

Functional Anatomy: The 60 Second Clinical Exam

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Session Objectives

- Understand how to integrate your anatomy knowledge with the history and/or physical exam to make a diagnosis.
- Recognize what physical exam findings would be associated with specific diagnosis.
- We will review upper and lower extremity nerve and muscle anatomy.
- We will review several “cases” to illustrate how to apply anatomy to a clinical situation:
- I will try to have you do exams virtually today!

“Doc, I’m having increasing back pain with leg pain and difficulty walking.”

- 81 yo male, 3 mo LBP
 - Onset gradual, no trauma
 - Radiating leg pain, with numbness and weakness
 - Remote history of prior L5S1 decompression for “sciatica”
 - No h/o bowel or bladder dysfunction
 - Impaired mobility

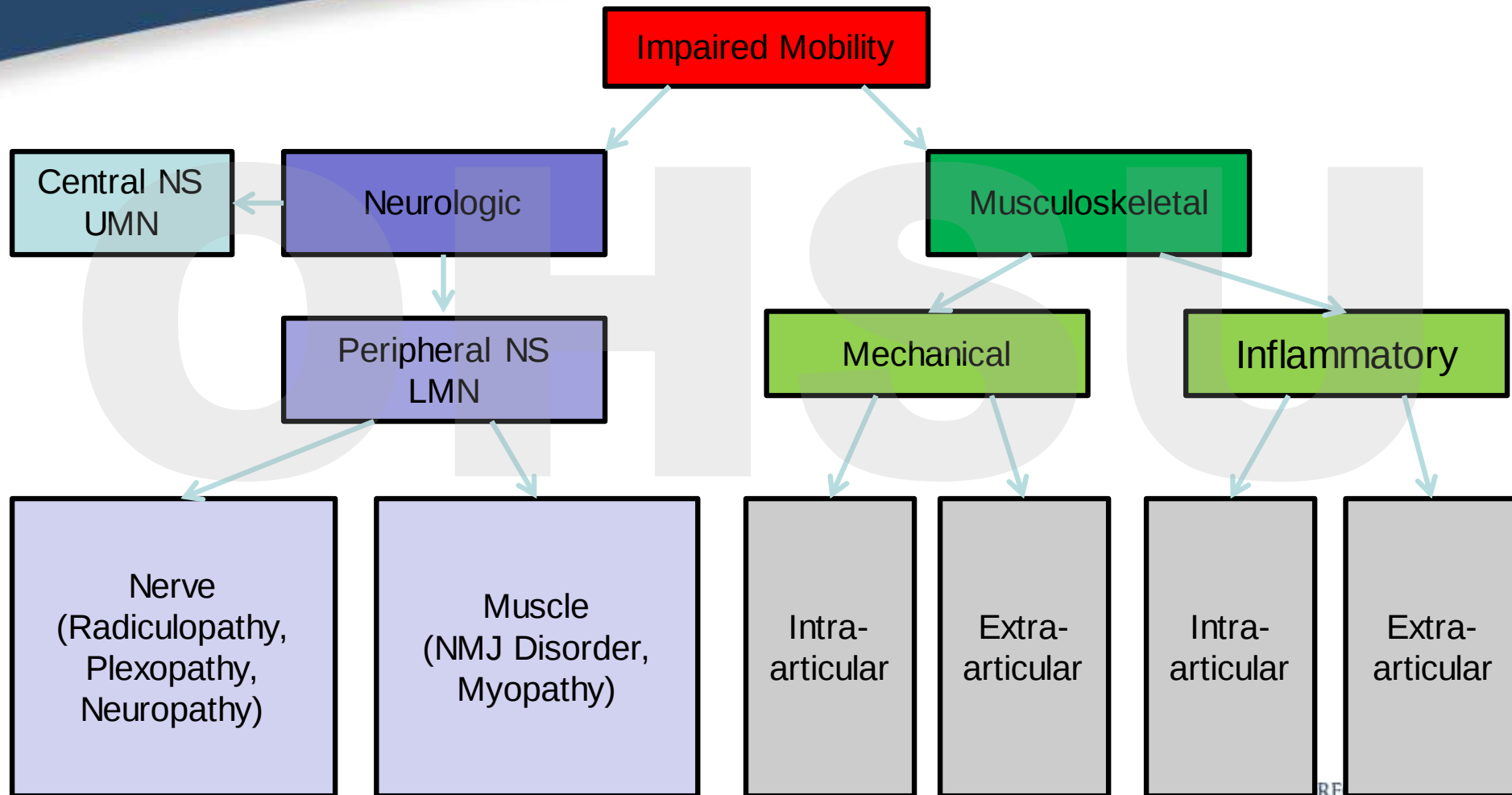


Our goals:

- Evaluate this concern, determine a likely etiology, and develop a diagnostic and/or management plan.
- Our clinical tools are the history and physical exam.
- Navigate the symptoms and signs to develop a likely etiology.

Evaluation Roadmap

Use Your Anatomy Knowledge to Make a Diagnosis



Neuromuscular Diagnosis

Pattern Recognition

	Symmetry	Proximal or Distal	Motor Weakness	Sensory Loss	Nerve or Root	Other
Motor Neuron Dz	Symmetric	Proximal and distal	Yes	No	Segmental, cranial	UMN/LMN
Radiculopathy	Asymmetric	Proximal and distal	Yes	Yes	Single root, mult. nerves	LMN Radicular sx
Plexopathy	Asymmetric	Proximal, distal, both	Yes	Yes	Multiple roots, nerves	LMN ST/IT/Pan
Mono-Neuropathy	Asymmetric	Distal (usually)	Yes	Yes	Single nerve, mult. roots	LMN Entrapment
Poly-Neuropathy	Symmetric	Distal	Yes	Yes	Multiple roots, nerves	LMN Stock./glove
Neuromusc. Junction D/O	Symmetric	Proximal	Yes	No	Multiple roots, nerves	LMN Flex. weak
Myopathy	Symmetric	Proximal	Yes	No	Multiple roots, nerves	LMN Ext. weak

