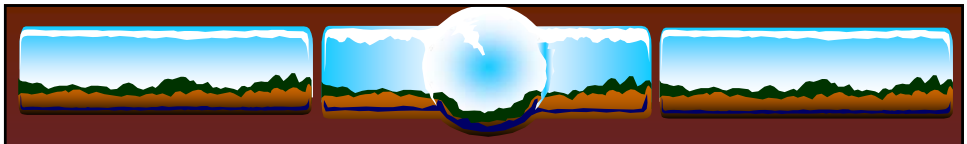
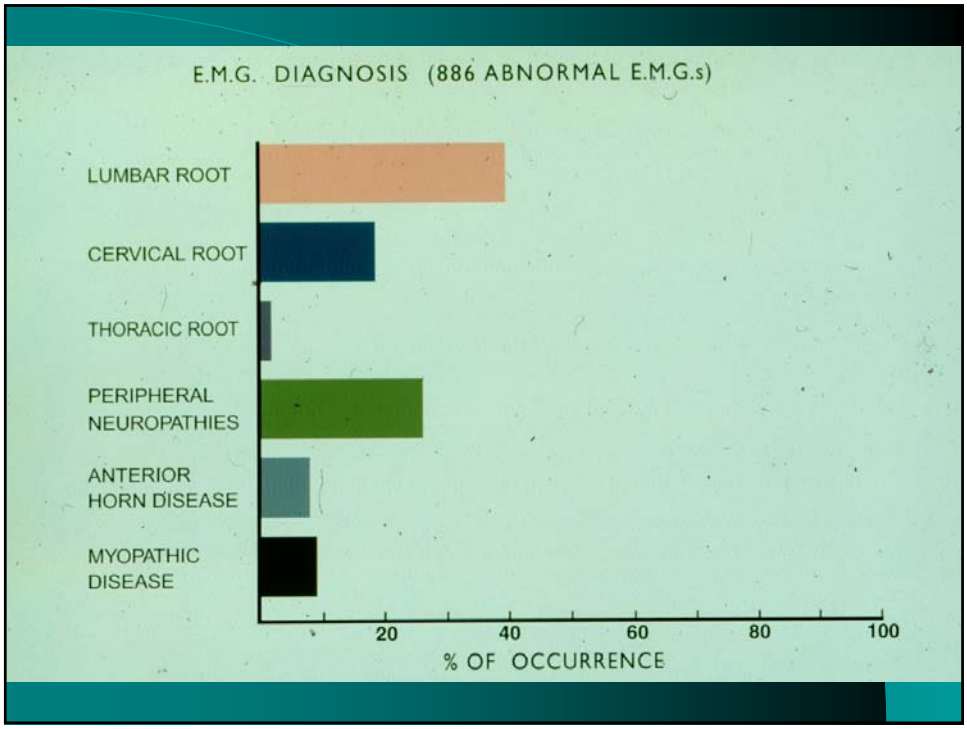


L/S Radiculopathy

Ernest W Johnson MD
Emeritus Professor PM&R
The Ohio State University

OBJECTIVES

- EDX of L/S radiculopathy
- Chronology of EDX abnormalities
- Use of H reflex in DX L/S radiculopathy
- Assessing severity



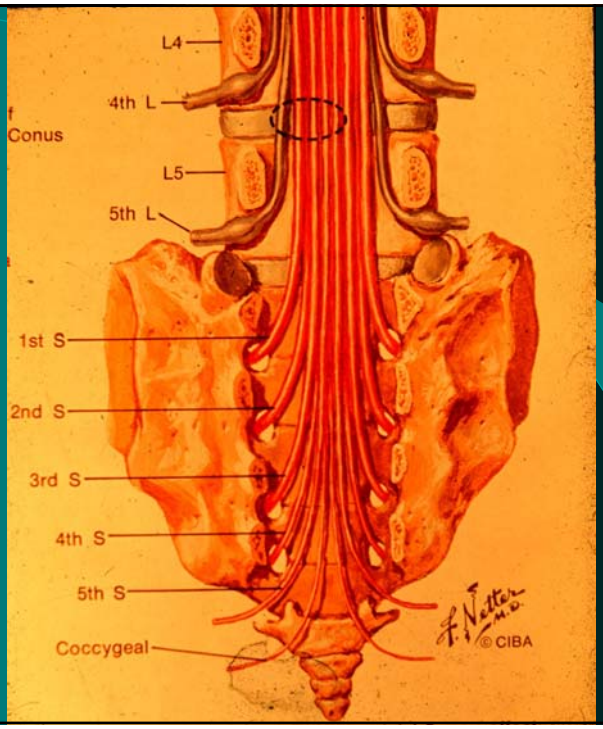
Frequency of L/S Radiculopathy

- L/5 ::S1 2::1
- L4 - 5%

Stedman – 25th Ed.

extremitas (eks-trem'I-tas)

[L. fr. *extremus*, last, outermost] [NA]. Extremity; one of the ends of an elongated or pointed structure. Incorrectly used to mean Limb. See membrum.



Check back for symmetry

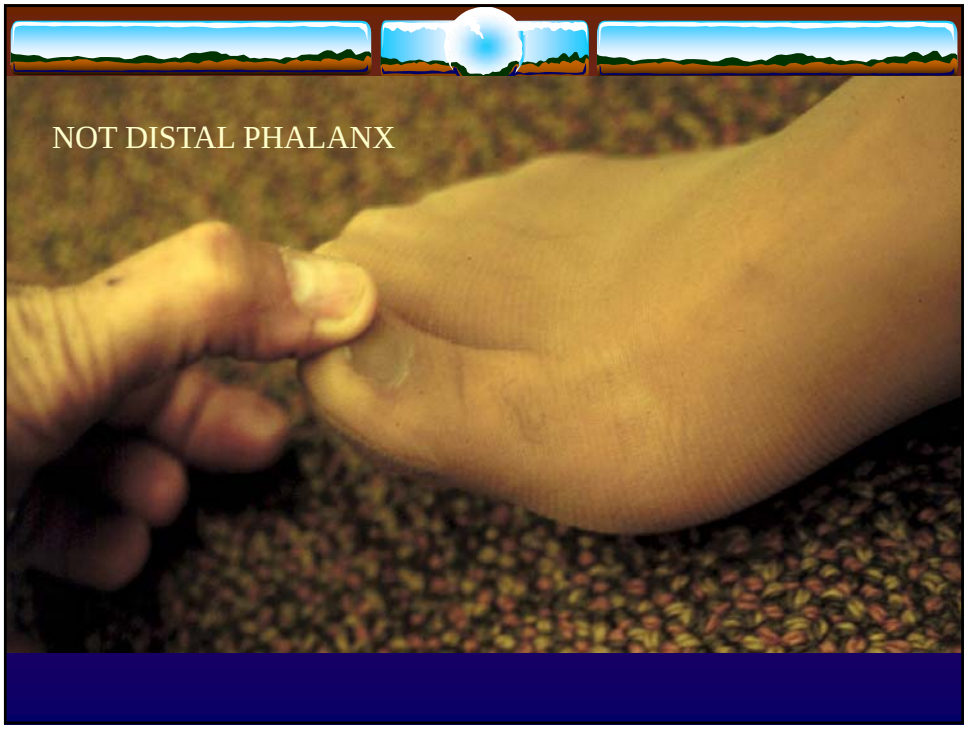
- Stand quietly
  - Both feel weight bearing
  - One foot weight bearing
  - Forward flexed

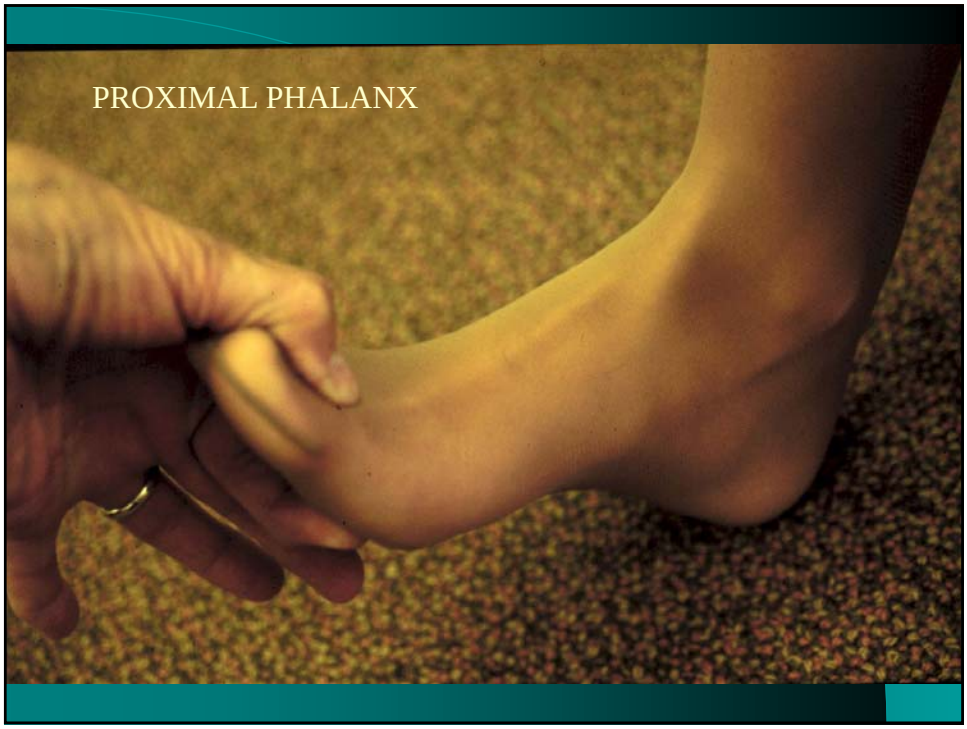
Exam prior to EDX

- Straight Limb Raising
  - Recumbent
  - Recumbent with dorsiflexion after lowering to no sx
  - Sitting
  - Sitting with neck flexion after SLR lowered

