Emergency Medical Services
Stroke Training Curriculum

3. Pre-hospital phase
The Difference that EMS can make
**Introduction**

Timely recognition of stroke symptoms is an important factor in the successful delivery of proven acute therapies.\(^1\)

Stroke symptoms typically begin suddenly and are dependant on the affected region of the brain.\(^2,3\) Initial patient assessments are based on the principle of assessing the ABCDEs and the vital signs and on performing a neurological assessment.\(^4,5\)

---

How can you change a life in 60 minutes? Video 1
RAPID PATIENT RECOGNITION AND REACTION TO STROKE WARNING SIGNS

RAPID EMERGENCY MEDICAL SERVICES (EMS) DISPATCH

RAPID EMS SYSTEM TRANSPORT AND HOSPITAL PRE-NOTIFICATION

DELIVERY DIRECT TO IMAGING

RAPID IN-HOSPITAL DIAGNOSIS AND TREATMENT

EFFECTIVE EMS SYSTEMS CAN MINIMISE DELAYS IN PRE-HOSPITAL DISPATCH, ASSESSMENT, AND TRANSPORT, AND INCREASE THE NUMBER OF STROKE PATIENTS REACHING THE HOSPITAL AND RECEIVING OPTIMAL TREATMENT.5,6,7

The situation at large

- Emergency services transport > 50% of suspected stroke patients
- The earlier treatment is initiated, the better the outcome
- Diagnosis requires stroke expertise
- Thrombolysis is underused
- Treatment carries a risk and requires monitoring
- Stroke unit care improves outcomes
Emergency stroke care depends on a 4-step chain

1. **GENERAL PUBLIC**
   - Recognise stroke symptoms
   - React appropriately

2. **EMERGENCY CALL CENTRE**
   - Identify stroke symptoms
   - Priority dispatch of EMS

3. **EMERGENCY MEDICAL SERVICES**
   - Prompt evaluation & stabilisation
   - Priority transfer to stroke facilities
   - Pre-notification of hospital

4. **STROKE UNIT**
   - Immediate triage, assessment and imaging
   - Multidisciplinary stroke team
   - Accurate diagnosis
   - Treat appropriately

---

EMS ARE THE FIRST POINT OF FMC
THEIR PRIMARY GOAL IS TO IDENTIFY SUSPECTED STROKE
AND TRIGGER FAST TRACK FOR STROKE TREATMENT\textsuperscript{10,11}

Every 15 minutes saved in treatment time = 4% reduction in mortality & 4% increase of chance of surviving the stroke with Life intact

Favourable outcome (mRS 0 - 1) vs. Time

Odds ratio (OR)

NNT 4 - 5
NNT 9
NNT 14
NNT 21

NNT, Number needed to treat; OTT, Time from stroke onset to start of treatment; mRS, modified Rankin Scale

Saving 30 minutes early after symptom onset could provide a greater increase in likelihood of favourable outcome than saving the same amount of time later\textsuperscript{14}.

\textbf{Favourable Outcome (mRS 0 - 1) vs. Time}

\textbf{Odds ratio (OR)}

\begin{itemize}
  \item NNT 4 - 5
  \item NNT 9
  \item NNT 14
  \item NNT 21
\end{itemize}

\textbf{NNT, Number needed to treat; OTT, Time from stroke onset to start of treatment; mRS, modified Rankin Scale}

GUIDELINES

- Patients or members of the public are encouraged to call the emergency services if a stroke is suspected (Class I, LOE B)

- Call centres should send out the EMS as a priority dispatch and time delays should be minimised (Class I, LOE B)

- EMS staff should use pre-hospital stroke assessment tools (such as LAPSS) to detect stroke (Class I, LOE B)

- Transport of patients to the nearest available stroke centre or most appropriate emergency stroke care is recommended (Class I, LOE A)

- EMS should pre-notify the receiving centre that a potential stroke patient is en route (Class I, LOE B)
Goals of the EMS in stroke

1. Dispatch & Rapid Response, to Minimise Delay to FMC
2. Evaluation
3. Stabilisation
4. Neurological Evaluation
5. Pre-notification of the Receiving Unit (Hospital, Stroke Centre)
6. Transport Directly to a Stroke-Ready Hospital (Where Available)

Minimise Brain Injury and Maximise the Patient’s Recovery

### IMMEDIATE EMS CONTACT AND PRIORITY DISPATCH ARE RECOMMENDED (CLASS II, LEVEL B)

**STROKE PATIENTS NEED TO BE TRANSPORTED TO THE NEAREST STROKE FACILITY WITHOUT DELAY (CLASS III, LEVEL B)**

**DISPATCHERS AND AMBULANCE PERSONNEL SHOULD BE TRAINED TO RECOGNISE STROKE USING SIMPLE TESTS, E.G. FACE-ARM-SPEECH-TEST (CLASS IV, GCP)**