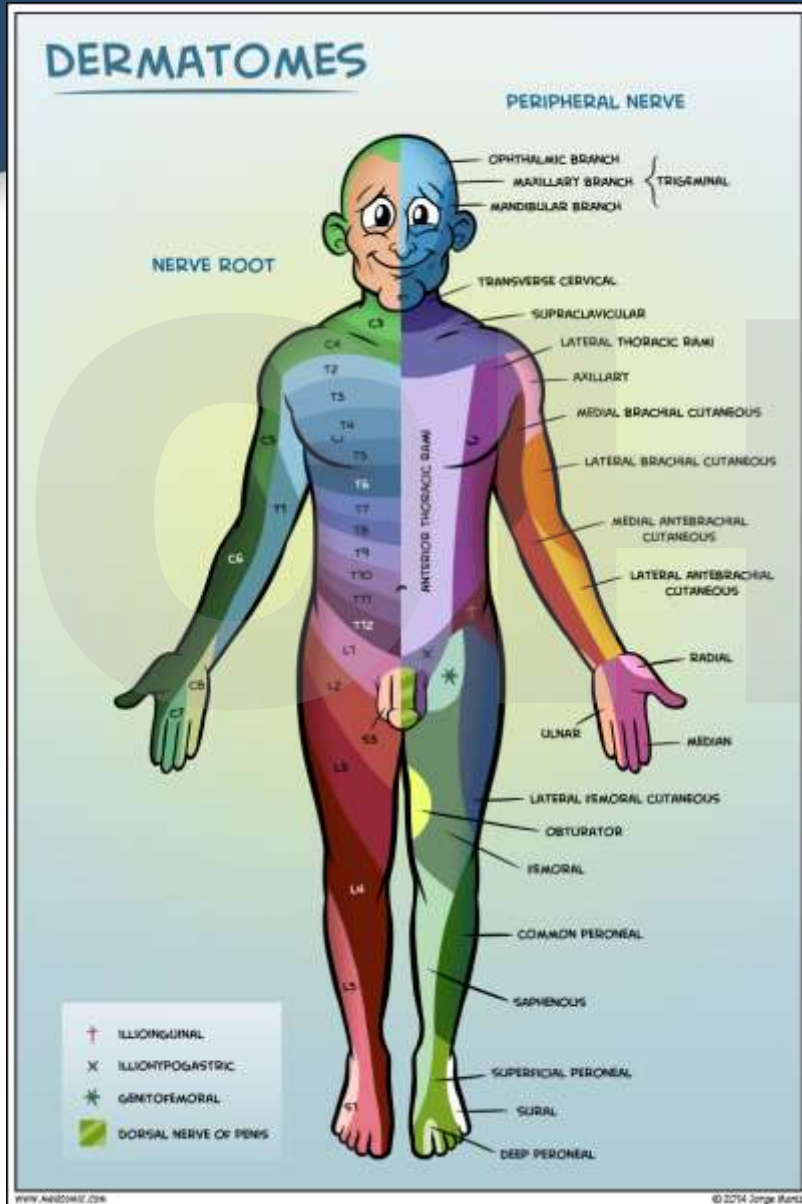
Anatomy Patterns

- There are some patterns to the organization of dermatomes and myotomes that can help us to remember the anatomy
- The dermatomes tend to form “loops” around the upper and lower extremity
 - C5-T1, L4-S1
- The myotomes have a proximal to distal pattern in the upper extremity
- The lower extremity is not as straight forward

Clinical Correlations

- Trying to sort out the wide variety of causes of numbness and weakness without knowing anatomy is like trying to do a jigsaw puzzle without having the picture on the cover of the box – your anatomy knowledge is this picture
- Step 1 – we are going to diagram the cover picture of the box
- Step 2 – we will practice physical exams
- Step 3 - we will review cases

