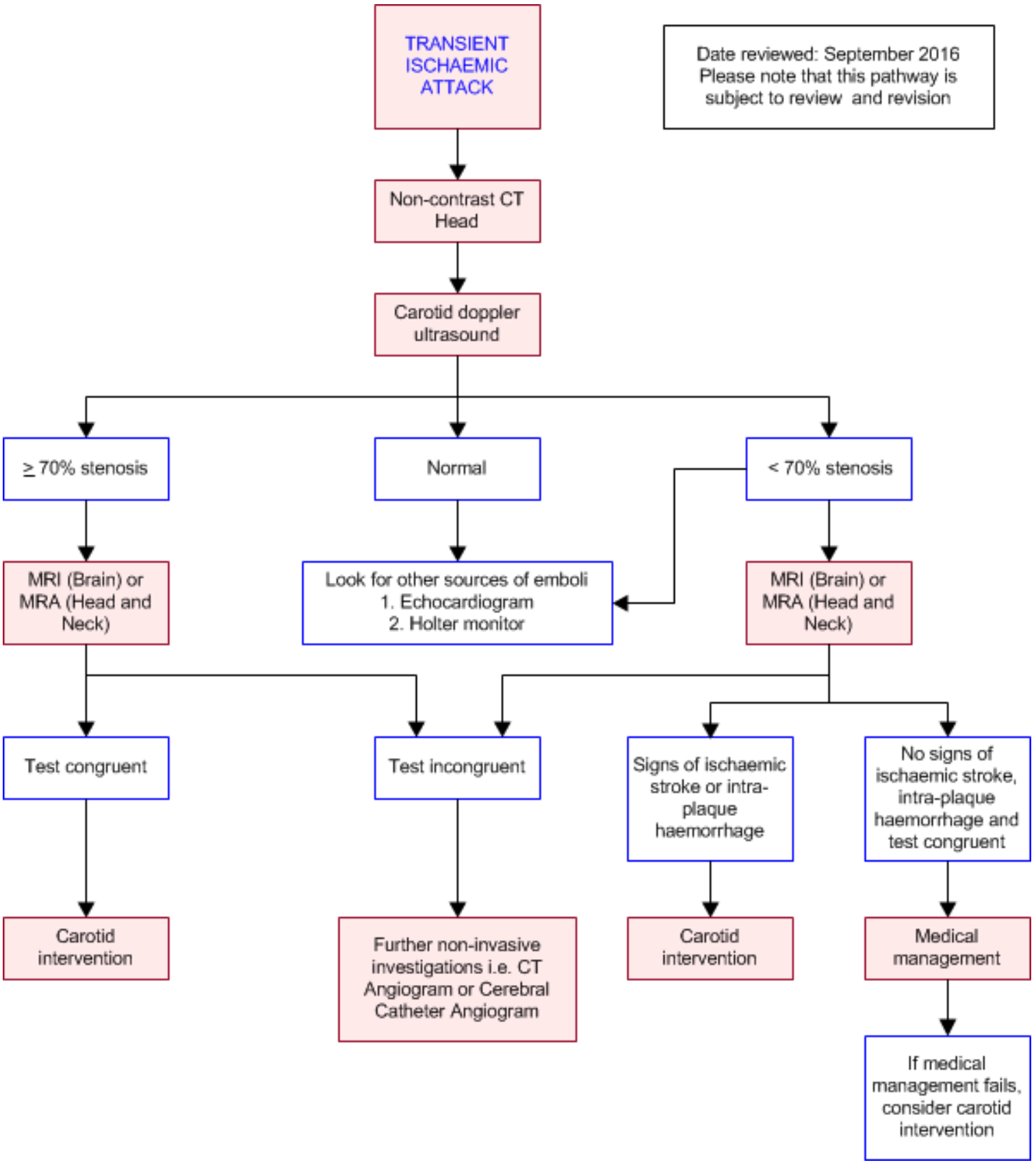

Image Gallery

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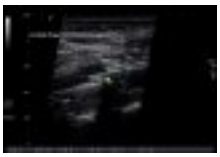
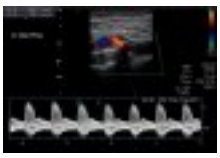
Note: These images open in a new page

1a



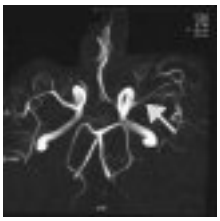
1b



Left Common and Internal Carotid Artery Stenosis

Image 1a and 1b (Carotid Doppler): Moderate amount of plaque at the origin of the left common carotid artery (arrow) extending into the internal carotid artery. Velocity measurements indicate stenosis in the order of 70%.