**THE TIME FROM CALL TO EMS DISPATCH SHOULD BE < 90 SECONDS**

**EMS RESPONSE TIME SHOULD BE < 8 MIN (CALL TO ARRIVAL ON SCENE)**

**ON-SCENE TIME SHOULD BE < 15 MIN**

**OTHER TRANSPORT METHODS (E.G. HELICOPTER) SHOULD BE CONSIDERED IN REMOTE OR RURAL AREAS (CLASS II, LEVEL B)**

**TELEMEDICINE SHOULD BE CONSIDERED IN REMOTE OR RURAL AREAS (CLASS II, LEVEL B)**

---

Summary

Activation of the Emergency Call and Priority Dispatch of EMS to the Suspected Stroke Patient is Recommended\(^5,15\)

Emergency services need to assign stroke calls the highest priority\(^{16}\)

Arrival by Ambulance and Pre-notification of the ED/SU increase the chance of thrombolysis\(^{16,17}\)

The faster treatment is initiated, the greater the benefit for patients with acute ischemic stroke\(^{18}\)

ED, Emergency Department

EMS, Emergency Medical Services

SU, Stroke Unit

---

1. Diagnose stroke
2. Choose hospital
3. Emergency transport
4. Pre-notify team

1. Diagnosing stroke – Call Centre
Stroke call centre and dispatch

1. CALL CENTRE ROLE

2. DISPATCH ALGORITHM

3. DISPATCH GUIDELINES
Call centre role

EMERGENCY CALL CENTRES AND DISPATCHERS HAVE AN IMPORTANT ROLE IN RECOGNISING POTENTIAL STROKE PATIENTS AND DISPATCHING AN EMERGENCY RESPONSE TEAM WITHOUT DELAY.

PROTOCOLS ARE AVAILABLE TO HELP IDENTIFY STROKE SYMPTOMS.

DISPATCHERS CAN CORRECTLY IDENTIFY UP TO 80% OF ALL STROKE CALLS IF SPECIFIC WORDS ARE MENTIONED.

*Specific words include stroke, facial droop, weakness/fall, or communication problems. In some countries, such as France (SAMU system), the calls are taken and triaged by an MD.

First call to emergency services
Dispatcher identification algorithm\textsuperscript{20}

**REASON FOR CALL**

**TYPICAL STROKE SYMPTOMS**

- (Sudden) speech problems
- Unilateral neurological deficits (except pain)
- Sudden onset, severe headache
- Other sudden onset neurological symptoms

**CALLER SPONTANEOUSLY MENTIONS "STROKE"**

**ATYPICAL STROKE SYMPTOMS**

- Falls
- Movement disorders (person is alert, but e.g. unable to get up off the floor)
- Confusion
- Impaired consciousness (person is breathing)

**OTHER SYMPTOMS (DEFINITELY NON-STROKE)**

---


Priority dispatch and rapid response
Importance of time

EMS ARE OFTEN THE FIRST MEDICAL CONTACT (FMC) FOR STROKE PATIENTS

TIME IS CRITICAL\textsuperscript{5,12}

- CLEAR PROTOCOLS SHOULD BE IN PLACE, DETERMINING WHICH PROCEDURES AND INVESTIGATIONS NEED TO BE PERFORMED AT EACH STAGE OF THE PATIENT’S MANAGEMENT

- INITIAL ASSESSMENT AND TREATMENT SHOULD BE CARRIED OUT AS RAPIDLY AS POSSIBLE

- ONLY ESSENTIAL TESTS AND INVESTIGATIONS SHOULD BE PERFORMED

THE PATIENT SHOULD BE ASSESSED AND TRANSPORTED TO A STROKE FACILITY WITHOUT DELAY

1. Diagnosing stroke
Mild stroke patient

video 2
Moderate stroke patient

video 3
Severe stroke patient

video 4
Pre-Hospital Recognition of Stroke

Assessment tools have been developed to help enhance the recognition of stroke symptoms and to improve the ability to identify stroke patients in the field. The most common and well-investigated tools are the Cincinnati Prehospital Stroke Scale and the Los Angeles Prehospital Stroke Screen. Newer stroke identification tools include the Face Arm Speech Test (FAST), which is similar to the Cincinnati Prehospital Stroke Scale, and the Melbourne Prehospital Stroke Scale, which is similar to the Los Angeles Prehospital Stroke Screen. Tools for rating stroke severity in the field have also been developed including a shortened version of the NIH Stroke Scale (NIHSS) and the Los Angeles Motor Scale (see Table 1).

Evidence-based practice: The use of a stroke rating scale, preferably the National Institutes of Health Stroke Scale (NIHSS), is recommended by the American Stroke Association.
Pre-Hospital Recognition of Stroke

**TABLE 1: COMPONENTS OF SELECTED PREHOSPITAL ASSESSMENT TOOLS**

<table>
<thead>
<tr>
<th>CINCINNATI PREHOSPITAL STROKE SCALE</th>
<th>LOS ANGELES PREHOSPITAL STROKE SCREEN</th>
<th>LOS ANGELES MOTOR SCALE</th>
<th>FACE ARM SPEECH TEST</th>
<th>NIHSS-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial droop</td>
<td>Facial weakness</td>
<td>Facial weakness</td>
<td>Facial palsy</td>
<td>Right leg motor</td>
</tr>
<tr>
<td>Arm weakness</td>
<td>Arm strength</td>
<td>Arm strength</td>
<td>Arm weakness</td>
<td>Left Leg motor</td>
</tr>
<tr>
<td>Speech</td>
<td>Grip</td>
<td>Grip</td>
<td>Speech impairment</td>
<td>Gaze</td>
</tr>
<tr>
<td></td>
<td>Screening criteria (4 items)</td>
<td></td>
<td></td>
<td>Visual fields</td>
</tr>
<tr>
<td></td>
<td>Blood glucose</td>
<td></td>
<td></td>
<td>Language</td>
</tr>
</tbody>
</table>

