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Diagnosis of Patient with Ischemic Stroke -

Localization in Stroke and The NIH Stroke Scale

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Disclosures:

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- No Disclosures

Objectives:

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- Explain latest updates and options for Ischemic and Hemorrhagic stroke management and standards of care.

Measuring Neurological Impairments

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- Goals
  - Assess baseline severity of stroke
  - Affects prognosis and decisions for treatment
  - Assess for improvement or worsening of the patient's neurological status
- NIH Stroke Scale most commonly used instrument
- Developed by researchers at University of Cincinnati, University of Iowa, and NINDS

Localization in Stroke

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- Acute onset of focal neurologic signs
- Reflects area of brain injury
- Stereotypic patterns of impairment
- Important prognostic information
- Suggests cause of ischemic stroke

Components of the Neurological Exam

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- Mental status
- Station and gait
- Motor
- Sensory
- Coordination
- Reflexes
- Cranial nerves

Assessment of Mental Status

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- Wakefulness is a vital sign – first component of neurological examination
- Alert, drowsy, stupor, coma, delirium
- Cognition usually assessed at same time
- Orientation, attention, language, memory, and fund of knowledge
- Assessed in history as well as formal testing

Rules of Thumb Wakefulness/Cognition

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- Decreased wakefulness – brain lesion
  - Diffuse brain dysfunction (delirium)
  - Focal brainstem lesion
  - Focal cerebral lesion/secondary brainstem involvement
- Decreased cognition despite normal wakefulness
  - Focal dysfunction of cerebral cortex – focal impairments of non-dominant/dominant hemispheres
  - Multiple aspects of cortex – dementia

Coma

- Examination – to differentiate a structural cause (stroke) from global cause (hypoxia)
- Limited by the patient's status
- Focuses on the brain stem
  - Vital signs – especially breathing pattern
  - Pupils – size, equality, reactivity
  - Eye movements – location at rest, conjugate, response to stimulation
  - Corneal and gag reflexes
  - Motor responses – normal, weak, decorticate, decerebrate, no movement – responses to stimulation

Difference Between Speech and Language

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- Aphasia – disorder of language
  - Aural comprehension, oral production
  - Fluency, naming, repetition, understanding
  - Reading, writing
  - Lesions of dominant cerebral hemisphere
- Dysarthria – disorder of articulation
  - Production of spoken language
  - Involves larynx, throat, tongue, palate, lips
  - Wide variety of lesions – brainstem, muscle diseases

Motor Examination

- Atrophy, contracture, fasciculations
- Strength (power) and tone
- Flaccidity, spasticity, rigidity
- Involuntary movements
- Tremor, chorea, athetosis, dystonia
- Slowness of movements

Patterns of Motor Weakness

- Quadriparesis – involvement of all 4 limbs
  - Upper spinal cord, brain stem or bilateral cerebral hemispheres – brain lesions usually have facial involvement
- Paraparesis – involvement of both legs with arms normal
  - Spinal cord lesions
- Hemiparesis – involvement of one half body
  - Brain stem or cerebral hemisphere lesions
  - Contralateral to site of lesion
- Monoparesis – involvement of only one limb
  - Wide variety of locations

Sensory Examination

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- Components of somatosensory examination
  - Pain, temperature, position, vibration
  - Brain, spinal cord, root, plexus, nerve
  - Sensory loss, hyperesthesia
- Patterns reflect the location of the lesion
- Dissociated sensory loss – some modalities preserved/others impaired
  - Peripheral nerve, spinal cord, brainstem lesions

Lesions in the Dominant Cerebral Cortex

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- Usually, the left hemisphere
- Signs vary by location and size of lesion
- Contralateral hemiparesis (UMN)
- Contralateral hemi-sensory loss
- Contralateral visual field loss (homonymous hemianopia)
- Aphasia
- Apraxia, acalculia, alexia
- Mild dysarthria