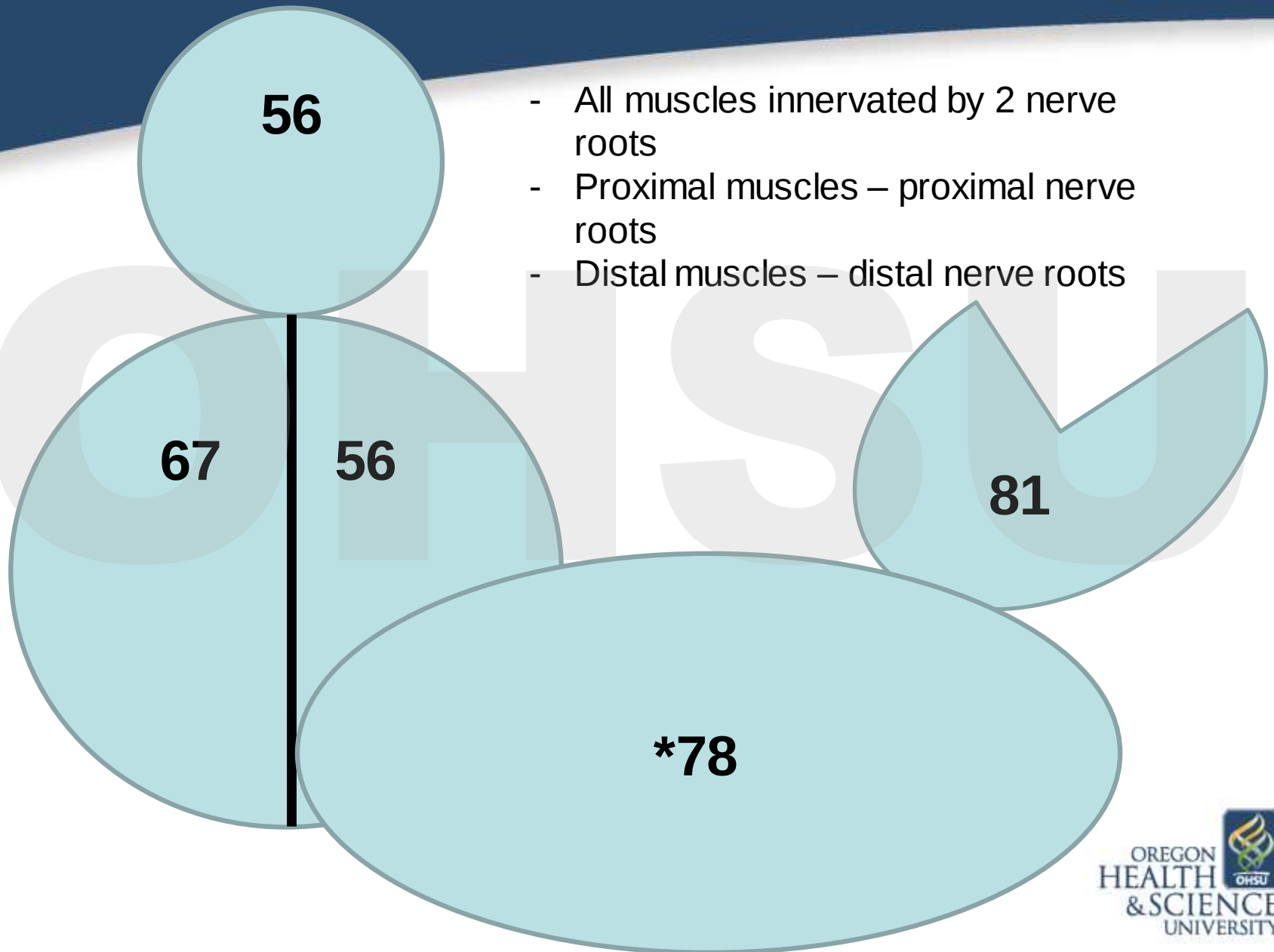
Sensation – Dermatomes/Cutaneous Nerves



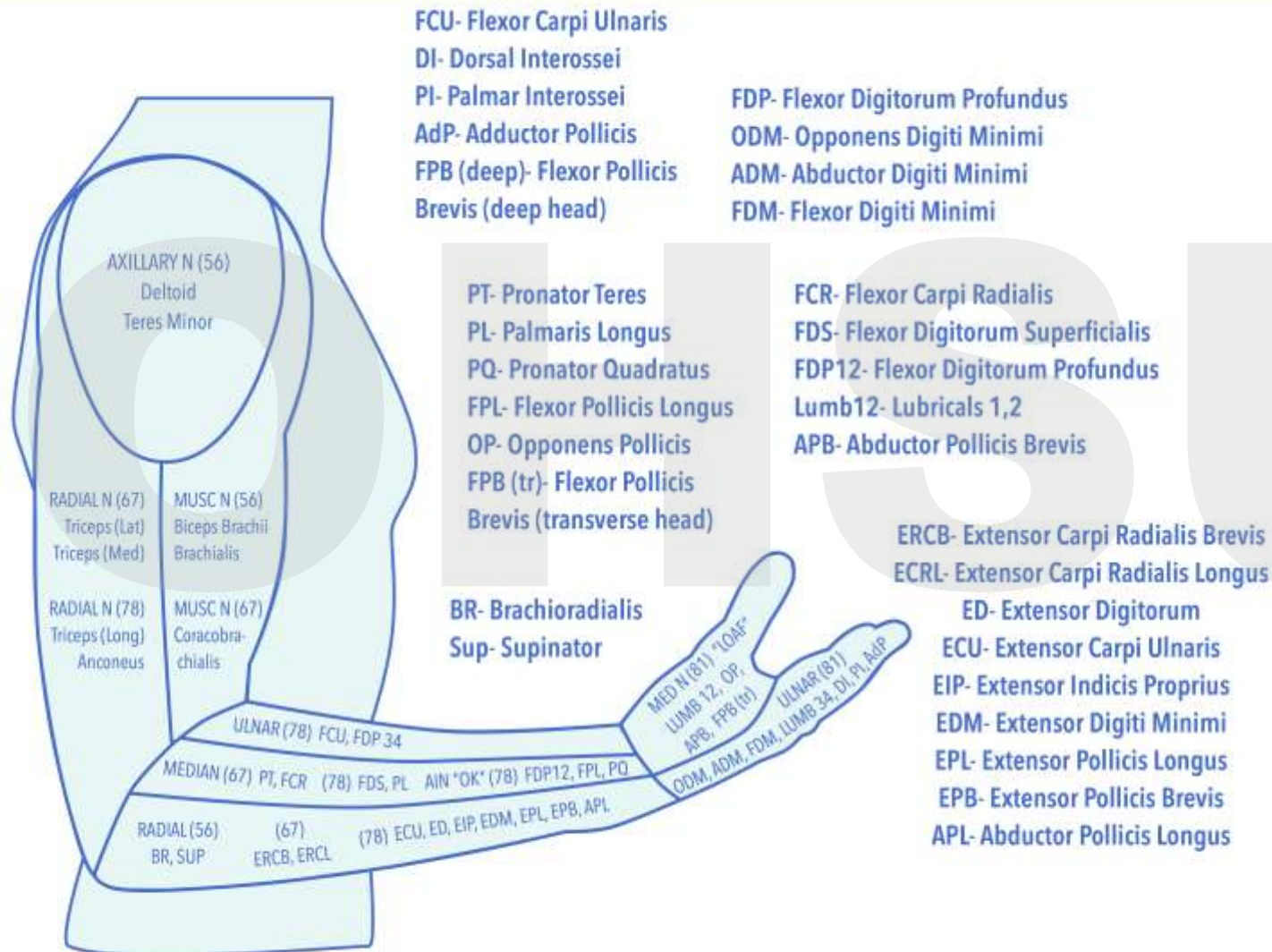
- Upper Extremity
 - C5-T1
 - Lateral to Medial “Loop”
- Lower Extremity
 - L4-S1
 - Medial to Lateral “Loop”