NIHSS indicated shortened National Institute of Health Stroke Scale

---

Pre-Hospital Recognition of Stroke

The majority of patients with an acute ischemic stroke will present to the Emergency Department in a hemodynamically stable condition. However, ischaemic strokes involving the posterior circulation as well as intracranial bleeding or subarachnoid haemorrhage may require immediate airway management, especially if the patient has an altered level of consciousness. Circulatory collapse or cardiac arrest, although possible, is uncommon in isolated ischaemic stroke but may be an early complication of severe subarachnoid haemorrhage. In addition, cardio circulatory failure may indicate accompanying medical conditions such as acute myocardial infarction, atrial fibrillation, or congestive heart failure.21

Stroke Scales

Agreement between ambulance paramedic - and physician - recorded neurological signs with FAST*23

**Face Arm Speech Test (F.A.S.T.)**

TO CHECK FOR STROKE SYMPTOMS, REMEMBER F.A.S.T.

**FACE**
- DROOPING or asymmetry on smiling

**ARMS**
- WEAKNESS or paralysis on one side

**SPEECH**
- DIFFICULTY or slurring of speech

**TIME TO CALL**
- the emergency services*

---

*112 is an emergency services call number that can be dialed free of charge from any telephone or mobile phone in numerous European countries, as well as several other countries in the world.

---

FAST scale

FACE DROOPING
Ask the patient to smile and show their teeth. Does one side of the face droop or is it numb?

ARM WEAKNESS
Ask the patient to raise both arms. Is one arm weak or numb? Does one arm drift downward?

SPEECH DIFFICULTY
Ask the patient to repeat a simple sentence. Is the sentence repeated correctly? Are they unable to speak, or are they hard to understand?

STROKE SCREENING

<table>
<thead>
<tr>
<th>Time of FAST assessment done</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
</table>

- Normal
  - Both sides of face move equally
  - Both arms move equally or not at all
  - Patient uses correct words with no slurring

- Abnormal
  - Unequal movement of the face
  - One arm drifts compared to the other
  - Slurred or inappropriate words or mute

FAST-ED scale[25]

<table>
<thead>
<tr>
<th>1</th>
<th>FACIAL DROP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORMAL OR MINOR PARALYSIS = 0</td>
</tr>
<tr>
<td></td>
<td>PARTIAL OR COMPLETE PARALYSIS = 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>ARM WEAKNESS - ASK THE PATIENT TO HOLD BOTH ARMS OUT WITH PALMS DOWN AND EYES CLOSED FOR 10 SECONDS. IF PATIENT CANNOT UNDERSTAND HOLD HIS/HER ARMS UP AND THEN LET THEM GO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO DRIFT = 0</td>
</tr>
<tr>
<td></td>
<td>DRIFT OR SOME EFFORT AGAINST GRAVITY = 1 (ONE ARM DRIFTS DOWN IN &lt; 10 SECONDS BUT HAS ANTIGRAVITY STRENGTH)</td>
</tr>
<tr>
<td></td>
<td>NO EFFORT AGAINST GRAVITY OR NO MOVEMENT = 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>SPEECH CHANGES - CHECK SPEECH CONTENT + ASK THE PATIENT TO NAME 3 COMMON ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABSENT = 0</td>
</tr>
<tr>
<td></td>
<td>MILD TO MODERATE = 1</td>
</tr>
<tr>
<td></td>
<td>SEVERE, GLOBAL APHASIA, OR MUTE = 2</td>
</tr>
</tbody>
</table>

### FAST-ED scale

#### 4. Receptive aphasia – Ask “Show me 2 fingers”
- **Patient shows two fingers = 0**
- **Patients does not understand e.g. does not show two fingers = 1**

#### 5. Eye deviation - Ask the patient to follow your finger as you move it from right to left and back from left to right
- **Absent = 0**
- **Partial = 1 (Gaze preference: Patient has clear difficulty when looking to one side)**
- **Forced deviation = 2 (Eyes are deviated to one side and do not move; cannot follow finger)**

#### 6. Denial/neglect - Ask “Are you weak anywhere?” and check if the patient recognizes his/her weakness and show the patient his/her weak arm and ask “Whose arm is this?”. Check if the patient recognizes his/her weak arm as his/her own
- **Absent = 0**
- **Extinction to bilateral simultaneous stimulation in only 1 sensory modality = 1 (Patient is weak but does not recognize it or patient does not recognizes his/her weak arm)**
- **Does not recognize own hand or orients only to one side of the body = 2 (Patient is weak but does not recognize it and patient does not recognizes his/her weak arm)**