L-5 PX

- Walk on heels (only gross test)
- Check strength of Ext H L
  - NB. Must do with ankle plantar flexed and push on proximal phalanx
- Measure atrophy of leg (greatest circumference)
- MSR – lateral HS

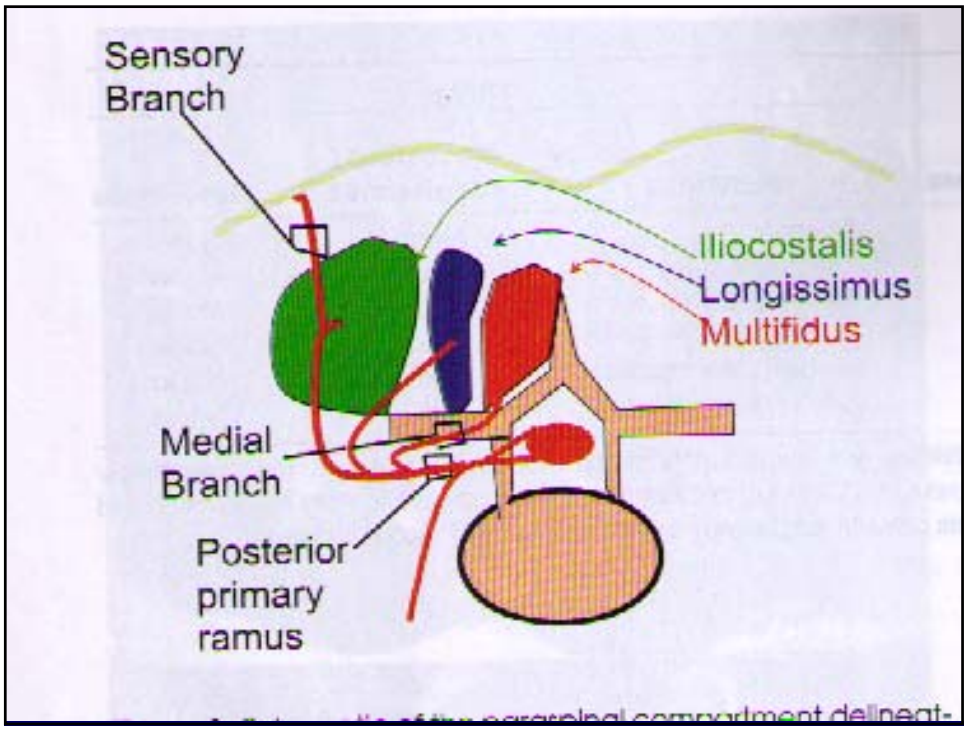


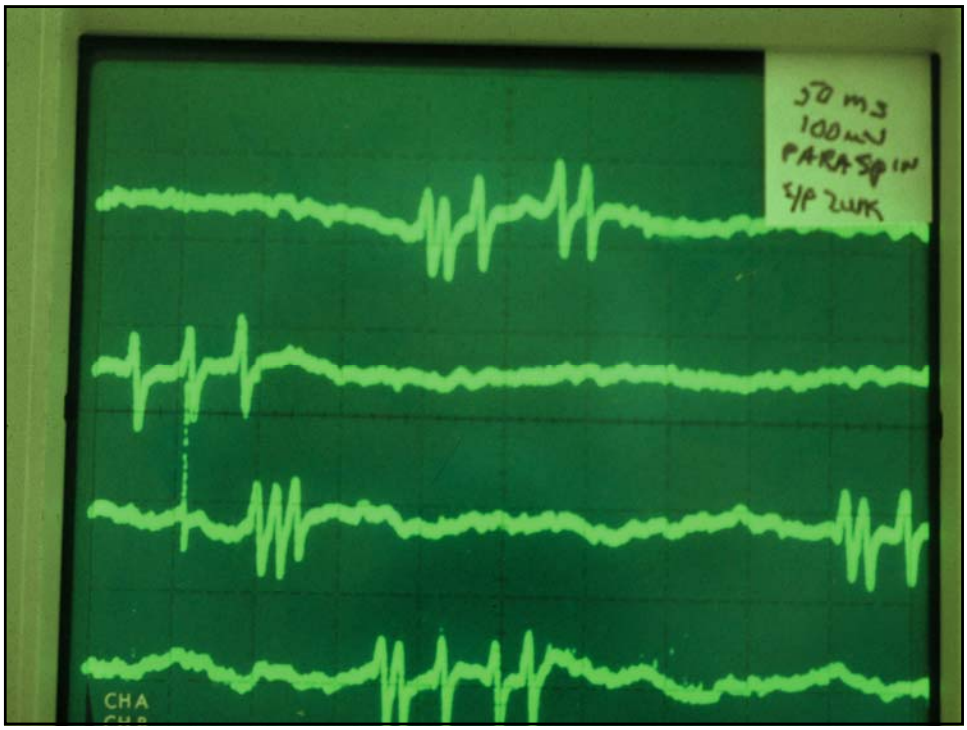

PROXIMAL PHALANX


S-1 Radiculopathy
Walking on toes is only a gross test
Must do heel raises unilaterally and compare (10)
MSR - Ankle jerk
Numbness lateral foot and sole

EDX of Lumbar radiculopathy

- Prone position is best
- Land marks
  - Mark L-4 spinous process at level of ilium crest
  - Mark L-5 – next caudal spinous process
  - Mark S-1 – next caudal spinous process
  - Draw diagonal line from post. sup. iliac spine to midline