Strength – Upper Extremity Myotomes

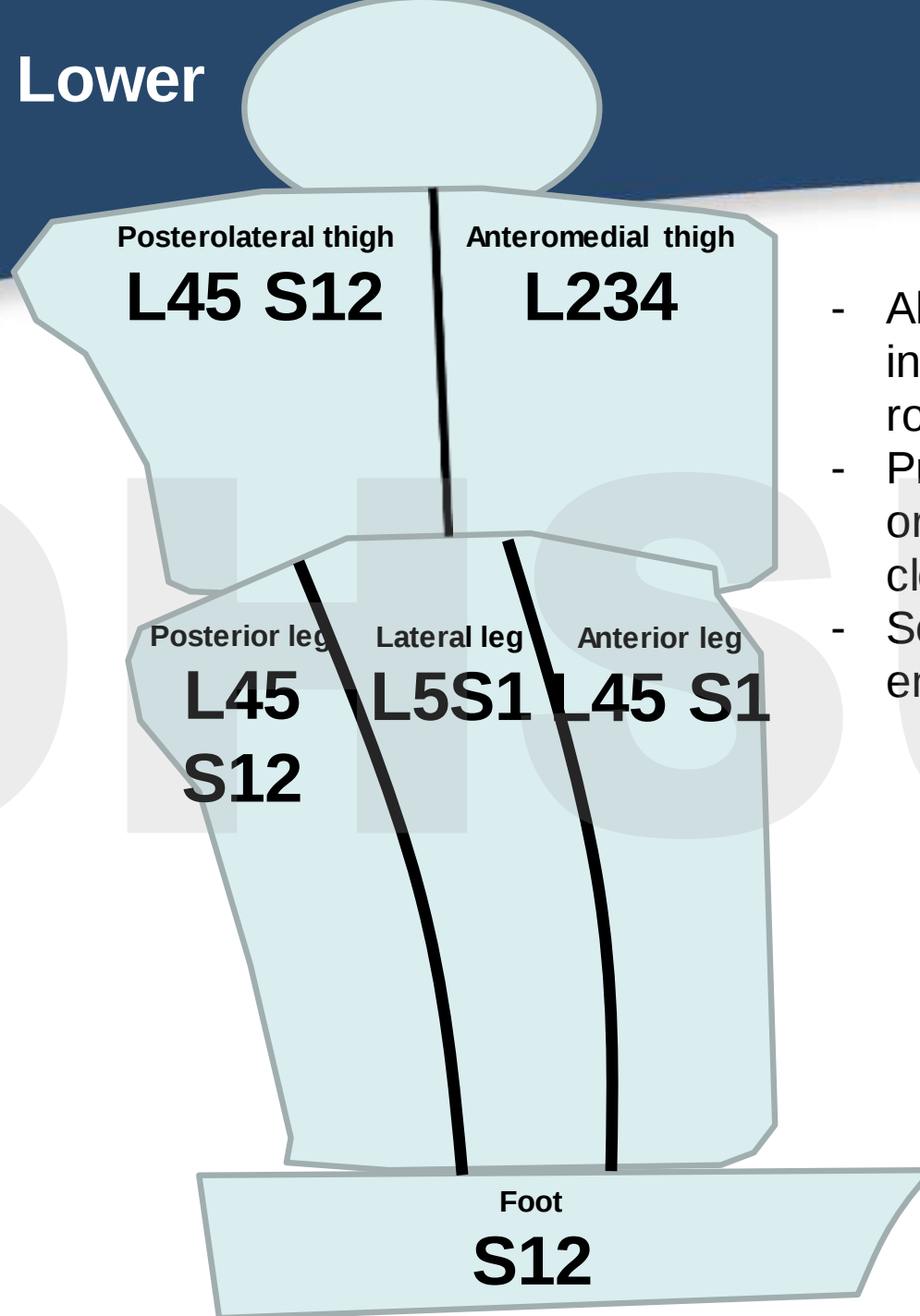
- All muscles innervated by 2 nerve roots
- Proximal muscles – proximal nerve roots
- Distal muscles – distal nerve roots



