IAIME
INTERNATIONAL ACADEMY OF INDEPENDENT MEDICAL EVALUATORS

Spine Nomenclature: Practical Application for the IME

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August 5, 2022

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2022 IAIME ANNUAL MEETING

PRESENTER FINANCIAL DISCLOSURE

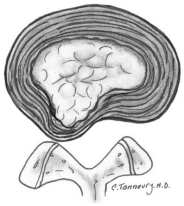
I have nothing to disclose.

I do not have any relationships to report with ACCME defined ineligible companies.

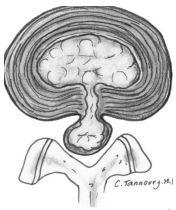
2

What is the difference between: Disc Protrusion and Extrusion?

Protrusion



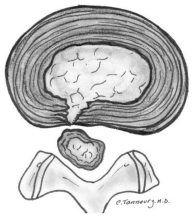
Extrusion



Fardon, TSJ, 2014

3

What is a Disc Sequestration?



Sequestration = free fragment

4

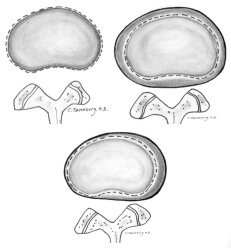
What is a Bulging Disc?

Greater than 25% of disc perimeter

Is NOT a Disc Herniation*

So what does it mean when a person says:

"I have two bulging discs in my spine"



*Fardon, Spine Nomenclature 2.0 (Open Access)

5

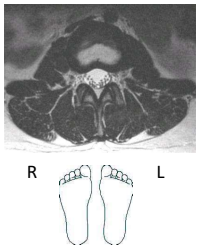
Imaging the Spine

X-ray **CT** **T1 MRI** **T2 MRI**

6

Imaging Orientation

Sagittal | Axial | Coronal



ResearchGate.net – sagittal | Case.edu – axial | Zephyr.com- coronal

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Disc Degeneration

- Disc Signal Loss
- Disc Height Loss
- Disc Bulge

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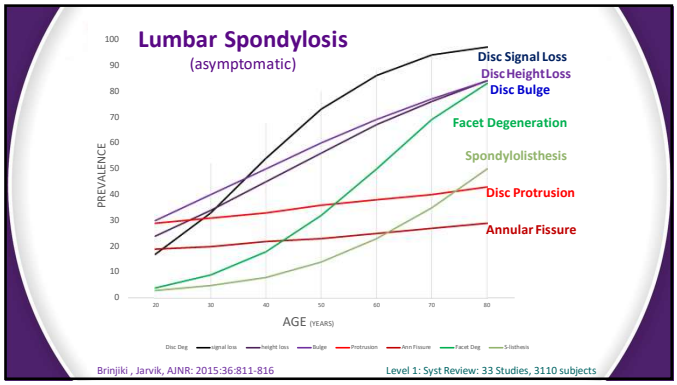
Lumbar Spondylosis: Prevalence in Asymptomatic Persons

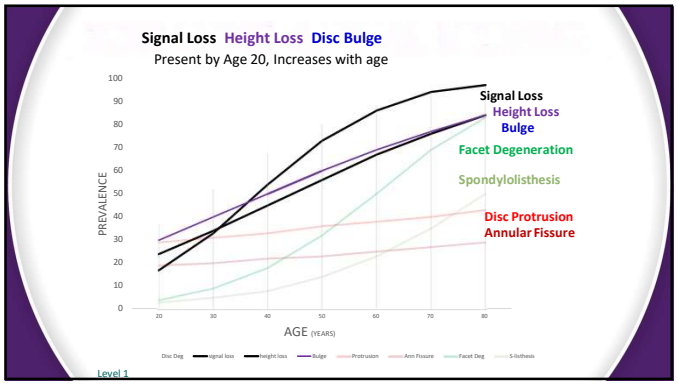
Age	Degen	Bulge	Protrusion
20-29	37%	30%	30%
30-39	50%	40%	30%
40-49	**70%**	**50%**	**35%**
50-59	80%	60%	40%
> 60	90%	70%	40%