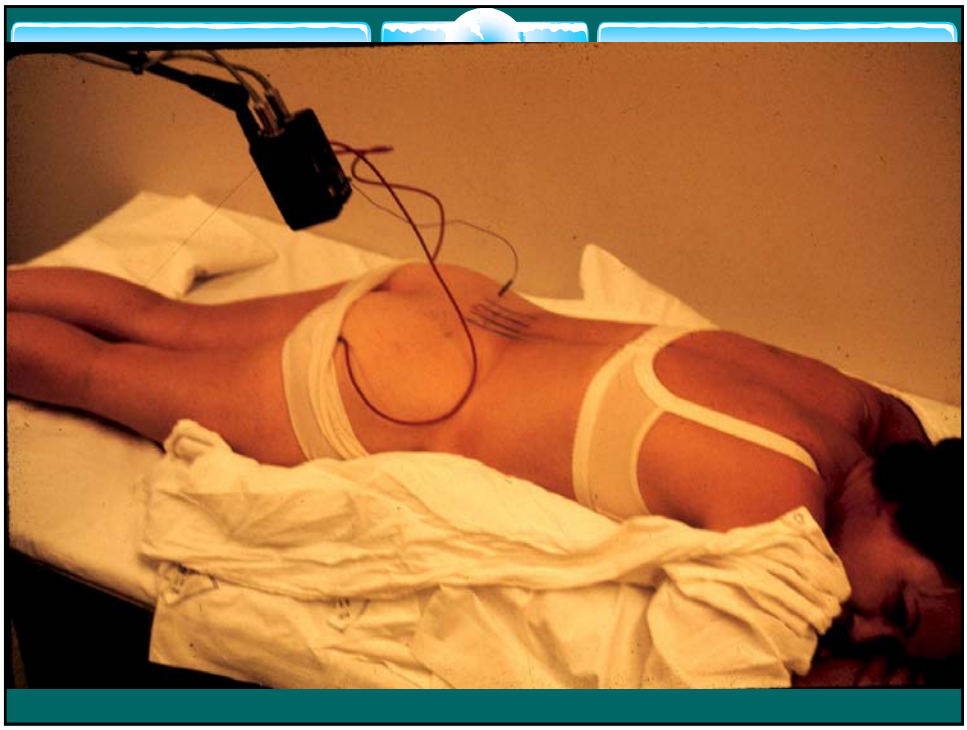



50 mg
100 mg
PARASP IN
5/P 2WK
CHA

Maximize relaxation

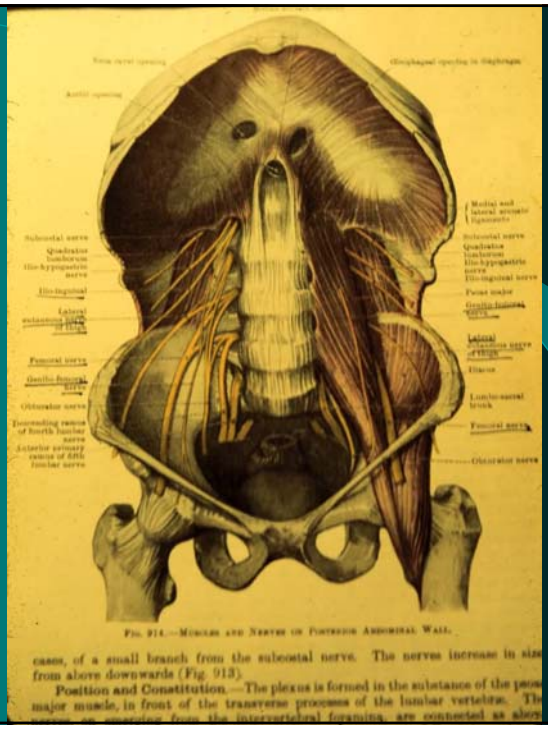
- Pillow under abdomen
- Pillow under ankles

- If still cannot get relaxation – use other hand to poke fingers in abdomen



Lower limb – motor innervation

- Quadriceps and adductors – L 2-4
- L-4 below knee – only anterior tibial
- L-5 below ankle – only ext dig br
- Toes – S1 – S2: medial to lateral ie. Digit 1 to digit 5

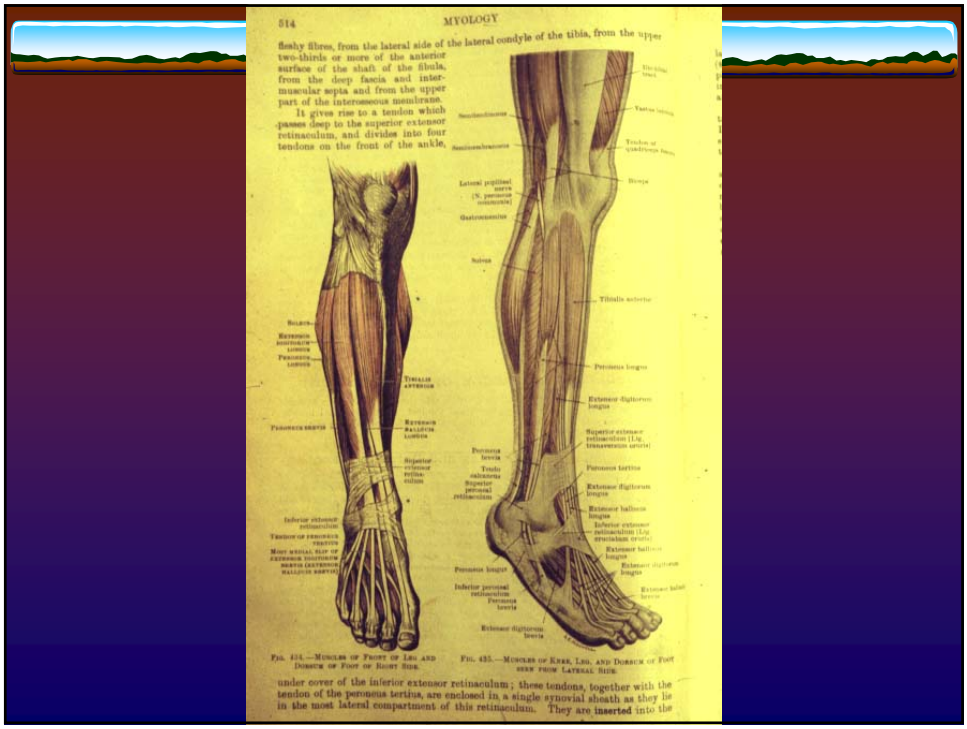


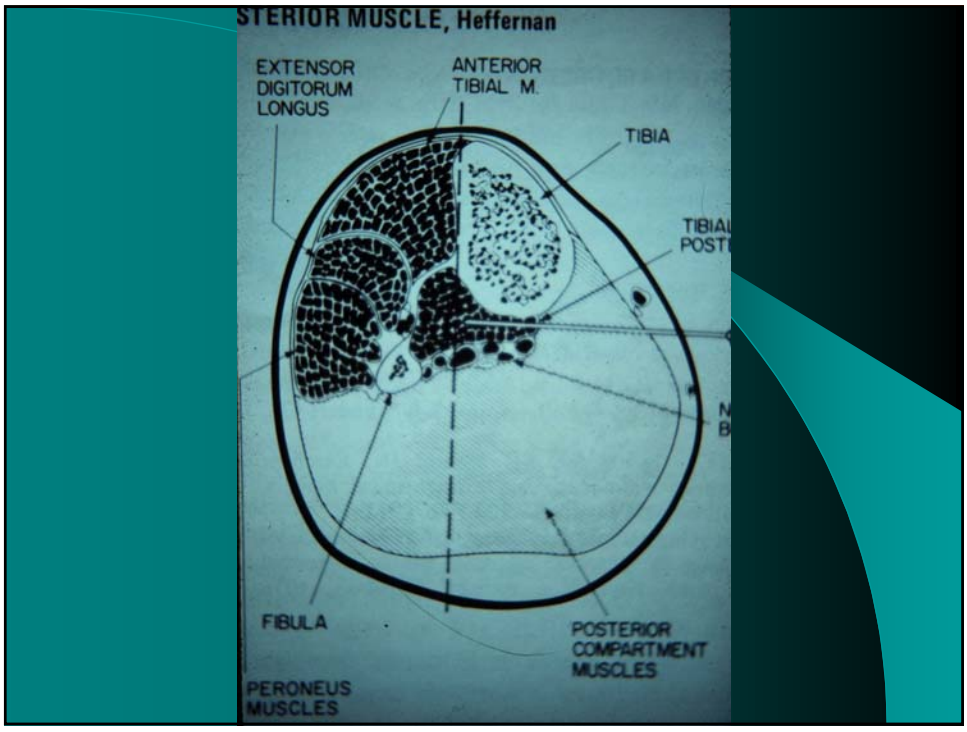
cases, of a small branch from the subcostal nerve. The nerves increase in size from above downwards (Fig. 913).

Position and Constitution.—The plexus is formed in the substance of the psoas major muscle, in front of the transverse processes of the lumbar vertebræ. The

Muscles to explore

- Paraspinals
- Same root but 2 different nerves
- One proximal muscle
- One distal muscle
- One muscle ABOVE suspected root
- One muscle below suspected root


514 MYOLOGY
fleshy fibres, from the lateral side of the lateral condyle of the tibia, from the upper two-thirds or more of the anterior surface of the shaft of the fibula, from the deep fascia and intermuscular septa and from the upper part of the interosseous membrane.
It gives rise to a tendon which passes deep to the superior extensor retinaculum, and divides into four tendons on the front of the ankle,
under cover of the inferior extensor retinaculum; these tendons, together with the tendon of the peroneus tertius, are enclosed in a single synovial sheath as they lie in the most lateral compartment of this retinaculum. They are inserted into the


STERIOR MUSCLE, Heffernan
EXTENSOR DIGITORUM LONGUS
ANTERIOR TIBIAL M.
TIBIA
FIBULA
POSTERIOR COMPARTMENT MUSCLES
PERONEUS MUSCLES


A
A

Example – L-5 Radiculopathy

- Explore
  - Ant tib
  - Flex dig long
  - Soleus (distal to suspected root)
  - Vastus medialis (proximal to suspected root}
  - Tensor fascia lata (a proximal muscle)
  - Paraspinals

Chronology of L/S radiculopathy

- When radicular pain begins:
  - Recruitment will be reduced (if significant weakness)
  - H reflex latency will be prolonged
  - Early “polyphasic MUP’s” will appear

Needle EMG Abnormalities - chronology

- 1st week – recruitment frequency will be increased
- By 7-8 days – positive waves in paraspinals (***Caution*** – a train will result if in end plate area!)
- 3rd week – abnormal irritability in paraspinals and proximal limb muscles
- 4th week all findings

