How to Think like a Neurologist – Review of Exam Process and Assessment Findings

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How to Think Like a Neurologist

Review of Exam Process and Assessment Findings

Gary Clauser
Lehigh Neurology
Objectives / Outline

- Review Common Neurological Cases
- Review Thought ("localization") Process
  - Simple determination of Central or Peripheral
  - Allowing better disposition / work up
Pre-Quiz

- Tel-Con  - 74yo female with known DM, hyperlipidemia. Awoke with new bilateral arm tingling. Seen in office in the afternoon. Now with numbness remaining in the left upper arm.
  - CT head (done emergently) – small vessel ischemic changes.

WHAT SHOULD I DO NEXT?
Pre-Quiz

Options

1) Admit for acute stroke
2) MRI brain and observe as outpatient
3) Observe as outpatient
4) Other options
   • MRI cervical spine
   • NCV/EMG
   • Reassurance
Case 1

A 74yo right handed female awakens with left arm heaviness
Diagnostic Process

- Symptoms/Signs: Left arm “heaviness”
- Cause: ????
Diagnostic Process

- **Phenomenology**  
  Left arm weakness

- **Etiology**  
  ????
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology
  - Left Arm Weakness

- Lesion

- Etiology
  - ????
Localize the Lesion

1) Determine the subsystem involved

2) Determine likely localization based on the pattern and nature of deficits

3) Confirm and refine localization with other subsystems
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Motor Pathway

Face

Arm

Leg
Motor Pathway

Face

Arm

Leg
Complaint of left arm heaviness
Possible Lesion Location??

1. Peripheral
2. Spinal Cord
3. Cortical

Face
Arm
Leg
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Examination
Exam

- CN – Visual fields normal, left facial droop
- Motor - mild left arm weakness; mild left leg weakness; right side normal
- Sensation – normal to light touch, no extinction or neglect
Exam:
- Left Facial Droop
- Left Arm Weakness
- Left Leg Weakness

Possible Lesion Location??
Exam:
- Left Facial Droop
- Left Arm Weakness
- Left Leg Weakness

Possible Lesion Location??
Exam:
- Left Facial Droop
- Left Arm Weakness
- Left Leg Weakness

Possible Lesion Location??
Exam:
Left Facial Droop
Left Arm Weakness
Left Leg Weakness

Possible Lesion Location??

Location:
1. Peripheral
2. Spinal Cord
3. Cortical
- Left Facial Droop
- Left Arm Weakness
- Left Leg Weakness
Case 1

Evaluation:
1) Where to image?
2) Differential of Etiologies…
Recap

- 74yo RH female with acute onset of left sided face, arm, leg weakness
- **Localized** to “Cerebral” event

*Imaging – CT head – “negative for bleed or mass”*  
(** without contrast = low sensitivity for mass)**
Etiology??

- Any Historical Clues??
  
  **Age**
  
  *74yo female*

  **Tempo of Onset**
  
  *Acute (“awoke with symptoms”)*
Tempo of Onset

Acute Onset
- Stroke
- Hemorrhage
- Trauma

Gradual Onset
- Tumor
- Demyelinating
- Hemorrhage
Ischemic Event

- Cortical vs Subcortical

- Why important??
  - Aid in determining pathophysiology
    - Cortical = embolic
    - Subcortical = small vessel atherosclerosis
Cortical Localization

- Dominant Hem
- Non-Dominant Hem
Cortical Localization

- Dominant Hem
- Non-Dominant Hem

Why Do Neurologists ask what hand dominance a patient is?
Rule out Cortical

Dominant vs Nondominant

95% rt handed people = left side Dom

85% left handed people = left side Dom
Rule out Cortical

Dominant Hem.  Non-Dominant Hem.
Rule out Cortical

Dominant Hem.

- Aphasia
  - Naming
  - Repeat
  - Comprehension
  - Reading/Writing

Non-Dominant Hem.
Rule out Cortical

Dominant Hem.
■ Aphasia
  – Naming
  – Repeat
  – Comprehension
  – Reading/Writing

Non-Dominant Hem.
■ Neglect
Rule out Cortical

**Dominant Hem.**
- Aphasia
  - Naming
  - Repeat
  - Comprehension
  - Reading/Writing

**Non-Dominant Hem.**
- Neglect
- Extinction
Rule out Cortical

**Dominant Hem.**
- **Aphasia**
  - Naming
  - Repeat
  - Comprehension
  - Reading/Writing

**Non-Dominant Hem.**
- **Neglect**
- **Extinction**
  - Touch on 2 sides → ignores affected side
Rule out Cortical

**Dominant Hem.**
- Aphasia
  - Naming
  - Repeat
  - Comprehension
  - Reading Writing

**Non-Dominant Hem.**
- Neglect
- Extinction
  - Touch on 2 sides
    ➔ ignores affected side

**Visual Fields**
Other Cortical Clues

- **Pattern Of Weakness**
  - **Face = Arm = Leg** (patient with normal cognition) → Subcortical
  - **Face and Arm > Leg** → Middle Cerebral Artery (MCA) Cortical infarct
  - **Leg > Face and Arm** → Anterior Cerebral Artery (ACA) Cortical Infarct

