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Stroke on the acute medical take

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This article is based on the excellent recent stroke guideline from the Royal College of Physicians (RCP) which is comprehensive, evidence based and easy both to read and to use.[1] From the perspective of the physician on-take, the approach to stroke medicine is changing because thrombolysis is now considered best practice if given within three hours of onset of symptoms.[2] Time is now in short supply and on the side of the stroke mimics.

Diagnosis

Triage

A Face Arm Speech Test (FAST)[3] should be used outside hospital as a screening test for stroke and transient ischaemic attack (TIA), and the Recognition of Stroke in the Emergency Room (ROSIER) test[4] by hospital healthcare staff. Stroke patients can be difficult to prioritise on a busy medical take which may include:

- patients unable to recognise their new disability (anosagnosia) due to their right parietal infarct
- people with a 'mild' or recovering limb weakness in whom a dense quadrantanopia (of interest to the DVLA) may pass unsuspected, and
- people dramatically unwell with a branch vertebral artery occlusion.

The lack of a close or reliable relationship between the severity and nature of the vascular pathology within the nervous system and the drama of its clinical presentation, coupled with the tendency for ischaemic symptoms to be negative rather than positive, militates against all patients with ischaemic stroke being recognised as in need of urgent attention. When compared to bleeding, pain or breathlessness, the symptoms and signs of ischaemic cerebrovascular disease do not lend themselves to the triage process. Stroke patients do not do autotriage.

Differential diagnosis

The arrival of a door-to-needle type mentality amongst frontline staff may lead to more incorrect diagnoses of stroke. The acute non-neurological causes of disability, including fractures of upper and lower limb bones, tendon ruptures, dislocations and joint effusions have already triggered concerns in our department following triage-type, snapshot assessments. It seems entirely reasonable for ischaemic vascular disease to be part of a clinician's differential diagnosis when faced for the first time with patients who subsequently will be shown to have (to name just a few):

- localised cerebral malignancy or infection
- myasthenia gravis
- Wernicke's encephalopathy
- Miler Fisher syndrome and other partial forms of Guillain-Barré syndrome
- benign positional paroxysmal vertigo (BPPV)
- Ménière's disease
- subdural haematoma (Fig 1)
- hypo- and hyperglycaemia, or
- compressive cervical cord lesions (particularly when presenting with asymmetric weakness).

The causes of episodic weakness (eg migraine, channelopathies and epilepsy (post-ictally)) will also cause some diagnostic problems when presenting for the first time. Although demyelination typically affects the optic nerve, the spinal cord and the cerebellar peduncles, it can present with a hemiparesis or hemisensory loss, and rarely with cortical type deficits due to lesions in the thalamus.

Vascular causes of ischaemia not attributable to *in situ* arterial thrombosis or arterial emboli will also produce the clinical picture of ischaemic stroke and, if diagnosed, raise questions about the

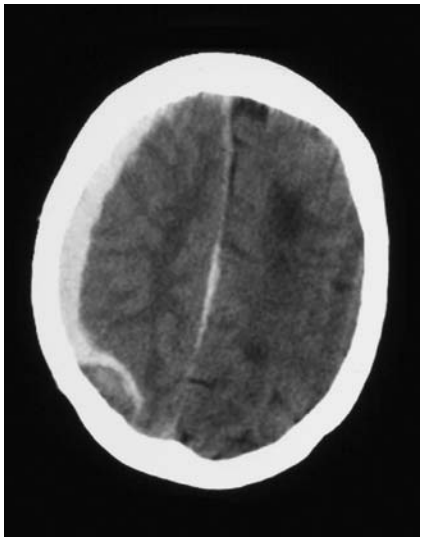

Fig 1. Computed tomography head scan showing large subdural haematoma. The patient had been treated with antiplatelet therapy for symptoms thought to be due to transient cerebral ischaemia. He required a craniectomy and a prolonged period of neurorehabilitation.

Key Points

The immaturity of some clinical signs can make the diagnosis of acute ischaemic stroke difficult in the first few hours after symptom onset

Thrombolysis for ischaemic stroke is licensed for use in the first three hours after symptom onset

All clinicians need to be aware of the inclusion and exclusion criteria for thrombolysis

Prompt initiation of secondary prevention following a transient ischaemic attack dramatically reduces the incidence of further events

KEY WORDS: clinical signs, stroke, thrombolysis, transient ischaemic attack

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appropriateness of thrombolysis, for example:

- venous infarction related to venous sinus thrombosis
- low flow states with associated infarction due to bilateral critical carotid stenosis
- large artery dissection causing hypoperfusion rather than embolic complications
- cerebral vasculitis, and
- profound hypotension or hypoxia.