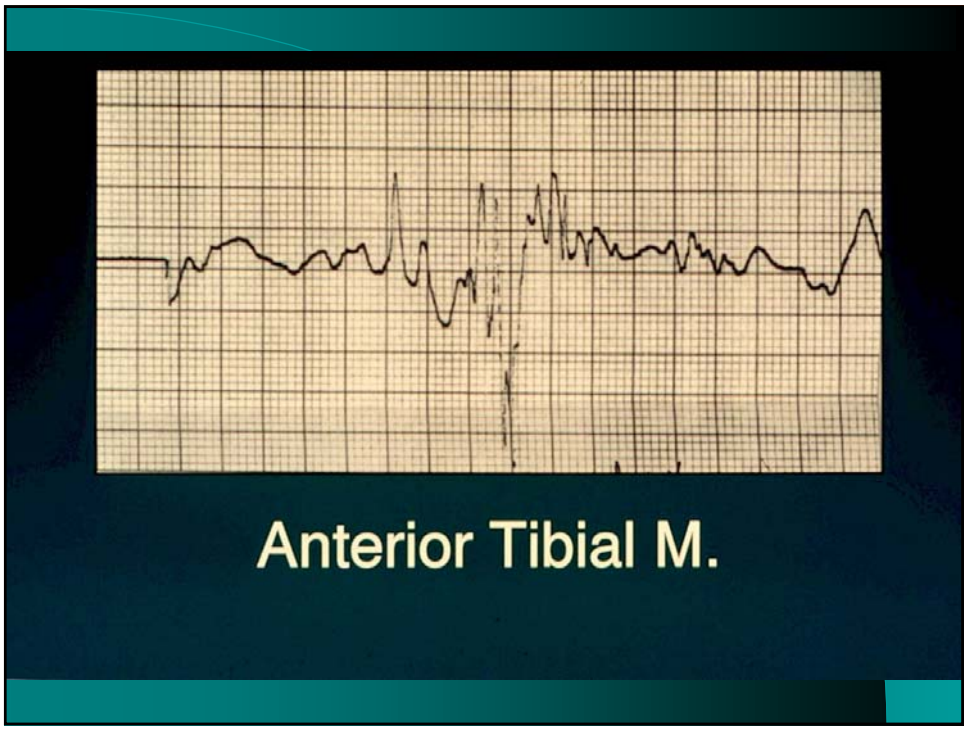
Recruitment frequency

- In normal muscles the 2d MU will appear when the 1st MU is firing 10-12 hz
- L-5 radiculopathy – ext dig long 16-18 hz
- Compare with contralateral muscle

- Easiest – a ***single*** joint muscle

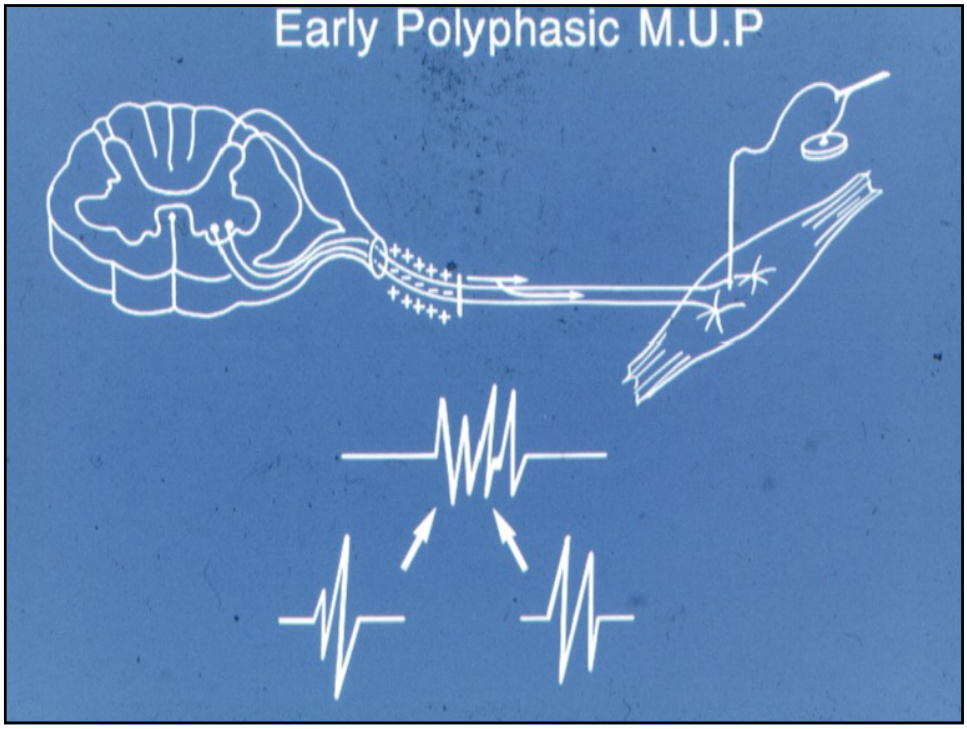
"Early polyphasic"

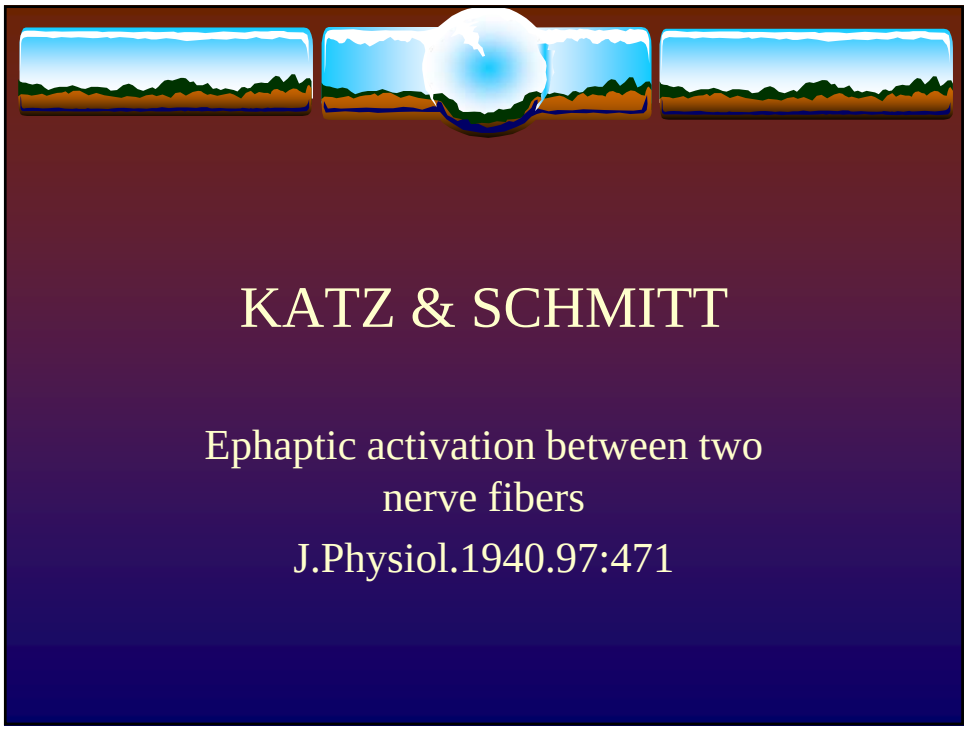
- LAMBERT IN 1968 (EEG.CL NEUROPHYSIOL 25:404):
  - A polyphasic MUP can be:
    - A SYCHRONOUS BUT NOT SIMULTANEOUS ACTIVATION OF 2 OR MORE MUP'S

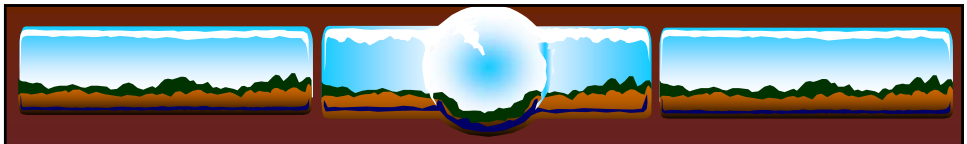


"Early polyphasic"

- 2 axons conduct at different rates thus impulses arrive slightly separated
- Looks like a polyphasic MUP
  - Normal amplitude
  - Increased duration
  - Several MUP's stucked together


Early Polyphasic M.U.P

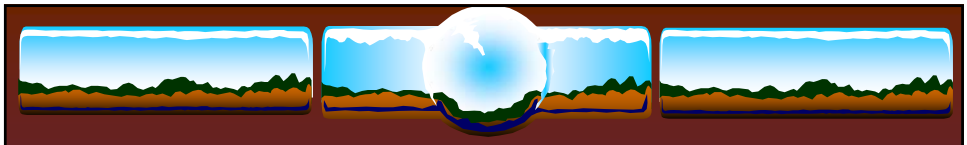

KATZ & SCHMITT
Ephaptic activation between two nerve fibers
J.Physiol.1940.97:471



ARVANITAKI, A

Effects evoked in an axon by the activity of a contiguous one.

