



Stroke imaging services; guidance and advice

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Summary

This is the fourth edition of the advice and guidance document *The Role of the Radiographer in Stroke Management* that was originally issued on 1st September 2007. Radiographers are a vital part of the specialist stroke care team. Patients with acute brain attack require rapid access to high quality and appropriate imaging in order to diagnose the type of stroke.

Patients who suffer a Transient Ischaemic Attack (TIA) have been shown to be at high risk of suffering an ischaemic stroke and also require urgent imaging after appropriate assessment in order to ensure reduced morbidity.

These patients also require follow up imaging, either by Computed Tomography (CT) or Magnetic Resonance (MR) in order to assess the efficacy, and/or options for further treatment.

Introduction

Radiographers are a vital part of the specialist stroke care team. Patients with acute brain attack require rapid access to high quality and appropriate imaging in order to diagnose the type of stroke^{1,2} and to allow for early intervention, such as thrombolysis, which has been shown to significantly improve patient outcome if administered within three hours.³

Patients who suffer a Transient Ischaemic Attack (TIA) have been shown to be at high risk of suffering an ischaemic stroke and may also require urgent imaging after appropriate assessment in order to ensure reduced morbidity. These patients also require follow up imaging, either by Computed Tomography (CT) or Magnetic Resonance (MR) in order to assess the efficacy of, and/or options for, further treatment. Further developments in treatment options for TIA (particularly carotid endarterectomy) mean that radiographers may also be involved in the provision of carotid Doppler Imaging.

Definitions

Transient Ischaemic Attack – sometimes defined as a minor stroke, in which the blood supply to the brain is temporarily disturbed, leading to stroke like symptoms, but where the symptoms resolve within 24 hours. The cause of a TIA is the same as the cause of ischaemic stroke (see below).

Stroke - caused by a disturbance in the blood supply to the brain. There are two main types:

1. Ischaemic stroke - triggered by a clot narrowing or blocking a blood vessel to the brain causing the area of brain supplied by that vessel to be starved of oxygen, leading to the death of brain cells.
2. Haemorrhagic stroke (or Primary Intracerebral Haemorrhage) triggered by the rupture of blood vessels leading to bleeding into the brain and causing damage.

There are other unusual and relatively rare types of stroke and conditions that mimic the symptoms of stroke. Examples may include: cerebellar haematoma and large vessel dissection.

Imaging is vital in helping to identify the causes of acute stroke. Definitive diagnosis between these brain assaults is normally undertaken initially by CT brain scanning, and effective treatment, which can vary significantly depending on the type of stroke diagnosed, cannot be commenced until imaging and interpretation of these scans has taken place. The importance of the radiography workforce, therefore, cannot be overestimated.

The role of the radiographer

Radiographers undertaking this work not only have highly specialist skills in imaging modalities, but are experienced in the care and techniques required for scanning acutely ill patients who require urgent assessment during a critical period of the care pathway. Additionally, they may also have the advanced practitioner skills to review and report the images obtained to help facilitate rapid access to thrombolytic therapy by the stroke care team, or neurosurgical review, within the short timescale required. They may also be able to undertake the further imaging techniques such as CT Angiography and CT perfusion imaging. There will also be a need for MR scanning, specifically for TIA including Diffusion Weighted Imaging (DWI), MR perfusion, and, in addition, Magnetic Resonance Angiography (MRA), Contrast Enhanced MRA (CEMRA) if appropriate, and Carotid Imaging.

Imaging overview

The Department of Health document [Implementing the National Stroke Strategy: an imaging guide⁴](#) advises that Imaging Services Managers will need to be able to provide the following services:

TIA

- MRI/MRA brain scans available seven days per week for those patients who require it. Scanners will be required to have appropriate software for gradient echo and diffusion weighted imaging.
- provision for Contrast Enhanced MRA (CEMRA) for first line carotid imaging with facilities for pump injection
- carotid imaging available seven days per week, which will ideally include CEMRA and duplex ultrasound, and CT angiography, although this would depend on local protocol.

The Department of Health (DH) Stroke Policy Team recognises that this will be difficult to deliver. If MR is available, patients may have CEMRA at the same time. However, if MR is not available, but Carotid Doppler is, then that should be the pathway. The DH Stroke Policy Team advice is not prescriptive and a patient should only need one pathway.

Stroke

- 24 hour access to CT with patients who may be suitable for thrombolysis being scanned within as short a timescale as possible, but within the next (appropriately triaged) slot in normal working hours and within 60 minutes outside normal working hours
- rapidly accessible MRI, with the features described above for those patients who require it
- the ability to undertake more complex imaging examinations for stroke subtypes as described.

Further recommendations for imaging

The Nice Guidelines CG68 ⁵Stroke: Diagnosis and initial management of acute stroke and transient ischaemic attack (TIA) (2008) recommend the following imaging criteria for stroke and TIA.

Brain imaging for the early assessment of people with acute stroke

Brain imaging should be performed immediately for those with acute stroke who have any of the following:

- indications for thrombolysis or early anticoagulation treatment
- anticoagulant therapy
- a known bleeding tendency
- a depressed level of consciousness (Glasgow Coma Score below 13)
- unexplained progressive or fluctuating symptoms
- papilloedema, neck stiffness or fever
- severe headache at onset of stroke symptoms.

For all people with acute stroke without indications for immediate brain imaging, scanning should be performed as soon as possible.

Suspected TIA - referral for urgent brain imaging

People who have had a suspected TIA (that is, whose symptoms and signs have completely resolved within 24 hours) should be assessed by a specialist within one week of symptom onset and before a decision on brain imaging is made.