2



Left Middle Cerebral Artery Stenosis

Image 2 (MR Angiography): Narrowing of the left middle cerebral artery with reduced flow (arrow).

3a

3b

Left Internal Carotid Artery Stenosis

Image 3a and 3b (Digital Subtraction Angiography): Pre- and post-angioplasty views of a left internal carotid artery stenosis (arrows).

Teaching Points

- **Patients with TIA should preferably undergo neuroimaging evaluation within 24 hours of symptoms onset**
- **A non-contrast computed tomography (CT) is the initial imaging modality of choice in suspected TIA to identify haemorrhage, ischaemia or space occupying lesion**
- **Carotid Doppler ultrasound should be performed to assess for extracranial arterial stenosis or plaque**
- **If the carotid arteries are normal (i.e. no plaque) or had <70% stenosis, alternative sources of cerebral emboli should be considered**

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(Echocardiogram/Holter)

- **After carotid Doppler, Magnetic Resonance Imaging (MRI)-Brain and Magnetic Resonance Angiography (MRA)-Head and Neck should be considered to assess for ischaemic changes in brain parenchyma and carotid artery stenosis with plaque characteristics respectively**
- **If there is uncertainty as to the degree of carotid stenosis, further non-invasive imaging with CT Angiography is recommended. If two noninvasive tests are discordant, Cerebral Catheter Angiogram should be considered**
- **Treatment options include medical management, carotid endarterectomy or carotid angioplasty/stenting for athero-occlusive disease of the carotid artery**

Transient Ischaemic Attack (TIA)

- **Approximately half of the early risk of stroke after a TIA occurs within the first 48hrs and therefore early diagnostic workup and treatment is mandatory.** [2, 3] **The ABCD^2 tool has been suggested as a means of risk stratifying patients with TIA** [2]
  - **A Age ? 60 years (1 point)**
  - **B Blood pressure: systolic ? 140 or diastolic ? 90mmHg (1 point)**
  - **C Clinical features: unilateral weakness (2 points), speech impairment without weakness (1 point)**
  - **D Duration: ? 60mins (2 points) or 10-59 mins (1 point)**
  - **D Diabetes: Present (1 point)**

  Total Score >4 = high risk, ?4 = low risk

- **High risk patients should have imaging within 24 hours, be considered for admission or referral to a TIA clinic for urgent assessment and be treated as for an acute stroke. Low risk patients should have a head CT as soon as possible (within 48-72hrs) and should be referred to a general practitioner, private specialist or TIA clinic for ongoing assessment. Carotid duplex ultrasound is recommended for patients with carotid territory symptoms (eg, amaurosis fugax, dysphasia)** [1, 2, 4]

Computed Tomography (CT)

- **A non-contrast CT is the initial imaging modality of choice in transient ischaemic attack**
- **CT Brain is useful to exclude conditions that could mimic TIA such as haemorrhage or brain tumour and should be carried out in all patients** [2]
- **May reveal an area of brain infarction appropriate to TIA symptoms in 15-30% of patients (which may influence subsequent management, especially the**

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timing of an eventual carotid endarterectomy) 5, 6
- CT has high specificity (1.00, 95% CI 0.94 – 1.00) and low sensitivity (0.39, 95% CI 0.16 – 0.69) 7
- Advantages
  - Widely available and less expensive than MRI
  - Excellent sensitivity for detecting acute haemorrhage 8
- Disadvantages
  - Less sensitive than DWI for the detection of acute ischaemia within first 12 hours 7, 8
  - Ionizing radiation – this may be of significance in younger patients

Carotid Doppler Ultrasound (US)