Lesions in the Non-Dominant Cerebral Cortex

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- Usually, the right hemisphere
- Signs vary by location and size of lesion
- Contralateral hemiparesis (UMN)
- Contralateral hemi-sensory loss
- Contralateral visual loss (homonymous hemianopia)
- Neglect
- Anosognosia, asomatognosia, aprosody
- Mild dysarthria

Lesions Deep in the Cerebral Hemisphere

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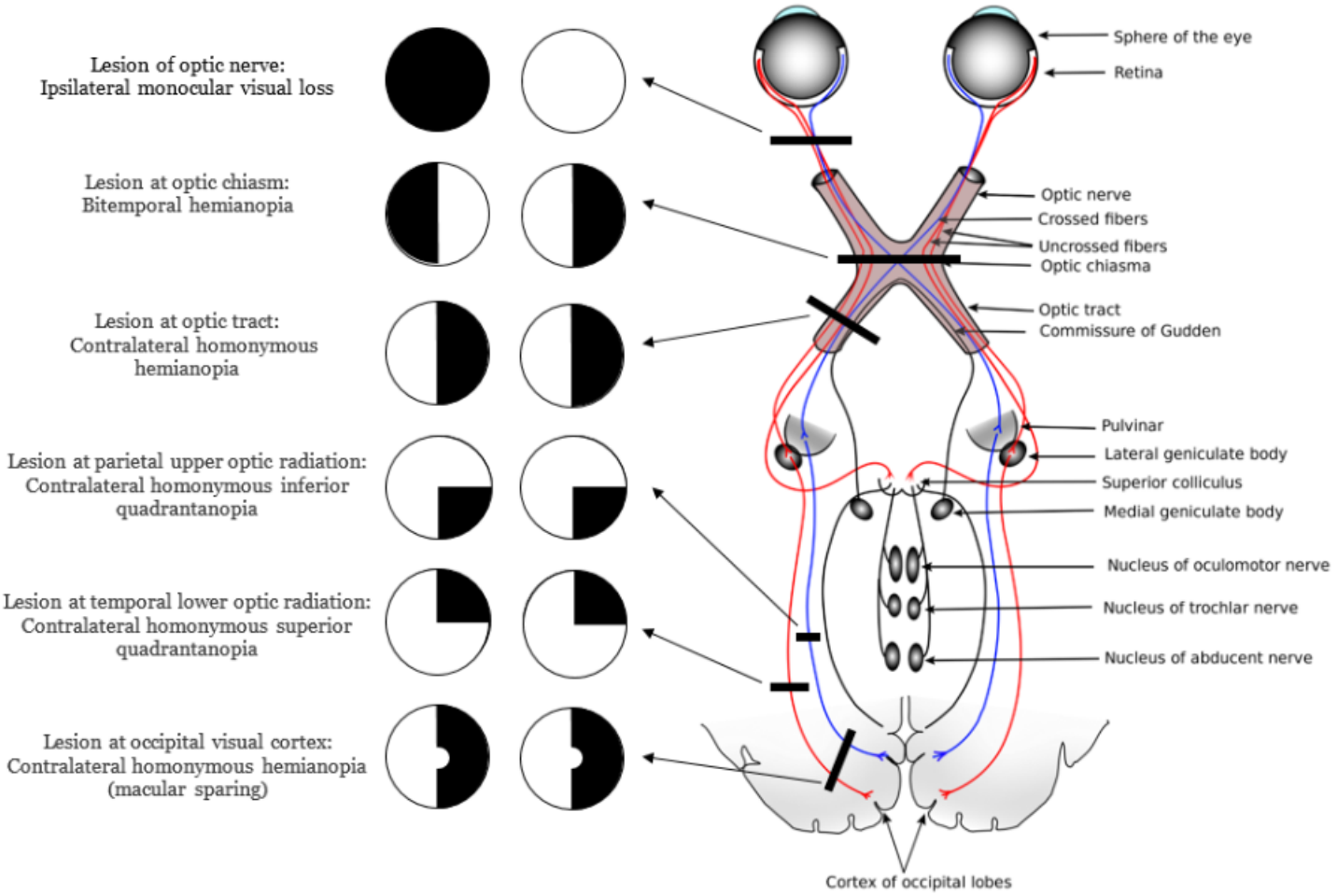
- Basal ganglia, internal capsule, thalamus
- Signs vary by location and size of the lesion
- Contralateral hemiparesis (UMN)
- Contralateral hemi-sensory loss
- May have paralysis without sensory loss or vice versa
- Dysarthria
- May have cognitive impairments – though usually mild