History

There are familiar and useful pointers in the story even though the patient or their relatives may not have had a chance to work out what it is they can and cannot do. The symptoms which make ischaemic cerebrovascular disease less likely include:

- severe headache (although some headache may be present, particularly in posterior circulation large artery events, with or without dissection)
- loss of consciousness at an early stage, with the exception of infarcts of the paramedian thalamus which can present with coma
- pain in the affected limb at presentation – the discomfort of hypertonia, the musculoskeletal complications of the upper motor neurone syndrome and central post-stroke pain, usually come weeks or months later
- lone vertigo, usually due to BPPV or viral labyrinthitis.

Vague symptoms such as slurred speech, transiently blurred vision, unsteadiness, dizziness and clumsiness are anatomically unhelpful but do not exclude a focal ischaemic event. Some constellations of symptoms (and signs) described during the course of a telephone referral may not at first suggest a single lesion, for example:

- medullary infarcts causing weakness of one arm and the opposite leg (the so-called cruciate hemiparesis)
- bilateral ptosis with unilateral third nerve nucleus infarcts
- left frontal lobe infarcts causing a right hemiparesis with a (sympathetic) apraxia of the left hand
- a Bell's palsy with an ipsilateral gaze palsy and a contralateral hemiparesis (Foville's syndrome due to a pontine infarct), and
- selective involvement of the face, hand and foot in the cheiro-oral-pedal syndrome.

The sudden onset of the more familiar problems listed in Table 1 makes for easier telephone triage.

Table 1. Clinical deficits associated with different vascular territories of the brain.

Anatomical location	Common neurological deficits
Left middle cerebral artery	Right-sided weakness involving face and arm>leg with expressive, receptive or mixed dysphasia
Right middle cerebral artery	Left-sided weakness, face and arm>leg, visual and/or sensory neglect or inattention of left side, denial of disability (anosognosia)
Lateral medulla (posterior inferior cerebellar artery and/or parent vertebral artery)	Ipsilateral Horner's syndrome, Xth nerve palsy (due to infarction of nucleus ambiguus), facial sensory loss (trigeminal nerve), limb ataxia with contralateral spinothalamic sensory loss. Typically, patients are vertiginous and unable to feed by mouth due (mainly) to failure of laryngeal closure during swallowing and ineffective coughing. Cervical radiculopathies may occur due to involvement of radicular branches of the vertebral artery
Posterior cerebral artery	Homonymous hemianopia with variable additional deficits due to involvement of parietal and/or temporal lobe
Internal capsule	Motor, sensory or sensorimotor loss involving face, arm and leg to a roughly similar extent. There may be profound dysarthria due to involvement of corticobulbar fibres but the patient should not be dysphasic or have other cortical type deficits such as dyslexia or dysgraphia
Bilateral paramedian thalamus (30% of the population have a single common arterial stem supplying the medial aspect of both thalami)	Coma or disturbed vigilance at presentation, ophthalmoplegia (internal and/or external), ataxia and memory impairment. Some patients require ventilation
Carotid artery dissection	Ipsilateral Horner's syndrome due to compression of the sympathetic plexus around the carotid artery; the same process can also affect the lower cranial nerves (Xth and XIIth most obvious clinically) in the carotid sheath, or the VIth nerve in the cavernous sinus. If ipsilateral cerebral infarction follows (due to hypoperfusion or embolisation) the clinical picture can mimic a brain stem event; in this way, carotid artery dissection can mimic vertebral artery dissection

Examination

If the problem is thought to be vascular, a detailed general medical examination can be of more immediate relevance than a detailed neurological examination.

Neurological examination

There are limitations to neurological examination in acute medicine. In the first few hours after an event some of the normally reliable upper motor neurone signs (spasticity, brisk reflexes, co-contraction, flexor or extensor spasms in response to noxious or proprioceptive stimuli) are immature or absent, making anatomical localisation difficult. Some deficits produce anatomically helpful clinical signs, but eliciting them requires considerable time, effort and cooperation between patient and doctor. This is

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particularly true for cortical cognitive deficits which are not readily apparent during conversation, for example:

- apraxia (dominant parietal lobe)
- visual and sensory inattention (non-dominant parietal lobe)
- alexia and agraphia (left angular gyrus), and
- visual agnosias (non-dominant parieto-occipital cortex).

Visual field defects

Visual field defects are very helpful in anatomical localisation, particularly the superior and inferior quadrantinopias of temporal and parietal lobe lesions, respectively, and the hemianopia of an optic tract or occipital cortex lesion. In a cerebral lesion the speed and amplitude of saccadic eye movement to the contralateral side (ie the weak side) is often reduced ,whereas the gaze palsy of a pontine lesion is to the side of the lesion (so called 'wrong way eyes').