Strength – Upper Extremity Myotomes and Nerves

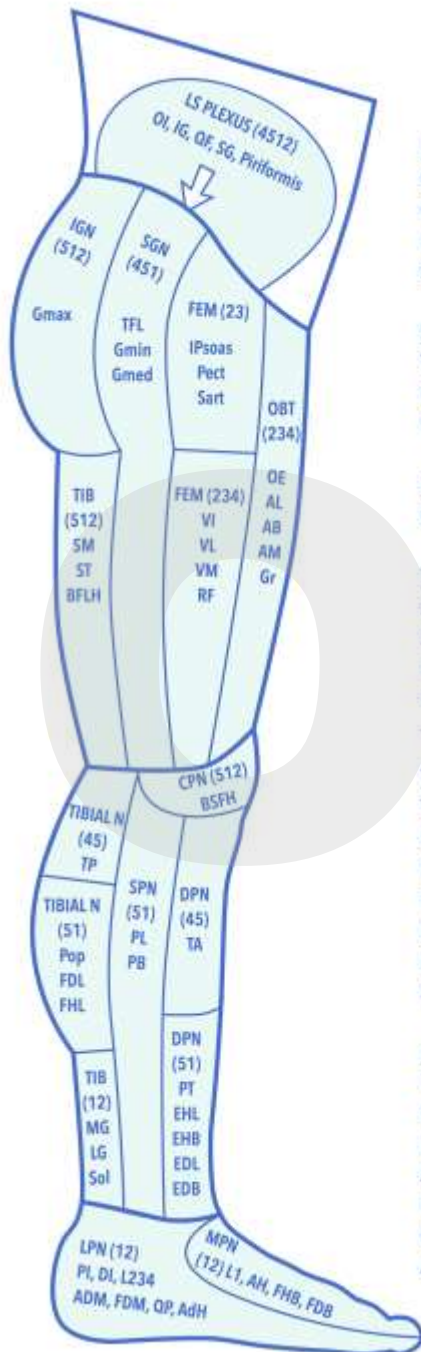


Strength – Lower Extremity Myotomes



- All muscles innervated by 2 nerve roots
- Proximal and distal organization is not so clear
- Some patterns emerge:
 - Posterior LE is L45 S12
 - Anteromedial thigh is L234
 - Foot is S12