Brinjiki , Jarvik, AJNR: 2015:36:811-816 Level 1: Meta-analysis: 33 Studies, 3110 subjects

9


Lumbar Spondylosis
(asymptomatic)
Disc Signal Loss
Disc Height Loss
Disc Bulge
Facet Degeneration
Spondylolisthesis
Disc Protrusion
Annular Fissure
PREVALENCE
AGE (YEARS)
Brinjiki , Jarvik, AJNR: 2015:36:811-816
Level 1: Syst Review: 33 Studies, 3110 subjects

10


Signal Loss Height Loss Disc Bulge
Present by Age 20, Increases with age
Signal Loss
Height Loss
Bulge
Facet Degeneration
Spondylolisthesis
Disc Protrusion
Annular Fissure
PREVALENCE
AGE (YEARS)
Level 1

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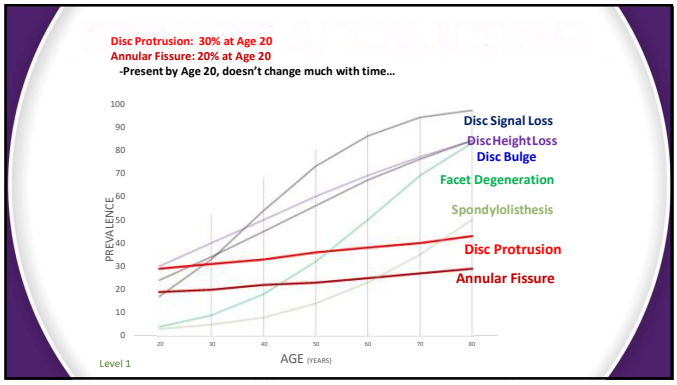
Disc Protrusion: 30% at Age 20
Annular Fissure: 20% at Age 20
-Present by Age 20, doesn't change much with time…
Disc Signal Loss
Disc Height Loss
Disc Bulge
Facet Degeneration
Spondylolisthesis
Disc Protrusion
Annular Fissure
PREVALENCE
AGE (YEARS)
Level 1

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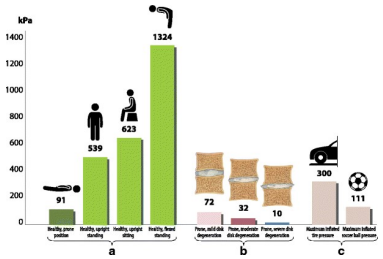
Intra-discal Pressure



Kushchayev SV, 2018

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Central Disc Protrusion

Age	Degen	Bulge	Protrusion
20-29	37%	30%	30%

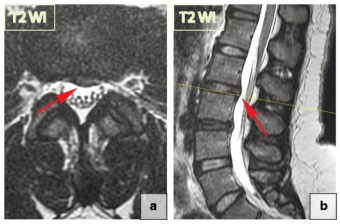

Image by Kushchayev 2018

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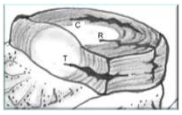
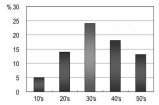
Annular Fissure "~~Tear~~"





Visible on MRI in 20% at age 30
(higher % with higher T magnet)
No correlation with pain
No correlation with trauma

Jarvik 2015, Fardon

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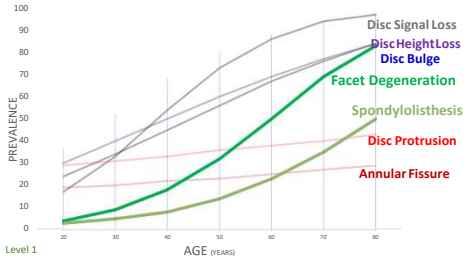
Facet Degeneration:
Spondylolisthesis:
-Absent Early in Life, Increase With Age…