Cranial nerve palsies

Infarction of the nucleus or the fascicle of the nerve within the brain stem is usually the cause of the cranial nerve palsies of stroke syndromes. In conjunction with the associated motor and sensory signs, this is anatomically very helpful in localising the lesion, with the possible exception of the third nerve nucleus as mentioned above.

Transient symptoms and signs

The RCP guideline recommends that any person seen in hospital or the community after a short-lived acute transient event that could be due to a cerebrovascular disturbance is given aspirin 300 mg daily and referred to a specialist service. If their age, blood pressure, clinical features, duration of symptoms and diabetes (ABCD2) score is 4 or above (or if they have crescendo TIAs, defined as more than two in a week) they should have specialist assessment and investigation within 24 hours of symptom onset and within one week for those with lower ABCD2 scores.

The EXPRESS study has shown how important it is to make the diagnosis of TIA, particularly in those patients at high risk of further events.[5] The incidence of such events is significantly reduced in those patients seen and treated urgently using conventional proven therapies. The risks of stroke after a TIA according to the score are listed in Table 2.

Treatment

Carotid endarterectomy

When the diagnosis of a TIA has been confirmed, carotid Dopplers are indicated to detect those who might benefit from carotid endarterectomy. This should be 50–99% or 70–99% stenosis according to the North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria[6] and the European Carotid Surgery Trialists' (ECST) Collaborative Group,[7] respectively. Suitable patients should undergo surgery within a maximum of two weeks of symptom onset.

Medical therapy

The RCP guideline is clear about best medical therapy. It should include giving advice and information relating to smoking, exercise, diet, weight loss, salt intake and alcohol.

Blood pressure (BP) should also be controlled, ideally at 130/80 mmHg unless there are bilateral severe (>70%) stenoses when a systolic BP of around 150 mmHg may be appropriate. If BP needs treating, for patients aged over 55 years or black patients of any age the first choice should be either a calcium-channel blocker or a thiazide-type diuretic. In hypertensive patients below 55 years the first choice should be an angiotensin-converting enzyme inhibitor (ACEI) or an angiotensin-II receptor antagonist if an ACEI is not tolerated.

Cholesterol. If total cholesterol is above 3.5 mmol/l or the low-density lipoprotein cholesterol is above 2.5 mmol/l statin therapy is recommended.

Anti-platelet therapy should comprise aspirin 50–300 mg per day and dipyridamole (modified release) 200 mg bd. If dipyridamole cannot be tolerated, aspirin alone is sufficient. If aspirin is not tolerated, clopidogrel 75 mg daily is a suitable alternative. The combination of aspirin and clopidogrel is not recommended.[8,9] Anticoagulants or antiplatelet therapy is recommended for people with arterial dissection, preferably as part of a randomised controlled trial (RCT) (eg CADISS[10]).

Table 2. ABCD2 risk of stroke after a transient ischaemic attack.

Score	Age (years)	Blood pressure (mmHg)	Clinical features	Symptom duration (min)	Diabetes mellitus
0	>60	<140/90	Other neurological deficit	<10	No
1	⩾60	Systolic >140 *or* diastolic ⩾90 *or* both	Speech disturbance without weakness	10–59	Yes
2			Unilateral weakness	⩾60	

Two-day risk of stroke: Score 6–7: high risk (8.1%)
4–5: medium risk (4.1%)
0–3: low risk (1.0%)

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Table 3. Inclusion and exclusion criteria used in the SITS-MOST study of particular relevance to the on-call general physician.[11]

Inclusion	Male or female aged 18–80 years
	Clinical diagnosis of ischaemic stroke
	Onset of symptoms within 3 hours of predicted initiation of thrombolysis
	Stroke symptoms present for at least 30 min without significant improvement before commencement of therapy
Exclusion	Evidence of ICH on the CT scan
	Duration of symptoms >3 hours from likely time of initiation of tPA infusion or unknown time of symptom onset
	Minor neurological symptoms or symptoms rapidly improving
	Severe stroke, as assessed clinically or by appropriate imaging techniques
	Seizure at stroke onset
	Symptoms suggestive of SAH even if the CT scan is normal
	Administration of heparin within the previous 48 hours and thromboplastin time above the upper limit of normal
	Past history of stroke *and* concomitant diabetes
	Previous stroke within last 3 months
	Known platelet count <100,000/mm^3
	Systolic BP>185 mmHg or diastolic >110 mmHg or the need to treat aggressively with iv medication to achieve these levels
	Blood glucose <50 or >400 mg/l
	Known haemorrhagic diathesis
	Warfarin therapy (although considered appropriate if INR<1.4)
	Recent or current bleeding
	Known history of or suspected ICH
	Presenting symptoms and signs or disability, likely to be due to recent or past SAH
	Known CNS disease (eg neoplasm, aneurysm, past intracranial or spinal surgery)
	Haemorrhagic retinopathy
	Recent (<10 days) traumatic external heart massage, childbirth, puncture of a non-compressible blood vessel (eg subclavian vein)
	Known bacterial endocarditis, pericarditis
	Acute pancreatitis
	Documented ulcerative GI disease during the last 3 months or oesophageal varices
	Neoplasm with increased bleeding risk
	Severe liver disease
	Major surgery or significant trauma in last 3 months