Visual Fields



Disorders of Ocular Movements

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- May involve hemisphere (supranuclear control,) brainstem, cerebellum, nerves, NMJ, muscle
- Lesions of CNS usually produce other signs too
- Isolated cranial nerve palsy (III) usually peripheral nerve
- Disturbances – eyes at rest (conjugate, deviation) movement of one or both eyes
- May have associated nystagmus, pupillary changes, or ptosis

Brainstem Lesions

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- Most commonly, stroke, tumor, MS
- Ipsilateral cranial nerve palsies
  - III – midbrain, VI, VII-pons, V, X, XII-medulla
- Contralateral motor or sensory loss
  - Motor impairments with midline lesions
  - May have bilateral motor impairments with large lesions
  - Sensory impairments with dorsolateral lesions

Take Home Points

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- Impairment in wakefulness – brain disease
  - Global brain dysfunction
  - Brain stem dysfunction
  - Cerebral hemisphere dysfunction with secondary brain stem involvement
- Impairment in cognition – cerebral cortex disease
  - Occur with diffuse or focal disease
  - Cognitive impairments of focal lesions of the dominant cerebral hemisphere differ from those found with lesions in the non-dominant hemisphere

Take Home Points

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- Depending the pattern of visual loss – dysfunction can be with lesions of the eye, optic nerve, optic chiasm, optic tract, or cerebral hemisphere
- Depending upon the nature and type of cranial nerve palsies – dysfunction is ipsilateral with lesions of the brain stem or the peripheral cranial nerve
- The patterns of cerebellar dysfunction vary by location – may be ipsilateral cerebellar hemisphere, vermis or pan-cerebellar
- Motor impairments generally are categorized as upper or lower motor neuron

Take Home Points

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- Lower motor neuron signs are found with lesions of the spinal cord, motor neuron, nerve root, plexus or peripheral nerve
  - Findings correspond to the anatomic structure involved
- Upper motor neuron signs are found with lesions affecting the corticospinal tract – cerebral hemisphere, brain stem, spinal cord.
  - Depending upon location or severity of lesion, the patterns of weakness are hemiparesis, paraparesis, or quadriparesis.

National Institutes of Health Stroke Scale

- 15 items of the neurological examination
- Each item independently scored
- Give a baseline severity of neurological impairments
- Could be used sequentially to monitor for worsening or improvement
- Range of scores 0 – 42
- Higher scores more severe stroke

Components of the NIH Stroke Scale

Component	*Scoring range*
Consciousness	0 – 3 points
Orientation	0 – 2 points
Commands	0 – 2 points
Best gaze	0 – 3 points
Visual fields	0 – 3 points
Facial motor function	0 – 3 points
Upper limb function (R/L)	0 – 4 (8) points
Lower limb function (R/L)	0 – 4 (8) points
Limb ataxia	0 – 2 points
Language	0 – 3 points
Articulation	0 – 2 points
Extinction	0 – 2 points

Brott et al, Stroke, 1989; 20: 864

Components- 1

- Level of consciousness
  - 0 alert
  - 1 drowsy
  - 2 stupor
  - 3 coma
- Questions
  - 0 answers both correctly
  - 1 answers 1 correctly
  - 2 answers both incorrectly

Components- 2

- Commands
  - 0 Performs both correctly
  - 1 Performs 1 correctly
  - 2 Performs neither correctly
- Best gaze
  - 0 Looks both directions
  - 1 Partial gaze palsy
  - 2 Forced deviation

Components- 3

- Visual Fields
  - 0 Full visual fields
  - 1 Partial hemianopia
  - 2 Complete hemianopia
  - 3 Bilateral visual loss
- Facial Palsy
  - 0 No facial weakness
  - 1 Partial facial palsy
  - 2 Complete facial palsy