---

Field assessment of stroke - LAPSS

### LOS ANGELES PRE-HOSPITAL STROKE SCREEN (LAPSS) HAS BEEN SHOWN TO BE MORE ACCURATE THAN THE F.A.S.T. STROKE SCREEN

<table>
<thead>
<tr>
<th>SCREENING CRITERIA</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE OVER 45 YEARS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO HISTORY OF SEIZURE DISORDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEW ONSET OF NEUROLOGICAL SYMPTOMS IN JUST 24 HOURS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PATIENT WAS AMBULATORY AT BASELINE (PRIOR TO EVENT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLOOD GLUCOSE BETWEEN 60 AND 400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXAM</th>
<th>NORMAL</th>
<th>RIGHT</th>
<th>LEFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACIAL SMILE/GRIMACE</td>
<td></td>
<td>DROOP</td>
<td>DROOP</td>
</tr>
<tr>
<td>GRIP</td>
<td></td>
<td>WEAK GRIP</td>
<td>WEAK GRIP</td>
</tr>
<tr>
<td>ARM WEAKNESS</td>
<td></td>
<td>DRIFTS DOWN</td>
<td>DRIFTS DOWN</td>
</tr>
</tbody>
</table>

### Comparison of pre-hospital stroke screening tools

<table>
<thead>
<tr>
<th>STROKE SCREENING TOOL</th>
<th>SENSITIVITY (95 % CI)</th>
<th>SPECIFICITY (95 % CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACE ARM SPEECH TEST (FAST)</td>
<td>82 % (76 TO 88)</td>
<td>83 % (77 TO 89)</td>
</tr>
<tr>
<td>CINCINNATI PREHOSPITAL STROKE SCREEN (CPSS)</td>
<td>≥ 1 ITEM: 85 % (80 TO 90)</td>
<td>≥ 1 ITEM: 79 % (73 TO 85)</td>
</tr>
<tr>
<td>LOS ANGELES PREHOSPITAL STROKE SCREEN (LAPSS)</td>
<td>91 % (76 TO 98)</td>
<td>97 % (93 TO 99)</td>
</tr>
<tr>
<td>MELBOURNE AMBULANCE STROKE SCREEN (MASS)</td>
<td>90 % (81 TO 96)</td>
<td>74 % (53 TO 88)</td>
</tr>
</tbody>
</table>

Cincinnati Pre Hospital Stroke Screen (CPSS)²⁹

<table>
<thead>
<tr>
<th>Facial Droop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal: Both sides of face move equally</td>
</tr>
<tr>
<td>Abnormal: One side of face does not move at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arm Drift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal: Both arms move equally or not at all</td>
</tr>
<tr>
<td>Abnormal: One arm drifts compared to the other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal: Patient uses correct words with no slurring</td>
</tr>
<tr>
<td>Abnormal: Slurred or inappropriate words or mute</td>
</tr>
</tbody>
</table>

How to perform comprehensive NIHSS Assessment *video 5*
NIH STROKE SCALE

The NIHSS is a scoring system for the assessment of acute stroke in the context of neurological diagnostic assessment. It is used for early detection and follow-up studies of strokes and as a basis for the indication of drug therapy options. NIHSS is routinely used in clinical practice.\(^5\)

The system tests eleven functions. The summation of the data from the tests shows a maximum of 42 points. The higher the score, the more extensive is the stroke. A thrombolysis for ischaemic infarction is generally indicated by an NIHSS score of between 6 and 22 points.\(^30\)

The advantages of the NIHSS system are that it is highly practical, very comparable and has a high degree of reliability. Moreover, the performance of the scale and the documentation are easy to learn.\(^21\)
National Institute of Health Stroke Scale (NIHSS)\textsuperscript{30}

1a. Level of Consciousness (LOC):
The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/ bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.

1b. LOC Questions:
The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not “help” the patient with verbal or non-verbal cues.

National Institute of Health Stroke Scale (NIHSS)\textsuperscript{30}

1c. LOC Commands:

The patient is asked to open and close his/her eyes and then to grip and release the non-paretic hand. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to him or her (pantomime), and the result scored (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.

2. Best Gaze:

Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis (CN III, IV or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.
National Institute of Health Stroke Scale (NIHSS) \(^{30}\)

3. Visual:
Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat, as appropriate. Patients may be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11.

4. Facial Palsy:
Ask - or use pantomime to encourage - the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barriers obscure the face, these should be removed to the extent possible.

National Institute of Health Stroke Scale (NIHSS) \textsuperscript{30}

5. Motor Arm:
The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

6. Motor Leg:
The limb is placed in the appropriate position: hold the leg at 30 degrees (always tested supine). Drift is scored if the leg falls before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic leg. Only in the case of amputation or joint fusion at the hip, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

7. Limb Ataxia:
This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralysed. Only in the case of amputation or joint fusion, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position.

O = Absent.
1 = Present in one limb.
2 = Present in two limbs.

UN = Amputation or joint fusion, explain: ________________

8. Sensory:
Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas (arms [not hands], legs, trunk, face) as needed to accurately check for hemisensory loss. A score of 2, “severe or total sensory loss,” should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item.

O = Normal; no sensory loss.
1 = Mild-to-moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched.
2 = Severe to total sensory loss; patient is not aware of being touched in the face, arm and leg.
National Institute of Health Stroke Scale (NIHSS) 30

9. Best Language:
A great deal of information about comprehension will be obtained during the preceding sections of the examination. For this scale item, the patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet and to read from the attached list of sentences. Comprehension is judged from responses here, as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in a coma (item 1a-3) will automatically score 3 on this item. The examiner must choose a score for the patient with stupor or limited cooperation. If the patient is mute and follows no one-step commands.