Level 1

Brinjiki , Jarvik, AJNR: 2015:36:811-816

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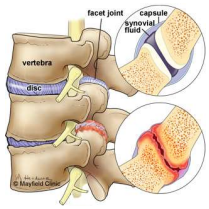
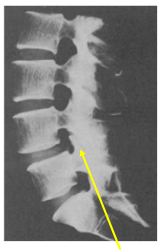
Facet Arthropathy





Foraminal narrowing

Spondylolisthesis (slip)

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Nomenclature:

L5-S1: Left paracentral disc protrusion contacts the S1 nerve root in the subarticular zone

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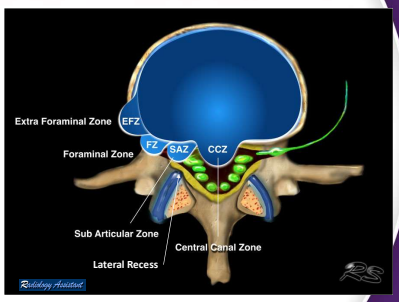
What Does That Report say?

Zones:
- Central
- Subarticular Zone
- Foraminal
- Lateral Recess
- Extra Foraminal



8/5/2022

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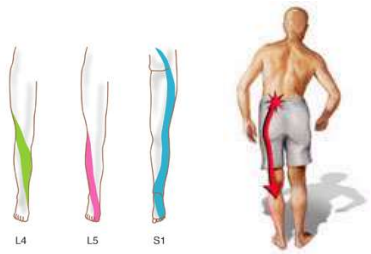
Clinical Correlation: Lumbar Radiculopathy

"My doc says I have 2 herniated discs in my back"



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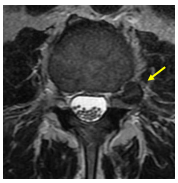
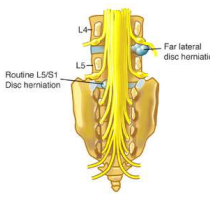
Far Lateral Disc





radiopaedia.org

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Magnetic Resonance Imaging in Follow-up Assessment of Sciatica (at one year)

	Unfavorable Outcome (%)	Favorable Outcome (%)	p Value
Disc Herniation Present	33	35	0.70
Nerve root Compression Present	26	24	0.87

The following are NOT associated with outcome

- Disc Herniation.
- Nerve-Root Compression
- Protrusion vs Extrusion
- **+/-** epidural enhancement.

el Barzouhi et al, 2014 NEJM

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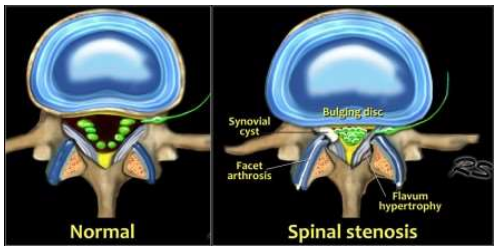
Spinal Stenosis:

- Central - Spinal Canal
- Foraminal - Nerve Root Exit



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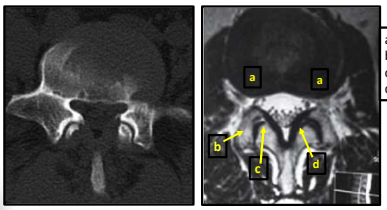
Lateral Recess Stenosis

Lumber MRI: "A combination of disc bulge, facet hypertrophy, and ligamentum flavum hypertrophy lead to lateral recess stenosis."



a) Disc Bulge
b) Facet hypertrophy (arthrosis)
c) Fluid with the facet joint
d) Ligamentum flavum hypertrophy

Arelhi Catalina González Cisneros Researchgate.net JNS doi.org/10.3171/2008.7.17634

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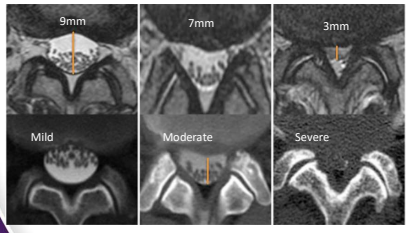
Central Spinal Stenosis

Lumbar MRI: "A combination of disc bulge, facet hypertrophy and ligamentum flavum hypertrophy lead to severe spinal stenosis. AP diameter of the canal is 3mm."