Components -4

- Motor arm
- Right and left scored independently
  - 0 No drift or weakness
  - 1 Drift, but holds limb
  - 2 Cannot maintain holding the arm up
  - 3 No effort against gravity
  - 4 No movement

Components-5

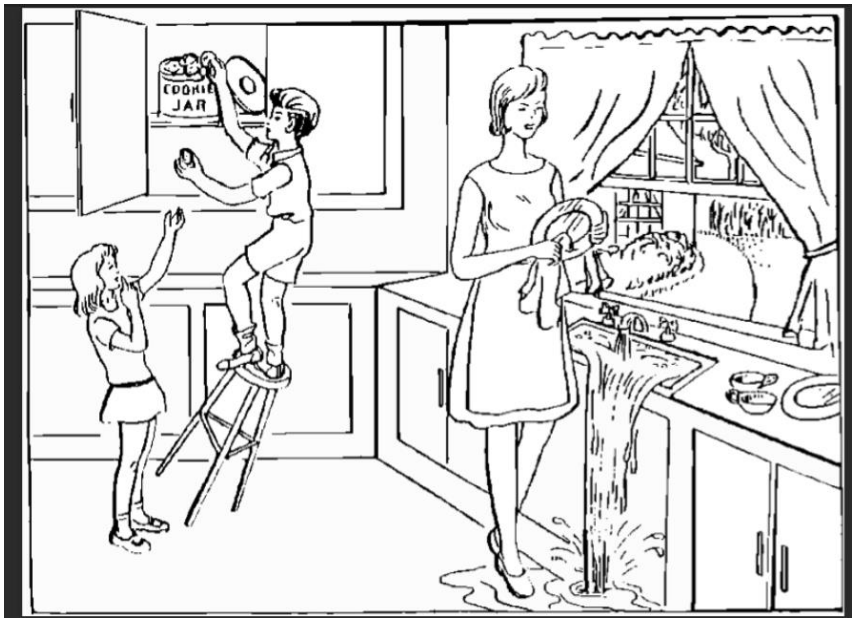
- Motor leg
- Each leg tested independently
  - 0 No weakness when holding limb up
  - 1 Drift, but does hold limb up
  - 2 Some effort against gravity
  - 3 No effort against gravity, but does move limb
  - 4 No movement