Image(s) have been omitted
Recap

- 74yo RH female with acute onset of left sided face, arm, leg weakness
- No Aphasia, No Neglect or Visual Field Cut
- Weakness appears equal

- Dx = Right Subcortical Stroke (Posterior Limb of Internal Capsule)
- Pathophysiology – small vessel atherosclerosis
Age Factor – Acute “Cerebral” Weakness

- Localization remains the same
- Causes will vary……

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<th>Teenager</th>
<th>Adult</th>
<th>Senior</th>
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<tbody>
<tr>
<td>Trauma/Bleed</td>
<td>Ischemia</td>
<td>Bleed / Trauma</td>
</tr>
<tr>
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<td>Tumor</td>
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<tr>
<td>Ischemia</td>
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<td>Multiple Sclerosis</td>
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Case 2

A 42 year-old teacher with a long history of mild recurrent low back pain complains of 8 days of progressive weakness and numbness of both legs.
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Weakness and Numbness of Legs

Face

Arm

Leg
Hx - Low Back Pain
? Lumbar Spine

Weakness and Numbness of Legs

Face
Arm
Leg
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Exam

- Significant weakness of proximal and distal leg muscles
- Mild weakness of distal arm muscles.
- There appears to be absent reflexes.
Bilateral Arms and Legs

Cortex:

1. Peripheral: Nerve / Nerve Root
   Muscle

Cervical Cord:

2

Face

Arm

Leg
Bilateral Arms and Legs

Bilateral = Unable to be “Cortical”

Cervical Cord:
1. Peripheral: Nerve / Nerve Root Muscle
2. Cerebral Cord:
3. Cortex:

Face
Arm
Leg
Cervical Cord:

- UMN

2

Peripheral:
Nerve / Nerve Root
Muscle
Cervical Cord:

- **UMN**

Exam
- Distal UE weak
- LE weak
- Absent reflexes

Peripheral:
- Nerve / Nerve Root
- Muscle
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<td>Hyper</td>
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## Major Lesion Categories

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Peripheral: Nerve / Nerve Root
Muscle

UMN

LMN

NMJ

Nerve

Muscle
Diffuse Weakness:
- Muscle
- Neuro-muscular Junction
- Diffuse neuropathy
- Lower motor neuronopathy
- Upper motor neuronopathy

UMN
LMN
NMJ
Muscle
Nerve
Motor Unit
Localize the Lesion

- Determine the subsystem involved

- Determine likely localization based on the pattern and nature of deficits

- Confirm and refine localization with other subsystems
Recap

- A 42 year-old teacher with a long history of mild recurrent low back pain complains of 8 days of progressive weakness and numbness of both legs.
Diffuse Weakness:
Polyradiculopathy
Nerve
Neuro-muscular Junction
Muscle
Diffuse Weakness:

Nerve
Neuro-muscular Junction
Muscle

Weakness and Numbness…

Motor Unit

UMN

LMN

Nerve

NMJ

Muscle
Diffuse Weakness:
Nerve

Weakness and Numbness…

UMN
LMN
Nerve

NMJ

Motor Unit

Muscle
Weakness & Numbness

UMN
LMN
Muscle
Sensory Neuron
Motor Unit
Nerve
NMJ
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology
  Diffuse Weakness & Numbness

- Lesion
  Diffuse neuropathy

- Etiology
  ????
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology: Diffuse Weakness
- Lesion: Diffuse neuropathy
- Etiology: AIDP (Guillain-Barre)
# Major Lesion Categories

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Cervical Cord:

**Face**

**Arm**

**Leg**

Peripheral: Nerve / Nerve Root

Muscle

Why not Cervical???
Why not Cervical???
Face
Arm
Leg

UMN Lesions – Reflexes??
UMN Lesions –
Reflexes = Increased
Case 3

- A 26 year-old graduate student awoke yesterday with left arm weakness.
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Left arm weakness.
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Exam

- Strength = 4/5 in the Left Tricep, Wrist Extensors, remainder = normal.
- Reflexes = 2 in the upper extremities and 2+ in the lower extremities.
- Sensory = decreased pin prick in the lower extremities and truncal region.
Exam

■ Strength = 4/5 in the Left Tricep, Wrist Extensors, remainder = normal.