BP = blood pressure; CNS = central nervous system; CT= computed tomography; GI = gastrointestinal; ICH = intracranial haemorrhage; INR = international normalised ratio; iv = intravenous; SAH = subarachnoid haemorrhage; tPA = tissue plasminogen activator.

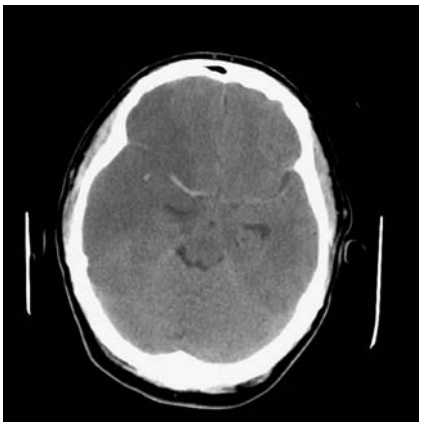

Fig 2. Computed tomography head scan showing middle cerebral artery occlusion with associated cerebral infarction and oedema 24 hours after symptom onset. Thrombolysis had been given 2 hours 40 min after presentation, without benefit.

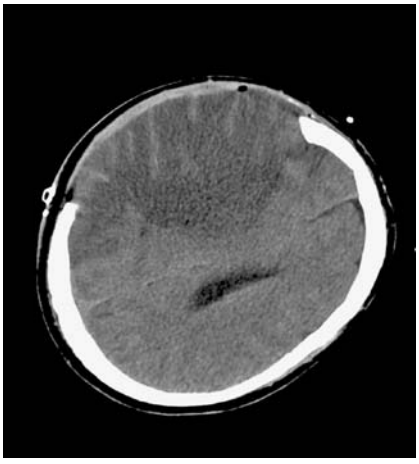

Fig 3. Computed tomography head scan showing changes following craniectomy. The patient survived and now does standing transfers independently six months after surgery.

Warfarin is recommended for patients with persistent or paroxysmal atrial fibrillation, heparin and then warfarin for patients with cerebral venous sinus thrombosis (including those with secondary cerebral haemorrhage).

Recommendations for stroke

Thrombolysis

The RCP guideline emphasises the need for thrombolysis to be given by physicians trained and experienced in the management of acute stroke, within a well organised stroke service with appropriate protocols for giving thrombolysis and managing the post-thrombolysis complications.

The SITS-MOST study[11] compared the results of symptomatic intracerebral haemorrhage and death (primary end-points) and independence (secondary end-point) for stroke patients treated with recombinant tissue plasminogen activator (rt-PA) in routine clinical settings with those from corresponding rt-PA treated patients in RCTs. This observational study confirmed that intravenous alteplase is safe and effective in routine clinical use when given within three hours of stroke onset, even in centres with little previous experience of thrombolytic therapy for acute stroke. For those centres not involved in thrombolysis, the Third International Stroke Trial is an excellent way to start.[12]

The inclusion and exclusion criteria used in the SITS-MOST study protocol serve as a guide for the on-call physician regarding the suitability of patients for referral to a thrombolysis service (Table 3).

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Decompressive craniectomy

Decompressive craniectomy can be a life-saving intervention for people with raised intracranial pressure occurring as a result of infarct-related cerebral oedema (Figs 2 and 3). Patients should be referred within 24 hours of symptom onset and treated within 48 hours. Patients under 60 years who have a middle cerebral artery infarct involving at least 50% of the middle cerebral artery territory on computed tomography scan and a depressed conscious level are potential candidates.

Conclusions

The clinical horizon has changed for physicians faced with a patient with symptoms and/or signs which could be due to vascular disease of the brain. If the potential of thrombolysis is to be realised, an accurate diagnosis is required within three hours in all patients who present with an acute problem that could be an ischaemic cerebral event. For patients with TIAs, an urgent diagnosis and initiation of secondary preventive measures dramatically reduce the risk of further events.

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