Stenosis due to:
- Facet Hypertrophy
- Ligamentum flavum hypertrophy
- Disc bulge, protrusion, extrusion
- Disc/osteophyte formation
- Facet Cyst

- Report may not be clear AND
- Easy to miss clinically

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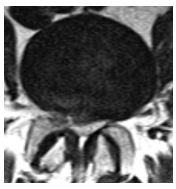
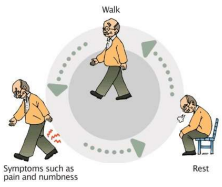
Neurogenic Claudication

Questions to ask:
- Can you walk? How far? What happens? If you sit and rest, does it get better?
- If you lay down at night, does your pain get better? If you get up and walk to the bathroom, by the time you get back to bed, is your pain better, or worse?





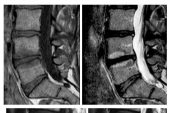
local-physio.co.uk/articles/lower-back-pain/spinal-stenosis/

26

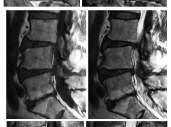
Vertebral Body Endplate Changes

Modic Changes

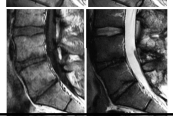
Inflammation



Fat Infiltration



Endplate Sclerosis



Schmorl's Node

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Cervical Spine

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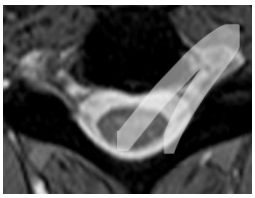
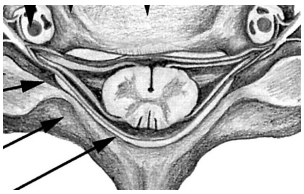
Cervical Anatomy





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Cervical Spondylosis ≠ Pain

Mild Moderate Severe

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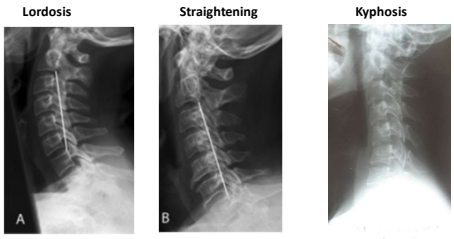
Lordosis vs. Kyphosis ≠ Pain

Imaging: *"Kyphosis is present at C5-6"*

Toyama Method: Bottom of C2- top of C7



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Natural History of Cervical Spondylosis

Incidental Imaging Findings in Asymptomatic Individuals

Age < 40, Predominant Changes
- Decreased signal
- Disc protrusion
- Anterior Dural Compression

Age >40, Predominant Changes
- Disc Space Narrowing
- Foramenal Stenosis
- Spinal Canal Narrowing
- Increased Signal Intensity in Cord

Okada 2009, Nakashima 2015

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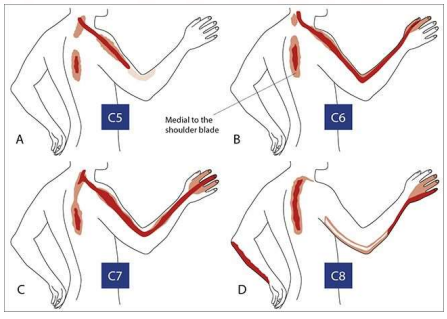
Clinical Correlation - Cervical Radiculopathy