J.Neurophysiol. 1942.5:89



Seltzer & Devor

Ephaptic transmission in chronically damaged peripheral nerves

Neurol. 1979 29:1061

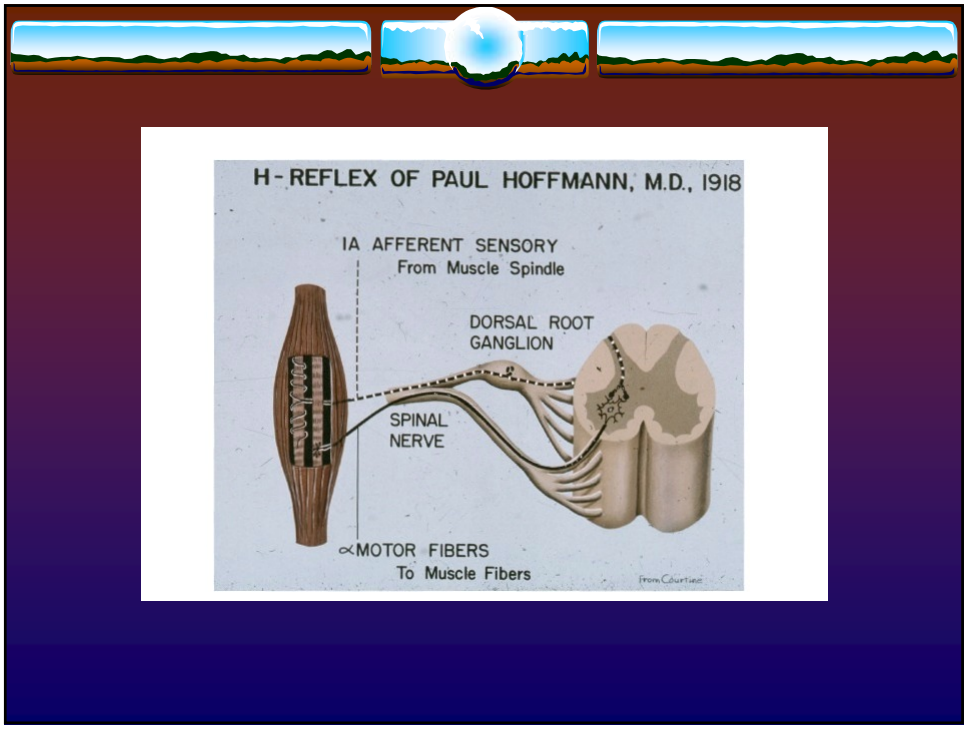
RASMINSKY, M

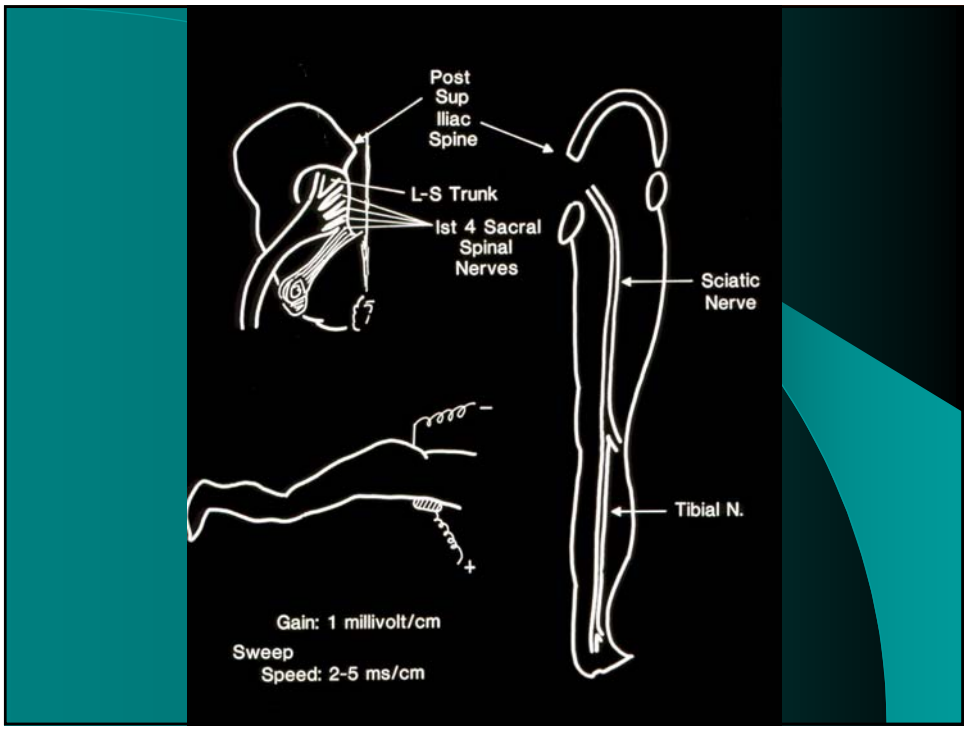
Ephaptic transmission between single nerve fibers in the spinal nerve roots of dystrophic mice.

J.Physiol. 1980. 305:151

‘H’ REFLEX LATENCY IN LUMBAR RADICULOPATHY

- Will be prolonged in S-1 radiculopathy from the onset of radiculopathic pain
- Difference in latency, side-to-side, =or< 1 millisec or even .5 millisec is a red flag.
  - Original study (1974) mean .8 8 =/- S.D. .4 ms
  - More recent series difference side-to-side .3 ms

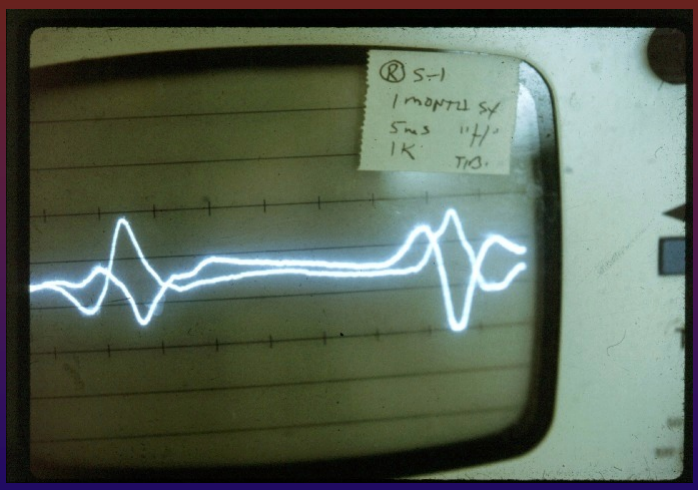

H-REFLEX OF PAUL HOFFMANN, M.D., 1918
IA AFFERENT SENSORY
From Muscle Spindle
DORSAL ROOT
GANGLION
SPINAL
NERVE
∝MOTOR FIBERS
To Muscle Fibers


Post
Sup
Iliac
Spine
L-S Trunk
Ist 4 Sacral
Spinal
Nerves
Sciatic
Nerve
Tibial N.
Gain: 1 millivolt/cm
Sweep
Speed: 2-5 ms/cm

Formula to calculate H latency

- .46 X distance from stimulation to medial malleolus
- + .1 age in years
- + constant – 9.14

- Difference side to side > 1.0 ms (conservative)
- My opinion is > .5 ms is “red flag”



Use of H reflex latency

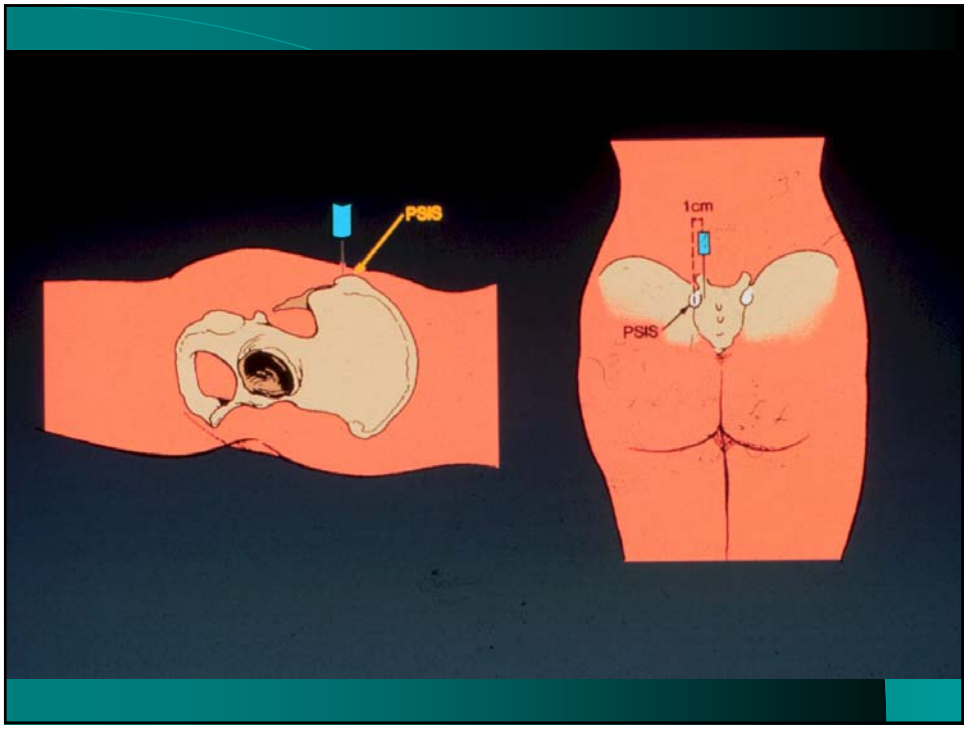
- Early in course of L/S radiculopathy
- When abnormal irritability is only in paraspinals
- Underlying peripheral neuropathy (diabetic)
- If muscle exploration is confusing
- Post laminectomy with recurrent symptoms