People who have had a suspected TIA who are at high risk of stroke (for example, an ABCD^{2*} score of

4 or above, or with crescendo TIA) in whom the vascular territory or pathology is uncertain, should undergo urgent brain imaging, preferably diffusion-weighted MRI.

People who have had a suspected TIA who are at lower risk of stroke (for example, an ABCD² score of less than 4) in whom the vascular territory or pathology is uncertain, should undergo brain imaging, preferably diffusion-weighted MRI.

Type of brain imaging for people with suspected TIA

People who have had a suspected TIA who need brain imaging (that is, those in whom vascular territory or pathology is uncertain) should undergo diffusion-weighted MRI except where contraindicated in which case CT scanning should be used.

Early carotid imaging in people with acute non-disabling stroke or TIA

All people with suspected non-disabling stroke or TIA who, after specialist assessment, are considered as candidates for carotid endarterectomy should have carotid imaging within one week of the onset of symptoms.

*The ABCD² score is a risk assessment tool designed to improve the prediction of short-term stroke risk after a transient ischemic attack (TIA). The ABCD² score is calculated by summing up points for five independent factors; Age, Blood Pressure, Clinical Features, Duration and Diabetes.⁶

Service provision

Access to imaging

At the time of implementing the stroke strategy, many clinical imaging departments were using systems that allowed rapid access to CT under NICE Guidelines for Head Injury. This meant that this access to CT scanning for patients 24 hours a day, seven days a week could be utilised for Stroke Imaging. Following this, many developments have taken place to further improve stroke services, such as the Accelerating Stroke Improvement (ASI) programme which was launched in 2010 by the Department of Health. The ASI further built upon the quality markers outlined in the national stroke strategy and the NICE quality markers developing nine key measures. Those related to imaging were:

- 50% of patients to have received brain imaging within one hour of arrival
- 100% of patients to have received brain imaging within 24 hours of arrival
- % of high risk TIA patients investigated and treated within 24 hours of first contact with a health professional.

Various methods of collecting data in order to audit stroke services were utilised; one such data collection was performed by The Stroke Improvement National Audit Programme (SINAP) and data collected relating to imaging in stroke circumstances during 2011 and 2012 can be viewed in its final report.⁷

There is now just one portal for collecting data related to stroke services and this is the Sentinel Stroke National Audit Programme SSNAP hosted by the Royal College of Physicians: further details and reports on recently collected data can be viewed at

<https://www.rcplondon.ac.uk/projects/sentinel-stroke-national-audit-programme>

In its annual report,⁸ the median arrival-to-scan time was reported as 88 minutes for patients admitted between April 2013 and March 2014.

The report highlights that there are differences in the numbers of patients getting a brain scan within 12 hours depending on what time of day and what day of the week they arrive. There is a very clear contrast with patients arriving after 5 pm who are less likely to receive a scan within 12 hours.

There is also a difference in service between five day and seven day services in terms of access to vascular imaging for high risk patients. The report can be viewed online at:

<https://www.strokeaudit.org/Documents/Results/National/2014/2014-AcuteOrgPublicReport.aspx>

There are many examples of how imaging departments developed in order to meet the key measures outlined in the ASI programme⁹ including : improving the patient pathway to the CT scanner, increasing the number of staff , utilising radiographer reporting , and extending the service.

Image interpretation and further imaging requirements

Interpretation of the images needs to be both rapid and accurate. This may be achieved using a variety of options involving neuroradiologists, appropriately skilled stroke physicians or the use of tele-radiology. A better solution may be suitably trained, competent and authorised advanced practitioner radiographers to provide both imaging and reporting. It should be noted that postgraduate courses in interpretation of head CT images have existed for some years and CT head reporting by radiographers is considered normal practice in many imaging departments.

Those patients who are either unsuitable for thrombolysis therapy, or who do not show a positive response, will need other types of imaging such as chest radiography, either at the bedside or in the department. They may also have associated pathology which has predisposed them to cerebral infarction, such as peripheral vascular disease, or a history of mobility problems that requires radiological investigation. The Royal College of Speech and Language Therapy has demonstrated the value of early assessment of dysphagia (difficulty in swallowing) which has the potential to cause long term problems. [10](#) Video fluoroscopy can be useful in the assessment and appraisal of damage; this is undertaken by speech and language therapists in conjunction with radiographers.

Stroke survivors who suffer deficit following a stroke may also suffer ongoing medical problems. These may include pneumonia, urinary tract infections, and thrombo-embolic events and they may also have sustained other injuries at the time of the stroke. In both cases they will be frequent visitors to the radiology department and will require sensitive support, particularly if they have cognitive impairment, in order to explain the imaging procedure to them and enable them to co-operate.

Workforce

The workforce required to deliver effective imaging in TIA and stroke patients includes staff with skill in image acquisition and interpretation, together with more specialised neuroradiological expertise when required. Clerical, nursing and portering staff within the imaging department also need to be considered.

The Society and College of Radiographers would expect all newly qualified radiographers to be competent to undertake emergency unenhanced CT imaging of the brain, following appropriate induction, and preceptorship in departments. However, additional skills will be required to undertake more advanced techniques such as CT and MR angiography and perfusion imaging. There will need to be consideration of how appropriately trained MR radiographers deliver the TIA and stroke service both in and out of hours.

The workforce carrying out carotid ultrasound investigations comes from a wide variety of backgrounds. As duplex ultrasound is operator dependent, ensuring the correct competences are held by this group is essential, and regular departmental audit should be undertaken.

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