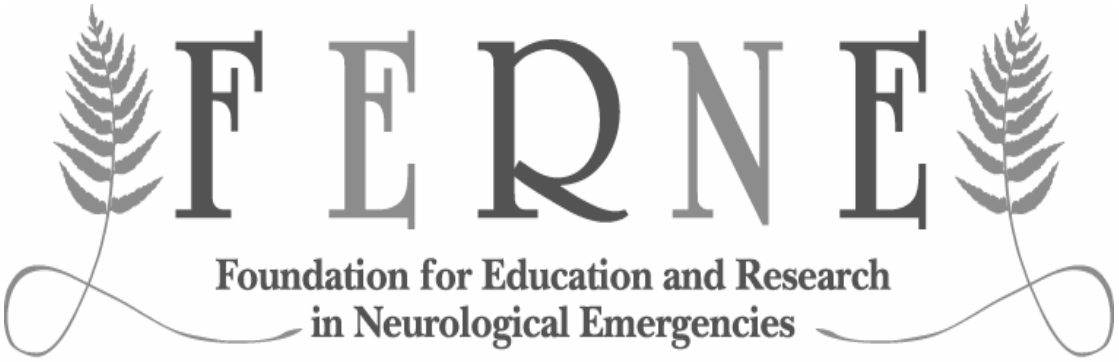

The Neurological Exam in the Emergency Department: A Focus on Stroke Patients

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Case Presentation

A 62 year old female acutely developed aphasia and right sided weakness while in the grocery store. The store clerk immediately called 911, with the arrival of CFD paramedics within 9 minutes, at 6:43 pm. She arrived at the ED at 7:05 pm, completed her head CT at 7:25 pm, and a neurology consultation was obtained at 7:35 pm, approximately one hour after the onset of her symptoms.

On exam, BP 116/63, P 90, RR 16, T 98, and pulse oximetry showed 99% saturation. The patient appeared alert, and was able to slowly respond to simple commands. The patient had a patent airway, no carotid bruits, clear lungs, and a regular cardiac rate and rhythm. The pupils were pinpoint, and there was neglect of the R visual field. There was facial weakness of the R mouth, and R upper and lower extremity motor paralysis. DTRs were 2/2 on the left and 0/2 on the right. Planter reflex was upgoing on the right and downgoing on the left. The patient's estimated weight was 50 kg.

How should the neurological exam be documented in the ED?

What is this patient's approximate NIH Stroke Scale (NIHSS) Score?

What are the next steps in the diagnosis and management of this patient?

Key Clinical Questions and Learning Points

What are the three physical findings addressed by the Cincinnati Prehospital Stroke Scale?

The three physical findings are facial droop, arm drift, and speech. Each is graded as either being normal or abnormal. This scoring system was validated in a 1999 publication: Kothari RU, Pancioli A Liu T et al, Cincinnati Prehospital Stroke Scale: Reproducibility and Validity, *Ann Emer Med*, 1999 Apr: 33(4): 373-378.

How is the NIH Stroke Scale (NIHSS) calculated?

There are 11 parts to the NIHSS, with 13 specific tests being performed. The NIHSS examines for level of consciousness, vision and gaze, facial palsy and extremity weakness, limb ataxia, sensory loss, language and dysarthria, and neglect. It is designed to be conducted over 7 minutes. This scoring system can be printed up as a PDF file from the Internet at www.

What are the minimum and maximum scores possible on the NIHSS?

A patient with a completely normal neurological exam and normal mental status will have an NIHSS of 0. The maximum recordable NIHSS score is 42. However, since acute ischemic stroke causes unilateral paralysis and blindness, the maximum score actually is 31 for a stroke patient with complete hemiparesis, hemianopia, hemineglect, and aphasia.

What are some examples of NIHSS scores based on stroke physical findings?

A patient with only minimal facial or extremity weakness with some loss of sensation would have a NIHSS score of 1-2. A patient with a slight alteration in mental status, some loss of vision, slight facial droop, complete hemiparesis, sensory loss on the hemiparetic side, mild aphasia, and slight neglect will have and NIHSS of approximately 19. If these findings are noted as being severe, then the NIHSS would approach 31.

What NIHSS score is considered a severe stroke clinically?

Patients with an NIHSS score greater than 15-20 are considered to have a severe stroke clinically.

What was the average NIHSS seen in patients treated in the NINDS trials?

The median (50% above and below) NIHSS score was 14, consistent with a patient who has mild to moderate stroke physical findings.

Does the NIHSS score correlate with neurological outcome?

Yes. About 80% of patients with an NIHSS < 12- 14 will have a good or excellent outcome, whereas only 20% of patients with an NIHSS > 20-26 will have this similar good or excellent outcome.

Can the NIHSS be approximated clinically?

Yes. By addressing four major areas that are tested by the NIHSS, it is possible to estimate a patient's NIHSS score. These four areas are CN/visual, motor, level of consciousness, and language/neglect.