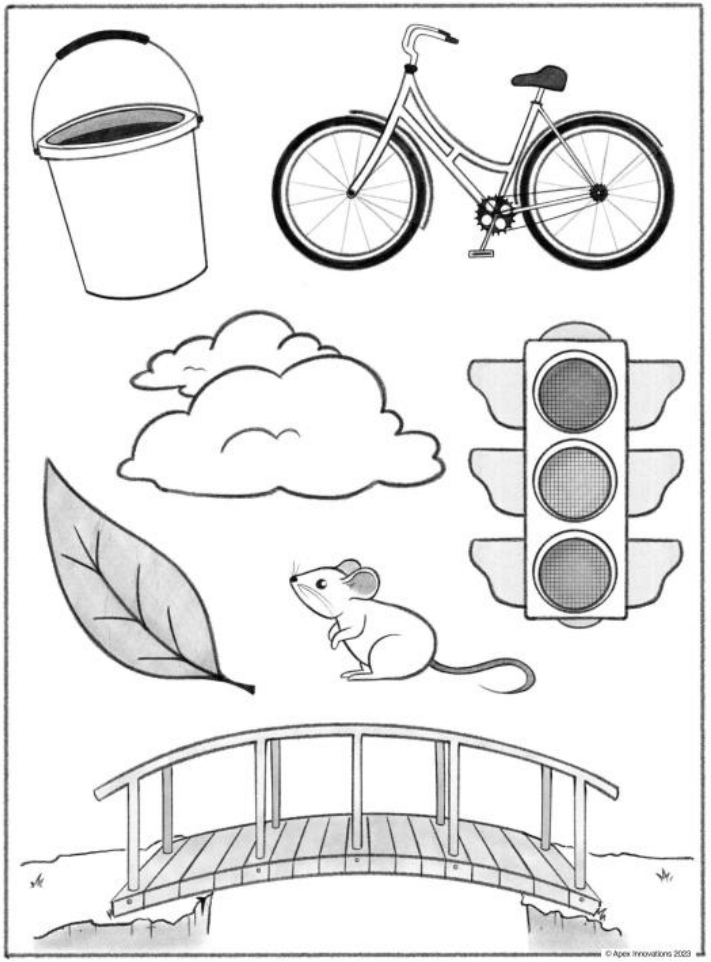
Component -6

- Limb Ataxia
  - 0 Absent
  - 1 Present in one limb
  - 2 Present in two limbs
  - UN joint fusion or absent
- Sensory
  - 0 No sensory loss
  - 1 Mild to moderate sensory loss
  - 2 Severe or total sensory loss

Component- 7

- Best Language
  - 0 No aphasia
  - 1 Mild to moderate aphasia
  - 2 Severe aphasia
  - 3 Mute or global aphasia


COOKIE
JAR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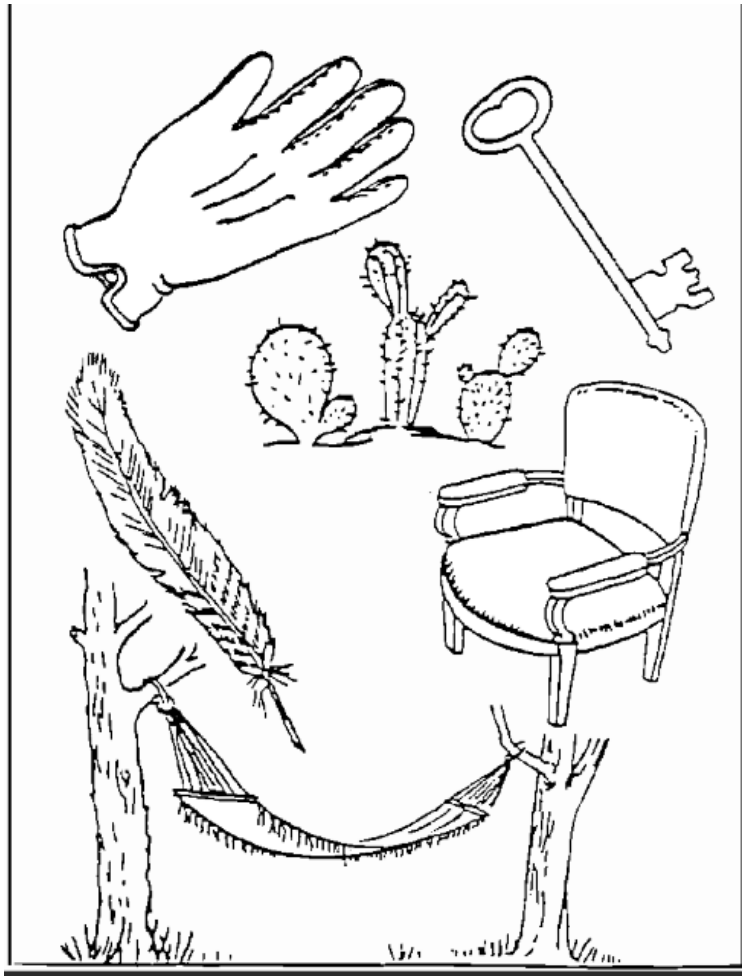

Reading and Articulation

- 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.