Strength – Lower Extremity Myotomes and Nerves



Lumbosacral Plexus

OI- Obturator Internus
QF- Quadratus Femoris
IG- Inferior Gamellus
SG- Superior Gamellus

Superior Gluteal Nerve

TFL- Tensor Fascia Latae
Gmin- Gluteus Minimus
Gmed- Gluteus Medius

Inferior Gluteal Nerve

Gmax- Gluteus Maximus

Tibial Nerve

SM- Semimembranosus
ST- Semitendinosus
BFLH- Biceps Femoris Long Head

Tibial Nerve (lower)

TP- Tibialis Posterior
Pop- Popliteus
FDL- Flexor Digitorum Longus
FDH- Flexor Hallucis Longus
MG- Medial Gastrocnemius
LG- Lateral Gastrocnemius
Sol- Soleus

Lateral Plantar Nerve

PI- Palmar Interossei
DI- Dorsal Interossei
L234- Lumbricals 2,3,4
ADM- Abductor Digiti Minimi
FDM- Flexor Digiti Minimi
QP- Quadratus Plantaris
AdH- Adductor Hallicis

Obturator Nerve

OE- Obturator Externus
AL- Adductor Longus
AB- Adductor Brevis
AM- Adductor Magnus
Gr- Gracilis

Femoral Nerve

IPsoas- Iliopsoas
Pect- Pectineus
Sart- Sartorius
VI- Vastus Intermedius
VL- Vastus Lateralis
VM- Vastus Medialis
RF- Rectus Femoris

Medial Plantar Nerve

L1- Lumbrical 1
AH- Abductor Hallucis
FHB- Flexor Hallucis Brevis
FDB- Flexor Digitorum Brevis

Common Peroneal Nerve

BFSH- Biceps Femoris Short Head

Superficial Peroneal Nerve

PL- Peroneus Longus
PB- Peroneus Brevis

Deep Peroneal Nerve

PT- Peroneus Tertius
EHL- Extensor Hallucis Longus
EHB- Extensor Hallucis Brevis
EDL- Extensor Digitorum Longus
EDB- Extensor Digitorum Brevis

The 60 Second Neuro Exam

Upper Extremity	C5	C6	C7	C8	T1
DTR	Bic (Musc.)	BR (Radial)	Tri (Radial)	-	-
Strength	Sh. Abd (Axillary)	Wr. Ext. (Radial)	Wr. Flex. (Med/Uln)	Fing. Flex. (Med/Uln)	Fing. Abd. (Ulnar)
Sensation	Lat. Sh. (Axillary)	Thumb (Med/Rad)	Middle (Med/Rad)	Little (Ulnar)	Med. Arm (MBC)
Lower Extremity	L2	L3	L4	L5	S1
DTR	-	-	Patellar (Femoral)	-	Achilles (Tibial)
Strength	-	Knee Ext. (Femoral)	Ank. DF (Peroneal)	Gr. Toe Ext. (Peroneal)	Ank. PF (Tibial)
Sensation	-	-	Med. Mall. (Saphenous)	1 st DWS (Deep Per.)	Lat. Heel (Sural)

Practice Physical Exam

- Upper Extremity

- Reflexes (3)
- Sensation (5)
- Strength (5)

- Lower Extremity

- Reflexes (2)
- Sensation (3)
- Strength (4)

Let's apply our knowledge

- The numb thumb
- Differential diagnosis
 - Median neuropathy
 - Radial neuropathy
 - C6 radiculopathy
 - Upper trunk plexopathy
 - Polyneuropathy