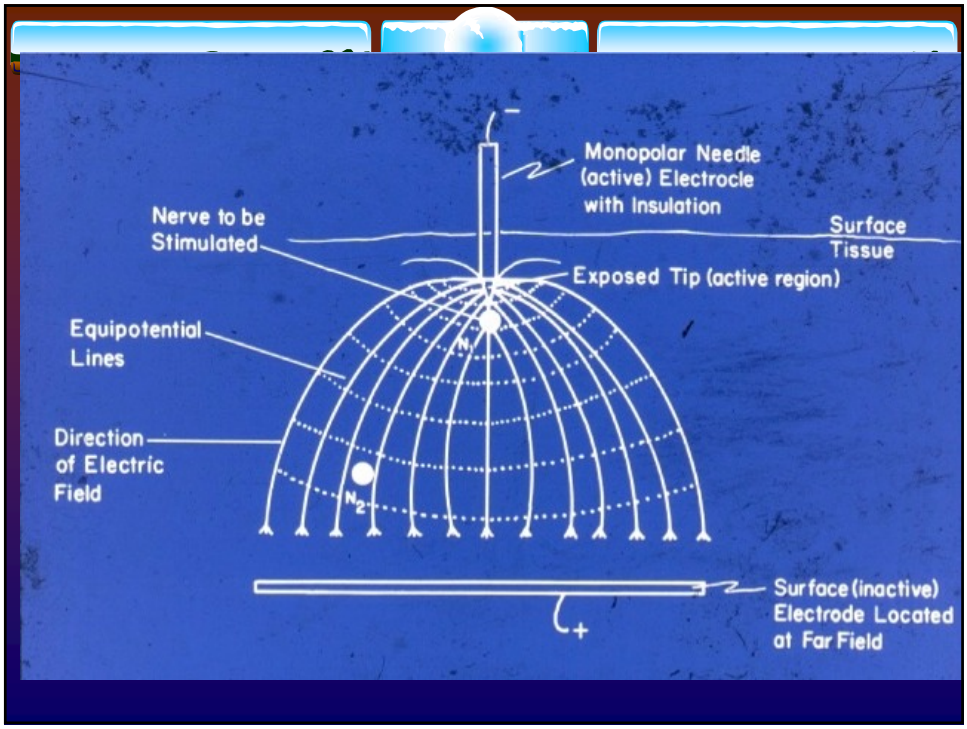
Use of H reflex latency when positive waves are only in paraspinals

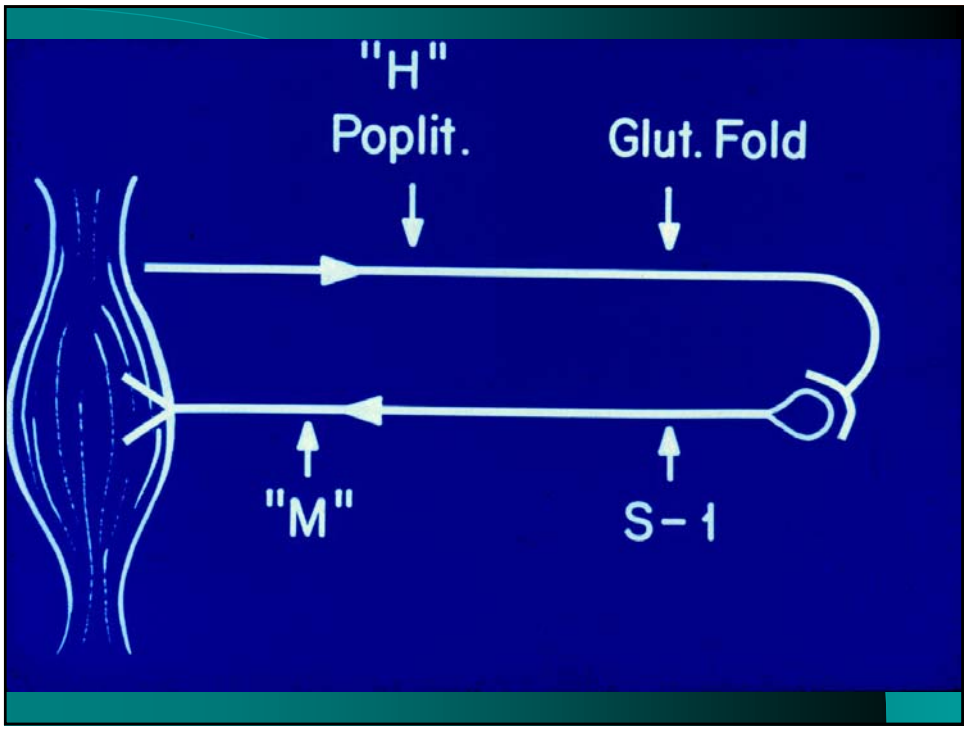
- 90 – 95% of all first appearing radiculopathies are L-5 or S-1
- Ratio of frequency – L-5:S-1 = 2:1
- H latency is prolonged – S-1; if normal – L-5

Needle stimulation of S-1 spinal nerve

- Find posterior inferior iliac spine
- Insert monopolar needle 1 cm cephalad and medial
- Apply 50 – 100 us duration stimulation for direct S-1
- Apply 500-1000 us duration stimulation for H reflex (low intensity)


PSIS
1cm
PSIS


Monopolar Needle
(active) Electrocle
with Insulation
Nerve to be
Stimulated
Surface
Tissue
Exposed Tip (active region)
Equipotential
Lines
Direction
of Electric
Field
Surface (inactive)
Electrode Located
at Far Field


"H"
Poplit.
Glut. Fold
"M"
S-1

S- 1 DIRECT LATENCY/H REFLEX LATENCY

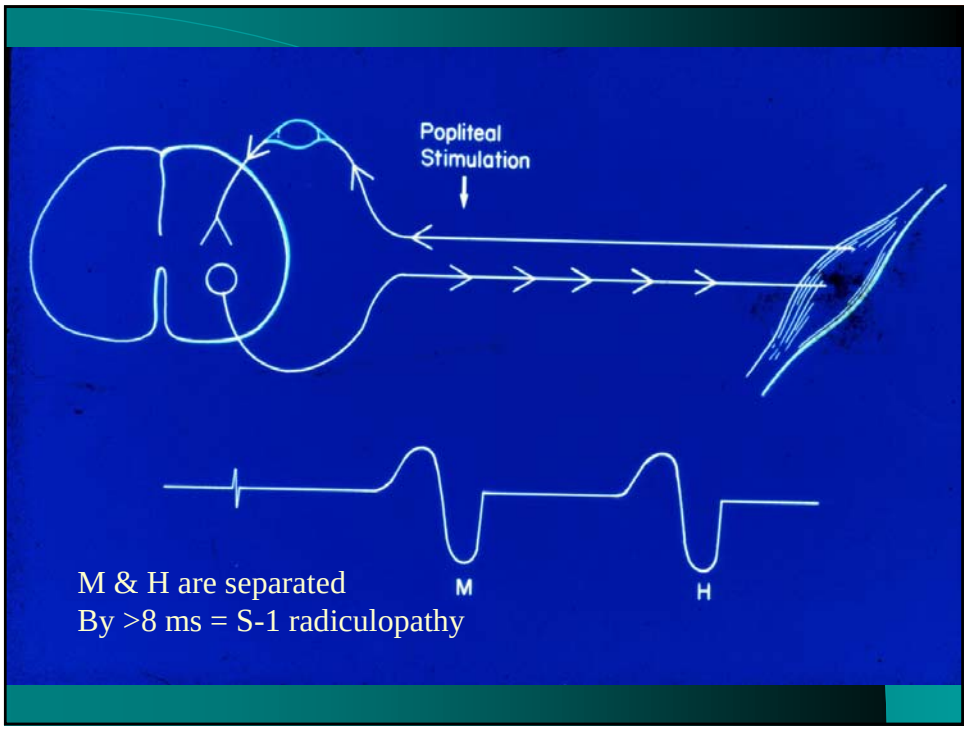
- Stimulate S-1 spinal nerve (PSIS) 50-100 uS
- Stimulate as above with 1 ms duration