- MAMA
- TIP TOP
- FIFTY - FIFTY
- THANKS
- HUCKLEBERRY
- BASEBALL PLAYER
- CATERPILLAR

Component -8

- Dysarthria
  - o Normal
  - 1 Mild to moderate dysarthria
  - 2 Severe dysarthria
  - UN untestable
- Extinction and Inattention
  - o No abnormality
  - 1 Unilateral extinction
  - 2 Profound extinction

Initial Validation
NIH Stroke Scale

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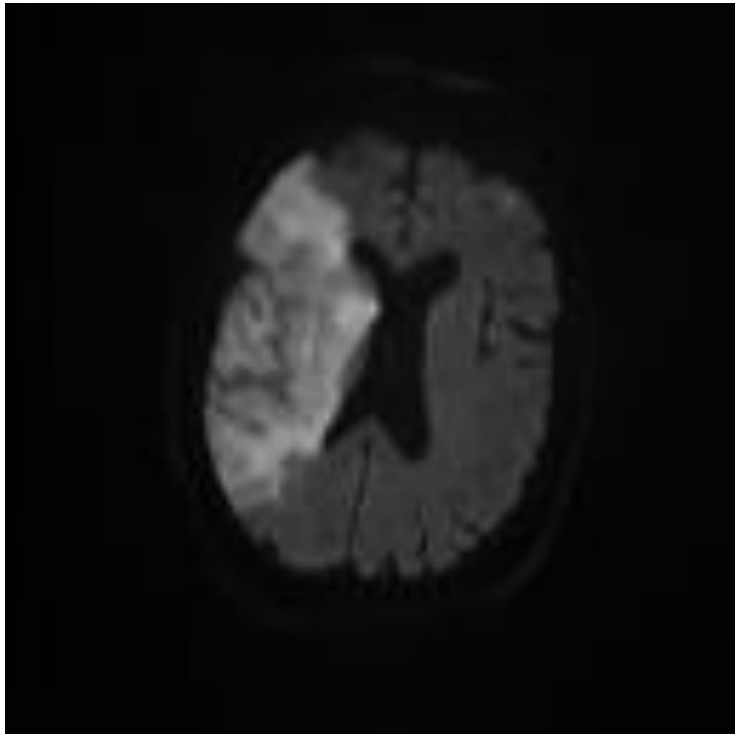
- Initial testing – high inter-rater agreement (ƙ = 0.69) and test – retest reliability (ƙ = 0.66 – 0.77)
- Prospectively assessed and total scores were compared to size of infarctions on CT and outcomes at 3 months
  - Acceptable scale validity
  - Scores correlated well with size of lesions and outcomes
- Tested in several other venues
- Now used internationally in wide range of stroke research

Brott et al, Stroke, 1989: 20: 864

Correlation of Stroke Severity with Total score on NIH Stroke Scale

- Total score is important in planning for acute care and prognosis
- Range of scores
  - 0 – 3 mild
  - 4 – 8 moderate
  - 9 – 14 mod. severe
  - 15 – 20 severe
  - 21+ very severe