0 = No aphasia; normal.
1 = Mild-to-moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials difficult or impossible. For example, in conversation about provided materials, the examiner can identify picture or naming card content from patient’s response.
2 = Severe aphasia; all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited. Listener carries burden of communication. Examiner cannot identify materials provided from patient response.
3 = Mute; global aphasia; no usable speech or auditory comprehension.

10. Dysarthria:
If patient is thought to be normal, an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barriers to producing speech, the examiner should record the score as unintelligible (UN), and clearly write an explanation for this choice. Do not tell the patient why he or she is being tested.

0 = Normal.
1 = Mild-to-moderate dysarthria; patient slurs at least some words and, at worst, can be understood with some difficulty.
2 = Severe dysarthria; patient’s speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysarthria, or is mute/anarthric.
UN = Intubated or other physical barrier, explain: _______

National Institute of Health Stroke Scale (NIHSS) 30

11. Extinction and Inattention (formerly Neglect):

Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.

0 = No abnormality.
1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.
2 = Profound hemi-inattention or extinction to more than one modality; does not recognise own hand or orients to only one side of space.

National Institute of Health Stroke Scale (NIHSS) 30

National Institute of Health Stroke Scale (NIHSS) \(^\text{30}\)

You know how
Down to earth
I got home from work
Near the table in the dining room
They heard him speak on the radio last night
National Institute of Health Stroke Scale (NIHSS)\textsuperscript{30}

MAMA
TIP-TOP
FIFTY-FIFTY
THANKS
HUCKLEBERRY
BASEBALL PLAYER

PRE-HOSPITAL
1. Diagnose stroke
2. Choose hospital
3. Emergency transport
4. Pre-notify team

2. Choose hospital
EMS ROLE – First Medical Contact

1. Timely Stroke Symptoms Recognition
2. Pre-notification
3. Rapid Transport to a Designated Stroke Centre

Choose hospital

Choose most appropriate hospital that can provide the patients with recanalization therapy, and stroke unit care

EVERY 30 MINUTES A STROKE PATIENT WHO COULD HAVE BEEN SAVED, DIES OR IS PERMANENTLY DISABLED, BECAUSE THEY WERE TREATED IN THE WRONG HOSPITAL.
Transport to nearest appropriate stroke facility

RANGE OF STROKE CENTRE CAPABILITIES

COMPREHENSIVE STROKE CENTRE
24/7 STATE-OF-THE-ART CARE WITH ALL THE LATEST EQUIPMENT AND FACILITIES FROM ACUTE STROKE TO REHABILITATION

PRIMARY STROKE CENTRE
EVIDENCE-BASED STROKE CARE, PROVIDING EXCELLENT ACUTE PHASE TREATMENT, USUALLY WITH TRANSFER FOR FURTHER CARE

ACUTE STROKE FACILITY
EFFECTIVE DIAGNOSIS AND TREATMENT IN THE VERY ACUTE PHASE, WITH TRANSFER FOR FURTHER CARE

3. Emergency transport
Emergency Transport

Collect as much information as possible that could be relevant to treatment decision for example drugs taken and scene description\textsuperscript{5,33}

Do not waste unnecessary time at the scene, transport patient emergently (< 15 minutes)\textsuperscript{5}

☐ Symptom onset\textsuperscript{5} < 4,5 hours ago  ☐ Symptom onset\textsuperscript{5} > 4,5 hours ago  ☐ Time of onset unknown\textsuperscript{5}

☐ Immediate transport to closest stroke centre

Do as much as possible before hospital arrival

Leaving as little as possible to be done after hospital arrival

Oxygen saturation  Blood pressure  IV access  Glucose test  Pre-Notify Hospital

Rapid evaluation - initial assessment of patient

INTERNATIONAL GUIDELINES\(^5\) RECOMMEND THE FOLLOWING

- Assess and manage ABCDE
- Measure blood pressure
- Check arterial oxygen level (pulse oximetry) – consider oxygen mask
- Establish IV access
- Measure blood glucose
- Record ECG\(^{12}\)
- Perform fast assessment\(^{15}\)
- Establish time of onset of symptoms (if possible)
- Pre-notify hospital/stroke unit
- IF possible, take relative or carer to the hospital, as a source of information about the patient\(^5\)

TRAINING IN STROKE ASSESSMENT ENABLES PARAMEDICS TO IDENTIFY 86 – 97 % OF STROKES\(^{26}\)

The **ABCDE** approach was developed as a way to prioritise the order of assessment and treatment of trauma patients.\(^4\)

<table>
<thead>
<tr>
<th>A</th>
<th>Assess airway and treat, if necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Assess breathing and treat, if necessary</td>
</tr>
<tr>
<td>C</td>
<td>Assess circulation and treat, if necessary</td>
</tr>
<tr>
<td>D</td>
<td>Assess disability and treat, if necessary</td>
</tr>
<tr>
<td>E</td>
<td>Expose and examine patient fully once ABCD are stable</td>
</tr>
</tbody>
</table>