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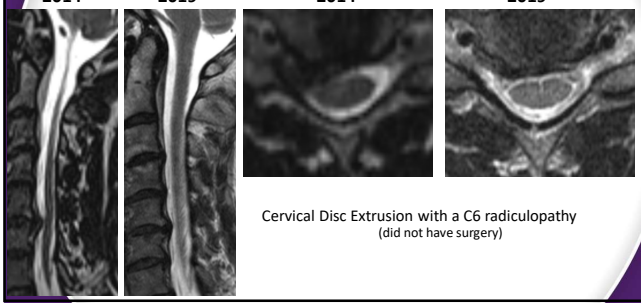
Cervical Disc Protrusion

2014 2019 2014 2019



Cervical Disc Extrusion with a C6 radiculopathy
(did not have surgery)

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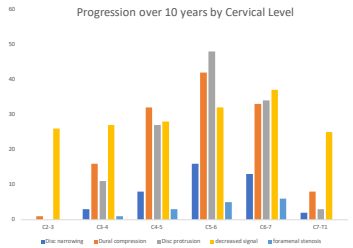
Natural History of Cervical Spondylosis



Okada Spine 2009:34:706-12

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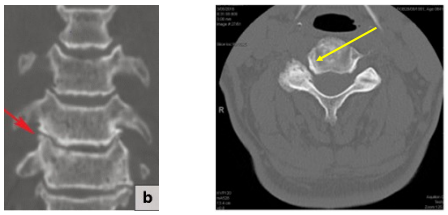
What is Uncovertebral Hypertrophy ?



Kushchayev 2018

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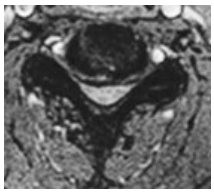
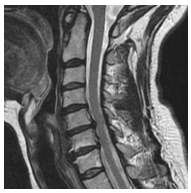
Disc-Osteophyte Complex

Axial MRI



Sagittal MRI



Foraminal stenosis *is* associated with radicular pain

IAIME

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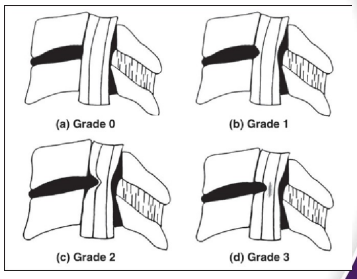
Cervical Stenosis

Grade:
0: Normal
1: Indents thecal sac, not cord
2: Contacts, deforms the cord
3: Cord signal



Kang

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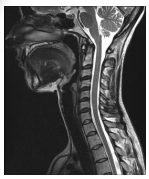
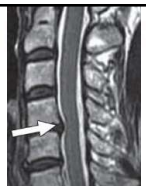
Cervical Stenosis



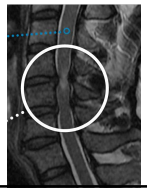
Grade:
0: Normal
1: Indents thecal sac, not the cord
2: Indents the cord
3: Cord signal, compromise

Grade 0



Grade 2

Grade 1



Grade 3

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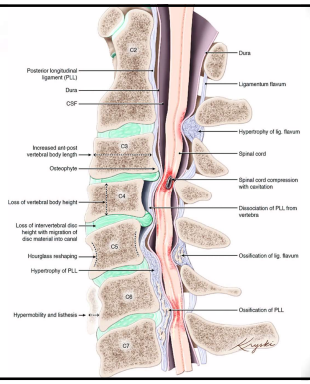
Degenerative Spondylotic Myelopathy



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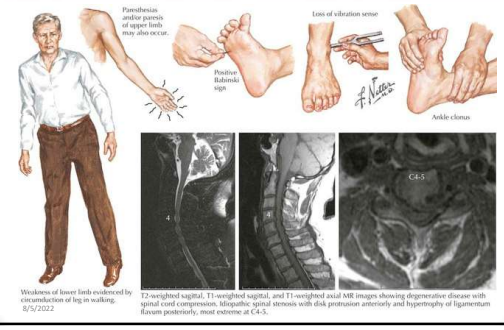
Degenerative Cervical Myelopathy



Weakness of lower limb evidenced by circumduction of leg in walking. 8/5/2022

T2-weighted sagittal, T1-weighted sagittal, and T1-weighted axial MR images showing degenerative disease with spinal cord compression. Idiopathic spinal stenosis with disk protrusion anteriorly and hypertrophy of ligamentum flavum posteriorly, most extreme at C4-5.