- LATENCIES: S-1/H = 48% normal
- LATENCIES: S-1/H = 45% if S1 radiculopathy

S-1 spinal nerve H reflex

- Stimulate with 1 ms duration and low intensity
- H wave will appear 1st and M wave following by 6-8 ms
- If take-off appears for M wave, there is usually more than 8- 9 ms between H & M


MOTOR NERVE CONDUCTION
RECORD MODE
AVERAGE: ON
STIMULUS SITE: 4
CURRENT: 26.5 mA
SWITCH: STIM
RECURRENT
NERVE :
I:13.0mA
I:15.0mA
I:19.5mA
I:23.5mA
LAT1: 28.9 ms DUR: 8.6 ms
STIM 1-2: DIST: TEMP:
LAT1: 21.2 ms DUR: 7.3 ms
STIM 2-3: DIST: TEMP:
LAT1: 0.0 ms DUR: 23.0 ms
STIM 3-4: DIST: TEMP:
LAT1: 0.0 ms DUR: 22.6 ms


Popliteal
Stimulation
M
H
M & H are separated
By >8 ms = S-1 radiculopathy

F & H in L/S Radiculopathy

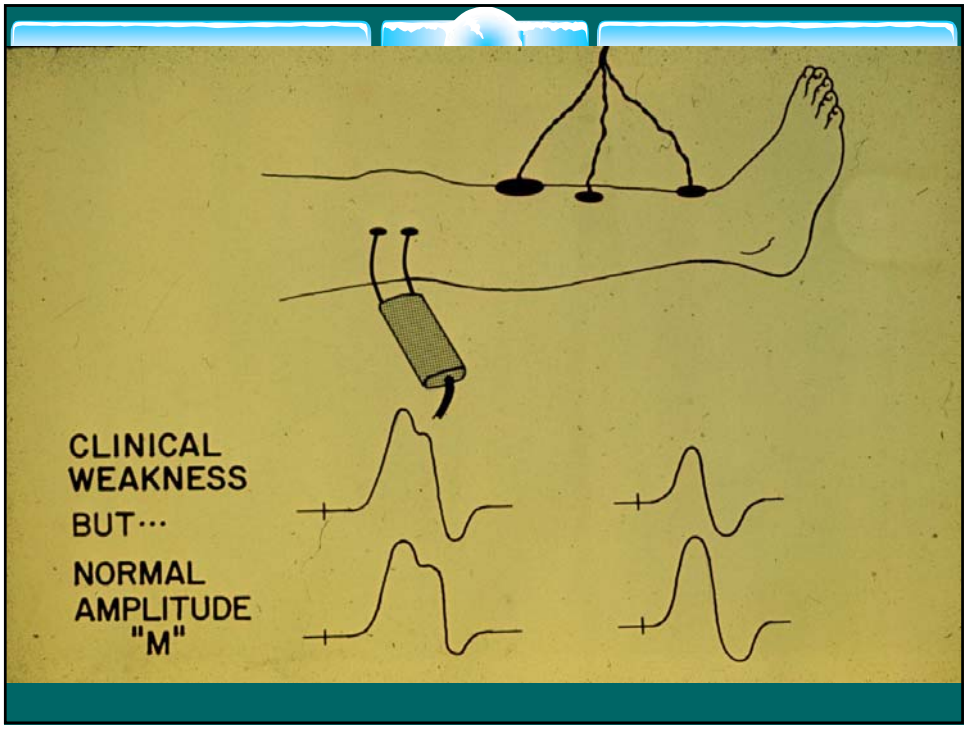
- If can't get H Reflex
  - Change gain to 200 uV and stimulus duration to .1 ms
  - Get 10 F waves
    - Mean of 10 is 1.8 ms longer than ipselateral H latency
    - Side-to-side difference of mean of 10 F waves - .6 ms

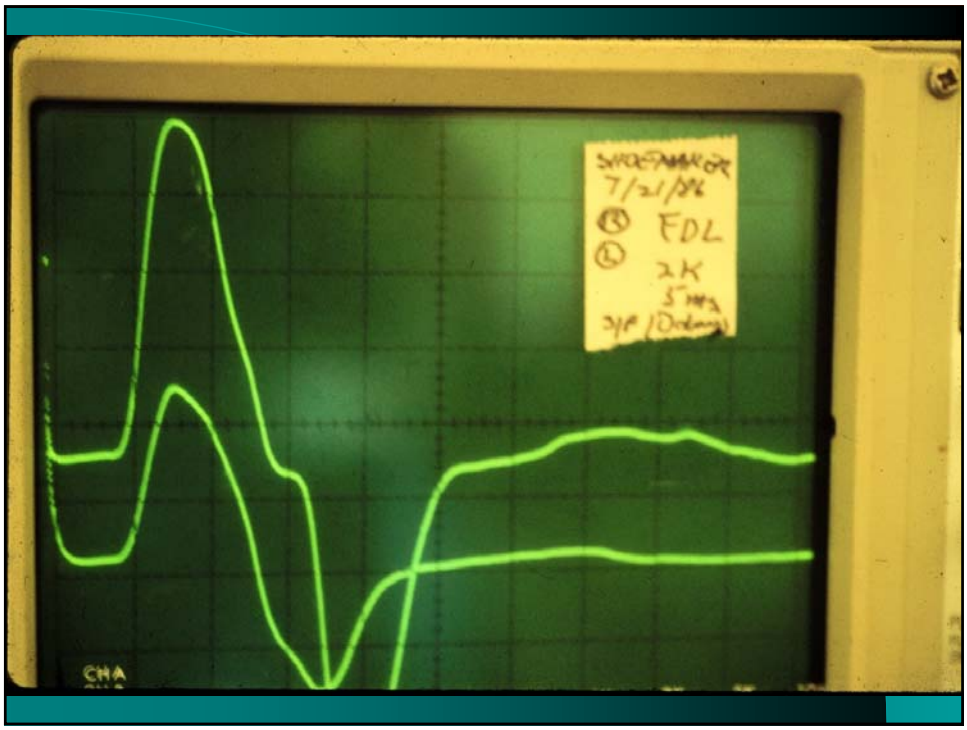
Dural sleeve as entrapment site

- Dural sleeve is inextensible
  - Ergo – a "sick" nerve can be compromised
    - Diabetic neuropathy – appears as multiple lumbar radiculopathy (formerly called "femoral neuropathy")

Prognosis

- After 7-10 days an axon undergoing wallerian degeneration will become ***inexcitable***
- ***Stimulation*** of nerve to weak muscle will identify the dead axons (NB. Amplitude, compare with contralateral)
  - L-4– ***ant*** tibial or vastus lateralis
  - L-5 – extensor dig long
  - S-1 – medial head gastroc


CLINICAL
WEAKNESS
BUT···
NORMAL
AMPLITUDE
"M"