---

Airway

Airway patency can be assumed if a patient is engaging in a conversation, demonstrating understanding and awareness. However, partial airway obstruction is not always immediately obvious. Therefore, clinical observation should ensure early detection of any increased respiratory effort or abnormal breathing sounds.\textsuperscript{34}

Changes in respiratory status can occur due to respiratory, neurological, metabolic and cardiovascular compromise, and are, therefore, a sensitive indicator of deterioration (see checklist for rapid ABCDE assessment). The importance of the respiratory rate, in particular, cannot be overemphasised: over 20 breaths per minute or fewer than 10 breaths per minute should be a cause for concern and 30 breaths per minute or more or fewer than 8 breaths per minute indicate a significant pathology necessitating immediate action.\textsuperscript{34}

Note: pulse oximeters provide valuable information regarding oxygen saturation, enabling hypoxaemia to be detected, but will not detect hypoventilation and hypercapnia\textsuperscript{34}

Breathing

**PULSE OXIMETRY**\textsuperscript{34}

- When using pulse oximetry, always record the amount of oxygen the patient is receiving and the flow device
- Pulse oximetry does not detect hypoventilation and hypercapnia
- In patients whose SpO\textsubscript{2} falls below 94%, arterial blood gas analysis should be considered in order to check for hypercapnia and metabolic problems
- **Evidence-based practice:** Supplemental oxygen should be provided to maintain oxygen saturation > 94%. Supplemental oxygen is not recommended in nonhypoxic patients with acute ischemic stroke.\textsuperscript{5}

---

Arrhythmias are a frequent symptom in patients with an acute stroke. Severe bradycardia (< 60/min), tachycardia (> 100/min) or arrhythmias (eg second or third degree atrioventricular block, ventricular tachycardia) should alert the stroke team to both an increased risk of a forthcoming cardiac arrest as well as to a cause of further deterioration of the cerebral lesion due to a decrease in cardiac output. New onset irregular pulse should be followed quickly up by a 12-lead ECG to identify and enable treatment of arrhythmias such as atrial fibrillation. Lab tests may include electrolytes, cardiac troponins, haemoglobin, and thyroid hormones.\textsuperscript{5,34,35,36}

**Evidence-Based Practice:** Cardiac monitoring is recommended to detect atrial arrhythmias that would necessitate emergency cardiac interventions.\textsuperscript{5}

According to the American Stroke Association, cardiac monitoring should be performed for at least the first 24 hours.\textsuperscript{5}

As part of disability assessment, look for indicators of a decreased level of consciousness and a focal neurologic deficit, using the AVPU method (see Table) or the Glasgow Coma Scale (GCS). Blood glucose level needs to be assessed in all patients with a decreased level of consciousness, as both hyper and hypoglycaemia can present as a medical emergency requiring urgent treatment. Check periodically for signs of focal neurologic deficit.34

Evidence-Based Practice: Hypoglycaemia (blood glucose < 60 mg/dL) should be treated in patients with acute ischemic stroke. Persistent in-hospital hyperglycaemia during the first 24 hours after a stroke is associated with a worse outcome than normoglycaemia, and thus it is reasonable to treat hyperglycaemia to achieve blood glucose levels within a range of 140 to 180 mg/dL and to closely monitor blood sugar levels to prevent hypoglycaemia in patients with acute ischemic stroke.5

### Table: THE AVPU METHOD34

<table>
<thead>
<tr>
<th>A</th>
<th>Alert</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Responds to voice</td>
</tr>
<tr>
<td>P</td>
<td>Responds on to painful stimuli</td>
</tr>
<tr>
<td>U</td>
<td>Unresponsive to all stimuli</td>
</tr>
</tbody>
</table>
Exposure

A head-to-toe examination is necessary to detect signs of trauma (eg after a stroke-induced fall), including areas of bleeding, bruising, and swelling, and to identify possible further signs of diseases and conditions associated with stroke (eg dehydration or hyperhydration) or stroke-independent conditions such as inflammation, infection, or pain. In addition to considering initial interventions, a full review of the patient’s chart, looking for trends and reviews of relevant investigations, should be considered.  

Guide to ABCDE

| A = AIRWAY       | • **Look** for signs of increased respiratory effort: sweating, inability to lie in the supine position or to swallow own saliva, etc.  
|                 | • **Look** for ability to cough and clear airway secretions  
|                 | • **Look** for complete obstruction: no sounds, but frantic effort to breath, seen as paradoxical chest and abdominal movements  
|                 | • **Listen** for signs of decreased patency (partial obstruction): stridor, snoring, wheezing, gurgling, crowing, inability to speak  
|                 | • **Feel** any movement of expired air from mouth or nose

| B = BREATHING    | • **Look** at patient’s colour (eg lips, oral mucosa, fingers for cyanosis) and position (eg inability to lie flat in cardiac or respiratory distress)  
|                 | • **Look** at patient’s use of accessory muscles, at depth and rhythm of breathing, and at paradoxical or inverse breathing (indicating severe airway obstruction)  
|                 | • **Measure** respiratory rate and oxygen saturation (note oxygen percentage and delivery method)  
|                 | • **Listen** to what the patient is saying and the ease with which he/she is talking  
|                 | • **Listen** for air entry bilaterally and in all lobes and for any added sounds through chest auscultation with stethoscope  
|                 | • **Feel** for tracheal deviation, cutaneous emphysema, areas of tenderness over chest wall, associated with tension pneumothorax or serial rib fractures  
|                 | • **Feel** for percussion changes in resonance, such as increased resonance with pneumothorax, or dull sounds with fluid