- Recommended for all patients with carotid artery territory symptoms (e.g., amaurosis fugax, dysphasia) who would potentially be candidates for carotid re-vascularisation
- Screening modality of choice for the study of vessels involved in causing symptoms of transient ischaemic attacks 9,10
- ~87% sensitivity and ~75% specificity in identifying severe internal carotid artery stenosis 10, 11
- In some centres, Doppler ultrasonography is viewed as a screening test and patients with > 50% stenosis in the ipsilateral carotid artery with symptomatic disease are referred for further imaging in the form of MRA or CTA
- Advantages: non-invasive, relatively inexpensive and widely available
- Disadvantages
  - More "operator dependant" compared to other imaging modalities
  - Difficult to distinguish between 'trickle flow' seen in severe stenosis, and complete occlusion

Magnetic Resonance Imaging (MRI)

- MRI involves static magnetic field and non-ionizing radiation to acquire diagnostic images
- MRI is ideal for soft tissue imaging like Brain and Spine
- Advantages:
  - Does not involve ionising radiation
  - Superior soft tissue contrast and hence better yield than CT
- Disadvantages:
  - Limited availability
  - Longer acquisition time
  - Not suitable for patients with metal implants or foreign body

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Magnetic Resonance Angiography (MRA)

- **Traditional non-enhanced MRA (Time of Flight MRA) is a non-invasive procedure utilising flow-related enhancement. Contrast-enhanced MRA (CE MRA) is a relatively new form of imaging involving a time-optimised bolus of gadolinium-based intravenous contrast to define the vasculature** 12, 13
- **The sensitivity and specificity for MRA in the detection of intracranial artery stenosis and occlusions has varied between 85%-100% and 91%-97% respectively in comparison to digital subtraction angiography** 14-16
- **Some studies** 17 **suggest that a higher agreement rate exists between Carotid Doppler ultrasound + MRA rather than between Carotid Doppler ultrasound + CTA and a recently published meta-analysis indicates MRA as the most accurate test for the identification of critical (>70%) stenosis in both symptomatic and asymptomatic subjects** 18
- **A strategy using combination of carotid Doppler ultrasound and MRA, reserving Digital Subtraction Angiography (DSA) for incongruent results, has been found to maximise quality adjusted life expectancy, and was cost effective alternative to using DSA alone** 9
- **More recent studies support the use of contrast enhanced MRA as a diagnostic alternative to DSA in the preoperative evaluation of patients prior to carotid endarterectomy** 19, 20
- **Advantages**
  - **non-invasive**
  - **relatively less expensive and safer than catheter cerebral angiography**
- **Limitations:** 21
  - **MR scanners are not widely available**
  - **Overestimates the degree of arterial stenosis especially in high grade narrowing**
  - **Difficulties in depiction of distal and small vessels which is exacerbated in older patients**
  - **Limited sensitivity for the detection of small cerebral aneurysms (**
  - **Carotid atheromatous ulceration is not reliably visualised**

Carotid Intervention 22, 23

- **Three major randomized trials have demonstrated the superiority of Carotid Endarterectomy plus medical therapy over medical therapy alone for symptomatic patients with a high-grade (>70% angiographic stenosis) atherosclerotic carotid stenosis** 24-26
- **For patients with a TIA or ischaemic stroke within past 6 months and ipsilateral severe (>70% stenosis) carotid artery stenosis as documented by non-invasive imaging, Carotid Endarterectomy (CEA) or Carotid Artery**

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Stenting (CAS) is recommended if peri-operative morbidity and mortality risk is estimated to be

Catheter Cerebral Angiogram

- **Digital Subtraction Angiography, the most widely used method of conventional catheter-based angiography, remains the gold standard for evaluating the cerebral vessels with regard to determining the degree of arterial stenosis and the presence of dissection, vasculopathy, vasculitis or occult lesion such as vascular malformation** 38
- **Rarely performed in acute setting due to availability of non-invasive modalities such as CTA and MRA**
- **Involves risk of stroke (0.14 to 1 percent) and TIA (0.4 to 3 percent)** 39, 40

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Date of literature search: May 2016

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