Prognostic Importance
NIH Stroke Scale score

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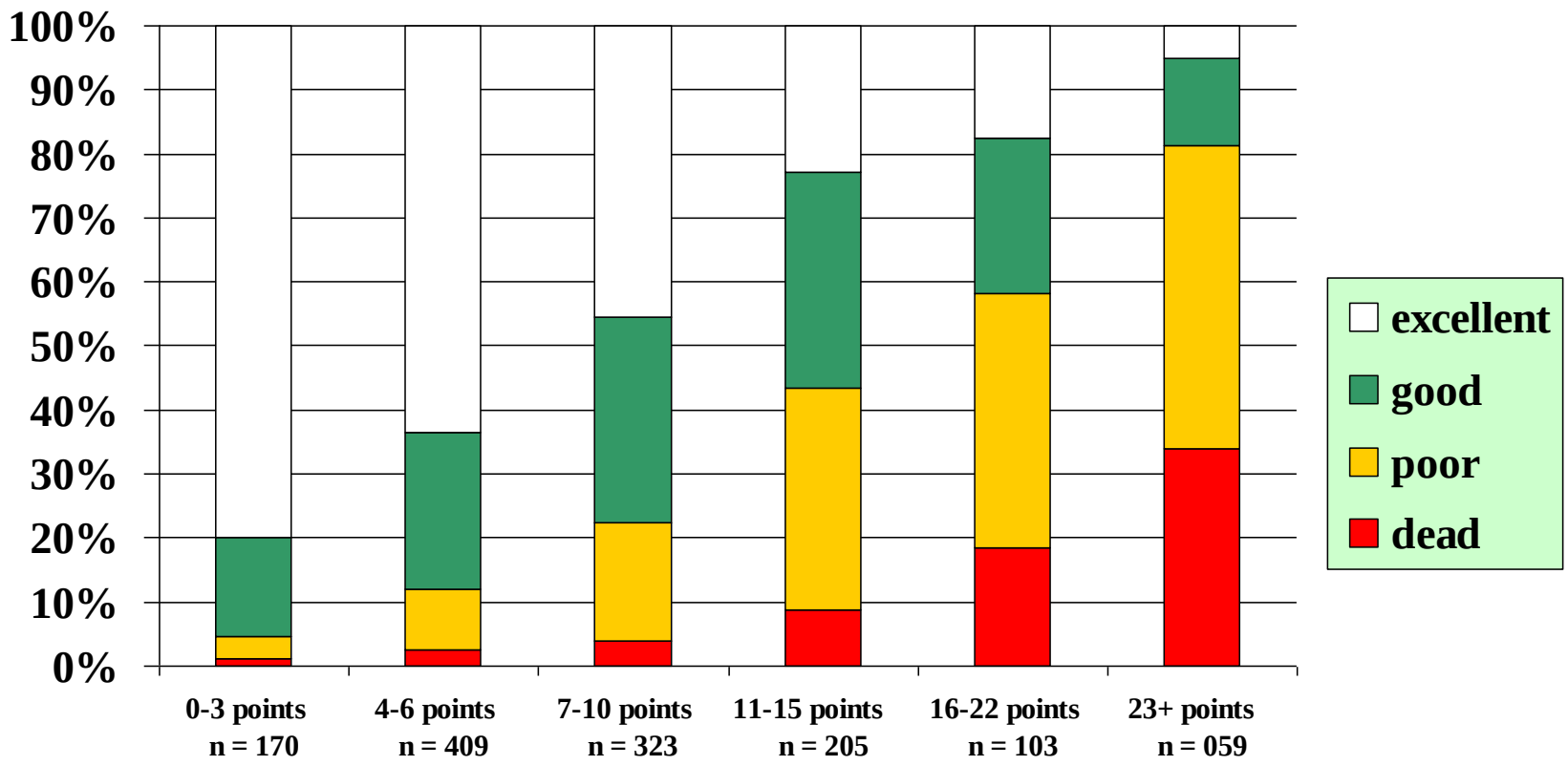

Adams et al, Neurology, 1999; 53: 126

Advantages of NIH Stroke Scale

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- Well-validated measure of stroke severity that can be performed rapidly by a wide range of health care professionals
- Good correlation with outcomes and used for planning acute and long-term care
- High inter-rater agreement and intra-rater reproducibility
- Adapted for multiple languages and cultures
- Can be administered via telemedicine
- Educational and certification programs exist

Disadvantages of NIH Stroke Scale

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- There is a “bias” towards the dominant hemisphere
  - With similarly sized lesions in similar locations, scores are higher with left hemisphere lesions
  - Result of orientation and commands linked to language
- Range of scores among raters
- Moderate-to-excellent agreement in most items with the following exceptions:
  - Ataxia, facial paresis, and aphasia

Increasing Reliability
Scoring of NIH Stroke Scale

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- Certification process using videotapes
  - Used in clinical trials
- Available at several websites
- Components
  - Education and testing
  - Remediation
- Central adjudication of scores

Albanese et al, Stroke; 1994; 25: 1748
Lyden et al, Stroke; 1994; 25: 2250

Current Status
NIH Stroke Scale

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- Modifications of NIH Stroke Scale have been attempted but original version remains the standard
- Most widely used clinical assessment scale of stroke severity in research and clinical care
  - Score used as an entry criterion for trials and in the selection of interventions
  - Score is now used in inter-physician communications in a way that is similar to the Glasgow Coma Score in patients with trauma
  - Likely will not be replaced in the near future and all physicians dealing with stroke should become proficient in its use