### Guide to ABCDE

<table>
<thead>
<tr>
<th>C = CIRCULATION</th>
<th>D = DISABILITY</th>
<th>E = EXPOSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Look: patient’s colour (e.g., pallor, cyanosis), sweating, increased jugular venous pressure</td>
<td>• Use AVPU or GCS to correctly assess level of consciousness</td>
<td>• Look: view the whole patient to determine any specific areas of bleeding, bruising, swelling, inflammation, infection or pain</td>
</tr>
<tr>
<td>• Listen: patients confusion, disorientation or drowsiness, complaints of chest pain, assess heart sounds</td>
<td>• Measure blood glucose</td>
<td>• Inspect: wounds, drains and invasive lines</td>
</tr>
<tr>
<td>• Feel: pulse (e.g., rate, rhythm, volume), peripheral temperature, capillary refill time, skin temperature (e.g., clammy skin, or warm and dilated)</td>
<td>•</td>
<td>• Feel: calves for any evidence of deep venous thrombosis, areas of associated pain</td>
</tr>
<tr>
<td>• Measure: blood pressure, urine output, body temperature, central venous pressure (in case of a central venous catheter)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ABC’s - Blood pressure

- Abrupt blood pressure lowering should be avoided.  

Cautious blood pressure lowering is recommended in patients with extremely high blood pressures (> 220/120 mmHg) on repeated measurements, or with severe cardiac failure, aortic dissection, or hypertensive encephalopathy.  

- Patients with the highest and lowest levels of blood pressure in the first 24 hours after stroke are more likely to have early neurological decline and poorer outcomes.  

- Blood pressure can usually be raised by adequate rehydration with crystalloid (saline) solutions. 

---

Assess airway compromise. Occurs more frequently in older patients, those with a severe stroke, or those with symptoms of dysphagia.\textsuperscript{38}

Use of supplementary oxygen to maintain oxygen saturation above 94%. Beyond 94%, oxyhemoglobin is saturated and no further physiologic benefit is derived.\textsuperscript{5}

\textbf{ABC’s - Oxygen saturation}

- Establish IV access and start 0.9% normal saline infusion\textsuperscript{5,15}
- Elevate upper body (incline head to 30\textdegree)\textsuperscript{5,15}
- Measure $\text{SpO}_2$ and give O\textsubscript{2} if necessary\textsuperscript{5,15} (If $\text{SpO}_2$ is < 94%)

ABC’s - Establish an IV access

- Start 2 large bore IV access (One could be used for thrombolytic therapy and the second to give contrast to identify patients for thrombectomy)\(^{21}\)

- However, transport should not be delayed for this.\(^{21}\)

- No strong evidence supports or refutes routinely giving fluid boluses to stroke patients. Patients with low systolic blood pressure and no contraindications should be given a bolus of IV fluids.\(^{5,15}\)

---

**ABC’s - Blood sugar test**

- **Hypoglycemia** could mimic stroke.\(^5\)

- Measuring glucose levels can help differentiate between stroke and hypoglycemia.\(^5\)

- Symptoms such as hemiparesis, hemiplegia, speech or visual disturbances, confusion, and poor coordination can all present in patients with hypoglycemia and can be corrected with administration of dextrose.\(^5\)

- Provide dextrose to those patients with glucose below 3.5 mmol/L.\(^{5,15}\)

- Pre-existing **hyperglycaemia** worsens the clinical outcome of acute stroke.\(^5\)

- Nondiabetic ischemic stroke patients with hyperglycaemia have a 3-fold higher 30-day mortality rate than do patients without hyperglycaemia. In diabetic patients with ischemic stroke, the 30-day mortality rate is 2-fold higher.\(^{39}\)

---

Responders must document:

- ✔ Patient last seen normal time
- ✔ Current medication list, pay special attention to medication to treat coagulation disorders
- ✔ Use of specific language, facilitates clear communication

Current and recent medical history

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Medications listed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coagulation disorders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heart failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Malignancy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respiratory disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recent invasive or surgical procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liver disease</td>
</tr>
</tbody>
</table>

Initial assessment form

<table>
<thead>
<tr>
<th>Time of symptom onset/last seen normal</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time emergency service was called</td>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>Time of initial screening of patient</td>
<td>Date</td>
<td>Time</td>
</tr>
</tbody>
</table>
## Relevant medical history

<table>
<thead>
<tr>
<th>STROKE RISK FACTORS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CARDIAC DISEASE</td>
<td></td>
</tr>
<tr>
<td>MEDS</td>
<td></td>
</tr>
</tbody>
</table>

**CONDITIONS THAT MAY PREDISPOSE TO BLEEDING COMPLICATIONS**

<table>
<thead>
<tr>
<th>STROKE MIMICS – MARKERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRUG ABUSE</td>
</tr>
<tr>
<td>ORAL CONTRACEPTIVES</td>
</tr>
<tr>
<td>INFECTION</td>
</tr>
<tr>
<td>TRAUMA</td>
</tr>
<tr>
<td>MIGRAINE</td>
</tr>
</tbody>
</table>