Case 1

- Sensation

- Numb thumb
 - Palmar and Dorsal
- Normal middle, little finger

- Strength

- Weak wrist extension
- Normal sh. abd., wr. flex., finger flexion

Upper Extremity	C5	C6	C7	C8	T1
DTR	Bic (Musc.)	BR (Radial)	Tri (Radial)	-	-
Strength	Sh. Abd (Axillary)	Wr. Ext. (Radial)	Wr. Flex. (Med/Uln)	Fing. Flex. (Med/Uln)	Fing. Abd. (Ulnar)
Sensation	Lat. Sh. (Axillary)	Thumb (Med/Rad)	Middle (Med/Rad)	Little (Ulnar)	Med. Arm (MBC)

Case 1 – C6 Radiculopathy

- Sensation

- Numb thumb
 - Palmar and Dorsal
- Normal middle, little finger

- Strength

- Weak wrist extension
- Normal sh. abd., wr. flex., finger flexion

Upper Extremity	C5	C6	C7	C8	T1
DTR	Bic (Musc.)	BR (Radial)	Tri (Radial)	-	-
Strength	Sh. Abd (Axillary)	Wr. Ext. (Radial)	Wr. Flex. (Med/Uln)	Fing. Flex. (Med/Uln)	Fing. Abd. (Ulnar)
Sensation	Lat. Sh. (Axillary)	Thumb (Med/Rad)	Middle (Med/Rad)	Little (Ulnar)	Med. Arm (MBC)

Case 2

- Numb little finger
- Normal thumb, middle
- Weak finger abd., finger flexion, wrist flexion
- Normal wr.ext., sh. abd.

Upper Extremity	C5	C6	C7	C8	T1
DTR	Bic (Musc.)	BR (Radial)	Tri (Radial)	-	-
Strength	Sh. Abd (Axillary)	Wr. Ext. (Radial)	Wr. Flex. (Med/Uln)	Fing. Flex. (Med/Uln)	Fing. Abd. (Ulnar)
Sensation	Lat. Sh. (Axillary)	Thumb (Med/Rad)	Middle (Med/Rad)	Little (Ulnar)	Med. Arm (MBC)

Case 2 – Ulnar Neuropathy at the Elbow

- Numb little finger
- Normal thumb, middle
- Weak finger abd., finger flexion, wrist flexion
- Normal wr.ext., sh. abd.

Upper Extremity	C5	C6	C7	C8	T1
DTR	Bic (Musc.)	BR (Radial)	Tri (Radial)	-	-
Strength	Sh. Abd (Axillary)	Wr. Ext. (Radial)	Wr. Flex. (Med/Uln)	Fing. Flex. (Med/Uln)	Fing. Abd. (Ulnar)
Sensation	Lat. Sh. (Axillary)	Thumb (Med/Rad)	Middle (Med/Rad)	Little (Ulnar)	Med. Arm (MBC)

Case 3

- Numb medial malleolus
- Normal 1st DWS, lateral heel
- Weak knee ext., ADF
- Normal gr. toe ext., APF

Lower Extremity	L2	L3	L4	L5	S1
DTR	-	-	Patellar (Femoral)	-	Achilles (Tibial)
Strength	-	Knee Ext. (Femoral)	Ank. DF (Peroneal)	Gr. Toe Ext. (Peroneal)	Ank. PF (Tibial)
Sensation	-	-	Med. Mall. (Saphenous)	1 st DWS (Deep Per.)	Lat. Heel (Sural)

Case 3 – L4 Radiculopathy

- Numb medial malleolus
- Normal 1st DWS, lateral heel
- Weak knee ext., ADF
- Normal gr. toe ext., APF

Lower Extremity	L2	L3	L4	L5	S1
DTR	-	-	Patellar (Femoral)	-	Achilles (Tibial)
Strength	-	Knee Ext. (Femoral)	Ank. DF (Peroneal)	Gr. Toe Ext. (Peroneal)	Ank. PF (Tibial)
Sensation	-	-	Med. Mall. (Saphenous)	1 st DWS (Deep Per.)	Lat. Heel (Sural)

The main concepts from this session are:

- Know basic nerve and muscle anatomy.
- Use your knowledge of anatomy to determine history questions and physical exam findings to determine diagnoses.