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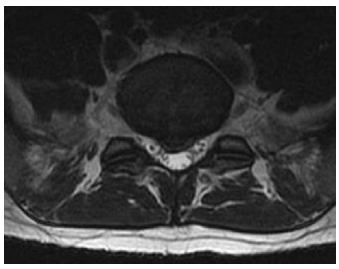
Case Example: Lumbar Disc Protrusion

L5-S1 central disc herniation in a 24-year-old female rower with right > left L5 radicular pain.

MRI: Central disc protrusion eccentric to the right that approximates the exiting nerve root with bilateral moderate foraminal stenosis



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Example: Cervical Spine Disc/Osteophyte

Cervical Spine MRI: which tells you more about the patient?

a. C5-6: Disc/osteophyes complex leads to moderate spinal stenosis. There is no signal within the spinal cord. Uncovertebral hypertrophy leads to bilateral, left greater than left stenosis.

b. C5-6: Disc/osteophyte complex contacts the thecal sac and displaces it posteriorly. There is no signal within the spinal cord. AP diameter of the spinal canal is 9 mm. Uncovertebral hypertrophy leads to mild right and moderate left foraminal stenosis.

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Cervical Spine Central Disc Protrusion

Which is more descriptive?

a. Central disc protrusion contacts the thecal sac, contacts the cord, displacing it posteriorly leading to mild-moderate stenosis. There is increased signal at the disc periphery consistent with annular fissure. CSF is posterior to the cord. There is no increased signal within the spinal cord.

b. Central disc herniation with an annular tear leads to mild-moderate spinal canal stenosis. There is no signal within the spinal cord.

casereports.bmj.com/content/2009/bcr.07.2008.0573

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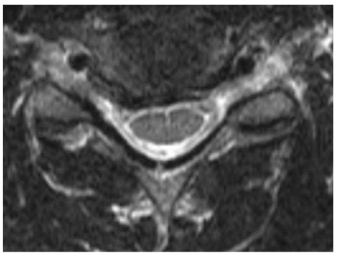
Cervical Spine Disc/Oteophyte

Disc/osteophyte complex eccentric to the right contacts the thecal sac, does not contact the spinal cord.

Mild facet arthropathy and uncovertebral hypertrophy lead to moderate right neuroforaminal stenosis.



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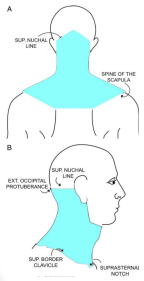
Neck Pain



Strong Evidence for an association with current neck pain:
- Previous Neck/shoulder pain (strong)
- Age (some evidence)
- Female Gender (strong)

Insufficient Evidence for an association
- Heavy Work
- Neck Posture
- Prolonged Work in a sedentary position
- Repetitive and Precision Work

Imaging findings do not predict neck pain.

Definition of Neck Pain: Guzman et al

Melhorn, Guides to Disease and Injury Causation

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What Does the Science Say? Low Back Pain (LBP):

Strong Evidence:
- Previous LBP is a risk factor for future LBP

Strong Evidence: **NOT** associated with LBP
- Age
- Prolonged Sitting
- Standing/Walking< 2 hrs/day
- Exercise and Leisure Activities

Insufficient Evidence for
- Heavy Work
- Awkward Positions
- Flexion
- Twisting

Imaging is not predictive of low back pain

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