**RULE OUT STROKE MIMICS**

- ESPECIALLY IN YOUNGER PATIENTS

---

Patient position

- Head injuries: bed at 30 degrees alleviates elevated intracranial pressure.\(^{40,41,42}\)

- Cerebral blood flow and cerebral perfusion pressure improved with the patient in a supine position.\(^{5,43}\)

- Patients should be laid flat as tolerated, unless precluded by clinical issues such as compromised respiratory status, secretions, or aspiration risk.\(^{5,43}\)

---

PRE-HOSPITAL
1. Diagnose stroke
2. Choose hospital
3. Emergency transport
4. Pre-notify team

4. Pre-notification
Pre-notification

STUDIES HAVE SHOWN: 1

1. SHORTER SYMPTOM ONSET TO HOSPITAL ARRIVAL

2. INCREASE IN THE AMOUNT OF PATIENTS WITH DOOR-TO-IMAGING TIMES WITHIN 25 MIN

3. LOWER ONSET TO DOOR TIMES OBSERVED (113 MIN VS. 150 MIN)

---

Pre-notification

**BENEFITS**

1. **ALLOWS HOSPITALS TO PREPARE AND MOBILIZE RESOURCES**
   - SUCH AS IMAGING BEFORE THE PATIENT ARRIVES
2. **REDUCES IN-HOSPITAL DELAY**
3. **STROKE TEAM PRESENT ON PATIENT ARRIVAL AT THE DOOR**
4. **COLLECT RELEVANT INFO**
   - **APPROPRIATE INFORMATION ALLOWS PATIENT TO BE REGISTERED IN HOSPITAL SYSTEMS BEFORE ARRIVAL**
   - (INFORMATION NEEDED INCLUDE: NAME, DATE OF BIRTH, INSURANCE NUMBER)

**HOW?**

- **STROKE PHONE IN HOSPITAL**
- **HOSPITAL BUSINESS CARD IN AMBULANCES**

**PRENOTIFICATION IS THE KEY THAT ALLOWS PATIENTS TO BE TREATED FASTER**

### Importance of EMS Notification

**Reduces in-hospital delays in stroke evaluation, including**

- **Time to stroke team arrival**<sup>44</sup>
- **Time to CT scan completion and interpretation**<sup>44,45</sup>
- Even higher benefit if EMS speaks directly with neurologist prior to arrival<sup>46</sup>  

**Increases the number of patients undergoing timely imaging and image interpretation by a physician compared with patients arriving by private transport**<sup>44,45</sup>  

**Increased likelihood of administration of tissue-plasminogen-activator**<sup>44,47</sup>  

---

Pre-admission Notification

Ischaemic strokes admitted to the Lille University Hospital

After call to hospital* = 50%
Thrombolysis rate: 22.5%
Median DTN time: 49 min

No call to hospital* = 50%
Thrombolysis rate: 5.1%
Median DTN time: 57 min

The best way to shorten DTN time

Not adjusted on case-mix. A part of the difference may be explained by differences in profiles.

Emergency department - activation of “Code Stroke”

Pre-notify and provide the following\textsuperscript{5}

<table>
<thead>
<tr>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENDER</td>
</tr>
<tr>
<td>TIME OF ONSET (TIME LAST SEEN “NORMAL”)</td>
</tr>
<tr>
<td>FAST TEST</td>
</tr>
<tr>
<td>OTHER SYMPTOMS</td>
</tr>
<tr>
<td>HISTORY OF OTHER RELEVANT DISEASES (SEIZURES, MIGRAINE, DIABETES, CANCER)</td>
</tr>
<tr>
<td>CURRENT MEDICATIONS</td>
</tr>
<tr>
<td>RESULTS OF POC TESTS – GLUCOSE</td>
</tr>
<tr>
<td>OTHER SIGNS OR RELEVANT DISEASE</td>
</tr>
<tr>
<td>ESTIMATED TIME OF ARRIVAL AT HOSPITAL</td>
</tr>
</tbody>
</table>

EMS STROKE RECOGNITION AND PRE-NOTIFICATION OF THE IN-HOSPITAL STROKE TEAM ARE ASSOCIATED WITH SHORTER TIMES FROM ARRIVAL AT HOSPITAL TO PHYSICIAN ASSESSMENT\textsuperscript{5}

---

Simulation video without pre-notification video 6
Simulation video with pre-notification *video* 7
Summary

THE ROLE OF THE EMS IN ACUTE STROKE CARE IS CRITICAL FOR THE LONG-TERM PROGNOSIS

EMS ARE RESPONSIBLE FOR:

- Rapid response to a stroke call
- Minimising pre-hospital delays
- Stabilisation of the patient
- Rapid stroke assessment in the field
- Establishing time of onset of symptoms
- Direct transport to the nearest appropriate stroke facility
- Pre-notification of the in-hospital stroke team
- Continued management of the patient according to standardised protocols en route to hospital

EMS Heroes— video 8
Multiple Choice Questions – CPD Accreditation

Please see webpage for online questionnaire

Blue button that says: “ACCESS MODULES Q&A”