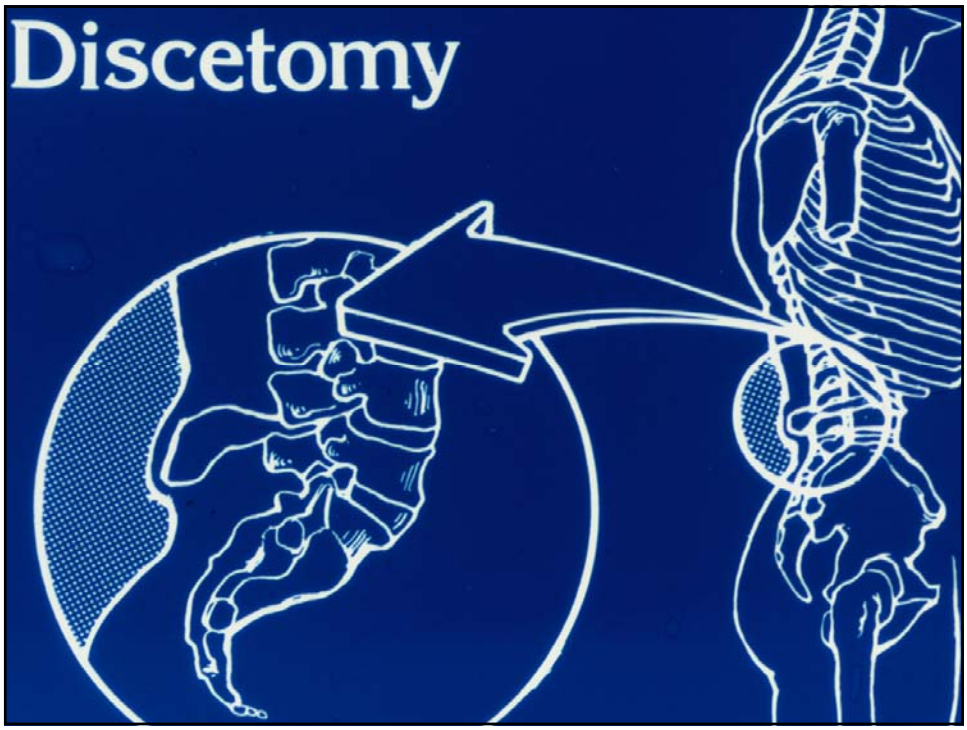

FDL
2K
CHA

Muscles to explore

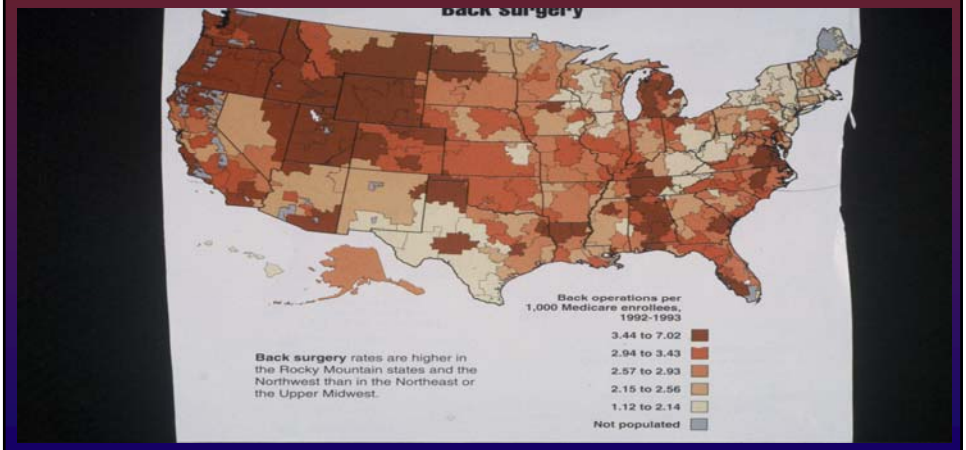
- One proximal muscle (L-5 eg. tensor fascia lata)
- One distal muscle (S-1 eg. Abd hall)
- Muscle from 2 different nerves (L-5 eg. Peron. long; flex dig long) BUT same root
- Paraspinous – level above and below
- Contralateral muscle of most abnormality

EMG of PARASPINALS S/P surgery

- Not significant if abnormalities are all along scar
- Can be significant if localized and:
  - > 3 cm lateral to scar
  - > 3 cm deep
  - Correlate with sx



Back surgery

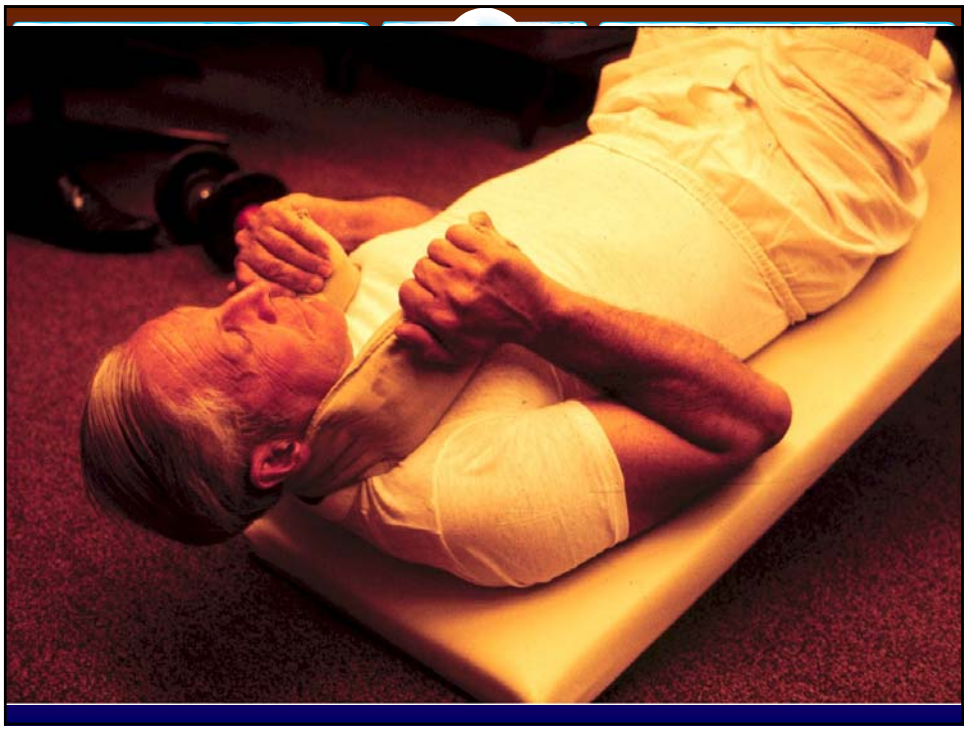


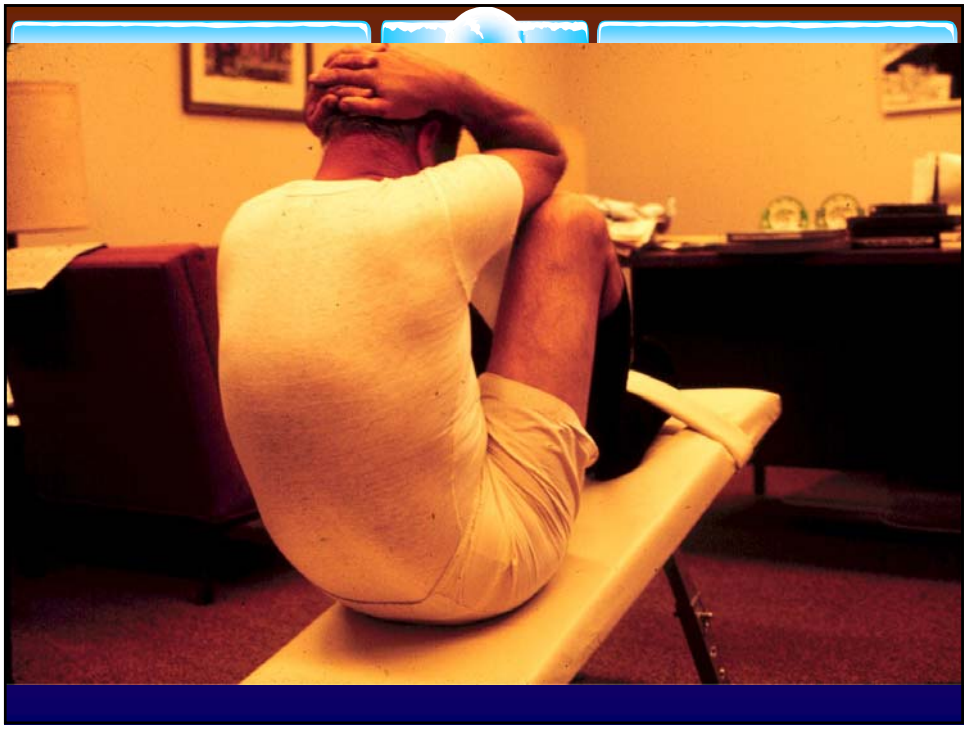
management

- Stop pain ?ESI
- Exercise program

Williams flexion exercises

- Sit-up in long sitting position
- Pull knees to chest (each and then both)
- Pelvis tilt
- Squat and reach
- Sit-up in short sitting position
- One limb stretch





Case study

- 45 y/o all=purpose worker (heavy) severe back and severe low back and left leg pain after lifingg 3 day onset previously
- PX – weakness left great toe extension and +++SLR on left.
- MRI – 'severe left L4,5 HNP'
- ?Management ??

Patient is scheduled to begin 2 week driving trip with family to Grande Canyon

- 28 tablets 10 mg prednisone
  - Take 7,6,5,4,3,2,1 same time every day and all at once
- Referral to interventional physiatrist
- ? Epidural
  - Conultan"epi could make worse; most severe HNP I have seen before EPI'
  - Patient in 1 week - 'Sx are better'
  - Ergo defer EPI and take another prescription with you

What Happened??

- 2days before trip saw consultant
  - Symptoms - a little better
- Left on trip
  - Several calls “no problems”
  - On return re-exam ‘min weaknaess left toe extensor and mild left SLR
  - Pain occasional only and mild

BOTTOM LINE

Most people recover from LBP even HNP and radiculopathy
ERGO . Tincture of time is best Rx
Control the pain

Major reason for operation is PAIN