■ Reflexes = 2 in the upper extremities and 2+ in the lower extremities.

■ Sensory = decreased pin prick in the lower extremities.
Exam

- Further Sensory Exam
  - Testing of Trunk sensory revealed a sensory level in mid abdomen
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Sensory Exam – Decreased LE and truncal region
Sensory Exam – Decreased LE and truncal region
Sensory Exam – Decreased LE and truncal region
Exam:
Left UE weak
Bilateral LE and Trunk Sensory
Localization: Where to Image?

1. Peripheral (LMN)

2. Spinal Cord

3. Cortex

Face

Arm

Leg

+++ + ++ +
1. Peripheral (LMN)

2. Spinal Cord

Localization: Where to Image?
Localization: Where to Image?
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology
- Lesion
- Etiology

Left Arm Weakness
Cervical Cord

???????
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology: Left Arm Weakness
- Lesion: Cervical Cord
- Etiology: Transverse Myelitis
Case 4

- 65yo RH male started on Antibiotics for cough. Next morning awakens with dysarthria.

- He has a history of HTN, diet controlled Diabetes, no prior strokes.
Etiology??

- Any Historical Clues??
  
  Age

  65yo male

  Tempo of Onset

  Acute ("awoke with symptoms")
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology
  - Dysarthria

- Lesion
  - ????

- Etiology
  - ????
Next Step???

1) MRI Brain
2) MRI Cervical Spine
3) Swallow Study
4) ?????
5) Call Neurology
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Localize the Lesion

- Determine the subsystem involved
- Determine likely localization based on the pattern and nature of deficits
- Confirm and refine localization with other subsystems
Complaint = Dysarthria

Face

Arm

Leg
Localize the Lesion

■ Determine the subsystem involved

■ Determine likely localization based on the pattern and nature of deficits

■ Confirm and refine localization with other subsystems
Exam

- CN – II-XII
- Strength = 5/5 in the Left Tricep, 4/5 Right wrist Extensors, 4/5 Hip flexors. Remainder = normal.
- Reflexes = 2 throughout.
- Sensory = normal.
Exam

- CN – II-XII
- Strength = 4/5 in the Left Tricep, 4/5 Right wrist Extensors, 4/5 Hip flexors. Remainder = normal.
- Reflexes = 2 throughout.
- Sensory = normal.
3. Cortex

Bilateral UE & LE Weakness
- Normal Sensory

2. Cervical

Face

1. Peripheral

Arm

Leg
1. Peripheral

- Bilateral UE & LE Weakness
- Normal Sensory

2. Cervical

Face = Unlikely Cervical

3. Cortex

Face

Arm

Leg
- Bilateral UE & LE Weakness
- Normal Sensory
- Bilateral UE & LE Weakness
- Normal Sensory

3. Cortex

1. Peripheral

Face

Arm

Leg
- Bilateral UE & LE Weakness
- Normal Sensory

1. Peripheral

Face

Arm

Leg
- Bilateral UE & LE Weakness
- Normal Sensory
Next Step???

- MRI Brain
- MRI Cervical Spine
- Peripheral Process, No imaging call
- Neurology
“Junior Neurologist”

Thinking it through…
Peripheral:
Nerve / Nerve Root
Muscle

Motor Unit

UMN
LMN
Nerve

NMJ
Muscle
Peripheral - Weakness
Intact reflexes
NL sensory

Sensory Neuron

UMN

LMN

Motor Unit

2. NMJ

Nerve

1. Muscle
Peripheral - Weakness
Intact reflexes
NL sensory

Motor Unit

2. NMJ

1. Muscle

3. Nerve
Myasthenia Gravis

1. Muscle
2. NMJ
3. Nerve

Peripheral - Weakness
Intact reflexes
N1 sensory

Sensory Neuron

LMN

Motor Unit

UMN

Muscle

Nerve

Sensory Neuron
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology
- Lesion
- Etiology

Bilateral Arm Weakness
Peripheral Muscle / NMJ

????
- Left with Muscle or Neuromuscular Junction

- Work up =
  - CK – Muscle
  - NMJ = AcetylCholine Rec Antibodies
Neurologic Diagnostic Process
Where is the Lesion?

- Phenomenology: Bilateral Arm Weakness
- Lesion: Peripheral / NMJ
- Etiology: Myasthenia Gravis
Summary

- Think Simple
  - *Peripheral or Central – will guide FIRST step of evaluation*

- Use Lesion Categories
  - Symmetric, Diffuse or Focal

- If Peripheral –
  - ? Both Sensory and Motor

- Reflexes are VERY HELPFUL
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