By assigning a grade to each area with regards to deficit (mild/moderate/severe), and a score of 2, 4, or 8, depending on the severity of the deficit, it is possible to estimate the NIHSS score. For example, if a patient has a severe deficit in all four areas, then the estimated NIHSS score would be 32. A mild deficit in all four areas would lead to an estimated NIHSS score of 8, and a moderate deficit in all four areas suggests an approximate NIHSS score of 16.

Can the NIHSS reliably be calculated retrospectively from the ED record?

Yes. Studies have demonstrated that the NIHSS (and other scoring systems) can be calculated retrospectively if there is adequate documentation of the neurological exam. This suggests the need to document this exam in a systematic and complete fashion in the ED medical record.

What are the parts of the neurological exam that should be documented in the ED medical record?

The recorded ED neurological exam should include the following parts: CN, motor, sensory, cerebellar, reflex, visual/neglect, language, and level of consciousness. The overall physical exam should also attempt to detect pathologies that would suggest the etiology of the stroke, such as atrial fibrillation suggesting an embolic stroke, and the presence of a carotid bruit or AAA suggesting a vasculopathic state and a possible thrombotic stroke.

How can the ED neurological exam be made more efficient?

By simply asking questions and documenting what is observed in each of the parts of the neurological exam, it can be made more efficient. For example, for the CN exam, ask the question: Is there a mouth droop or eye closure weakness? In the ED chart, simply record: "R mouth droop noted, no eye closure weakness." For the language exam, ask: Can the patient use his mouth muscles? Can he understand the spoken word? Does he struggle to generate the language he wishes to use? In the ED chart, record "The patient can use his mouth and understands language, but cannot find the words to express his thoughts."

What must be documented in the ED record when considering tPA use?

Who was spoken to and whether they understood what was stated?
The key clinical concepts from the NINDS clinical trial: With tPA,

- There is a 30% > chance of a good outcome at 3 months.
- There is 10x > risk of a symptomatic ICH (severe bleeding stroke)
- Mortality rates at 3 months are the same regardless of whether tPA is used

What was the rationale, risk/benefit assessment for using or not using tPA?
What was done to expedite Rx and to consult neurology and radiology early on?
For example:

- Patient was explained risks and benefits of tPA use and was able to understand and provide verbal consent (as able), and signature with L hand.
- Risk/benefit favored tPA given clear onset time, young patient with no significant morbidities or factors that would preclude tPA use, and approx NIHSS that suggests OK use.
- Rapid CT obtained, neurology aware of patient status, agreed with expedited tPA use, to follow.

Patient Case Outcome

The following is an example of how the ED medical record can be documented as a stroke patient is examined and treated.

ED History & Physical Document

- 62 yo F with sudden onset paralysis, aphasia at 6:30 pm, no trauma
- No history of similar symptoms in past
- Patient apparently was normal prior
- No known risk factors (DM, HTN)
- No chest pain SOB, or recent illness. No trauma or syncope
- No Hx surgery, bleed that would preclude tPA use

- Vital signs: hypertension noted, pulse ox OK, POC glucose OK
- HEENT: Pupils midrange, reactive, no papilledema, airway OK
- Neck: No Bruits, no nuchal rigidity
- Chest: BSBE No Rales
- Cardiac: No afib, no gallops or murmurs
- Abd: No evidence of AAA, peritonitis
- Ext: No DVT or pedal edema evident
- Skin: No cellulitis or wounds
- Neuro: Please see below

- CN: R mouth droop, no lid weakness
- Motor: R hemiparesis, flaccid
- Sensory: No light touch of R extremities
- Reflex: No DTRs RLE, upgoing great toe R
  Normal corneals, normal gag reflex
- Cerebellar: Slight truncal ataxia, to R
- Visual/Neglect: Lost vision & neglect on R
- Language: Dysarthria, expressive aphasia, no receptive aphasia
- LOC: Slightly somnolent, responds to verbal stimuli, GCS=13
- Approximate NIHSS: 18

ED Management and Patient Outcome

- CT: no low density areas or bleed
- No contraindications to tPA, BP OK
- NIH stroke scale: approx 18-20
- Neurologist said OK to treat
- No family to defer tPA use
- tPA administered, no complications

- **tPA Consent**
- Patient was explained risks and benefits of tPA use and was able to understand and provide verbal consent (as able), and signature with L hand.
- Risk/benefit favored tPA given clear onset time, young patient with no significant morbidities or factors that would preclude tPA use, and approx NIHSS that suggests OK use.
- Rapid CT obtained, neurology aware of pt status, agreed with expedited tPA use, to follow.

- **tPA Dosing:**
- 8:21 pm, approx 1'45" after CVA sx onset
- Initial bolus: 5 mg slow IVP over 2 minutes
- Follow-up infusion: 40 mg infusion over 1 hour

- **Repeat neurological exam at 90 minutes:**
- Repeat Exam: Increased speech & use of R arm,
  Decreased mouth droop & visual neglect
- Repeat NIH stroke scale: approximately 12-14

- **Hospital Course:** No hemorrhage, improved neurological function
- **Disposition:** Rehabilitation hospital on day 8
- **3 Month Exam:** Near complete use of RUE, speech & vision improved, slight residual gait deficit. Able to live at home with assistance.