

Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

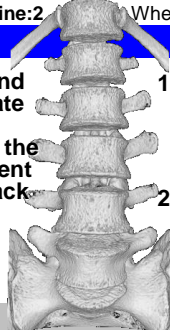
Goal Objectives

DDD
 Radiograph
 MRI
 HNP
 Stenosis
 Rx
 Post-Op
 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

Understand appropriate use of imaging in the management of Low Back Pain

1) **Imaging Chronic Low Back Pain**
 > DDD
 ✓ Radiographs
 ✓ **MRI: Gold Standard**

2) **Imaging Acute Low Back Pain**
 > Fractures
 ✓ Patterns
 ✓ **CT: Gold Standard**



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Story of the Lumbar Spine:2 When Things Break Down

How I Look at L-Spine Radiographs

DDD
 Radiograph
 MRI
 HNP
 Stenosis
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 Fx Patterns
 Comp/Burst
 Chance/Dis
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 Rigidity Fxs

AP & Lateral side-by-side on PACS

1. Label the vertebrae!
2. Vertebral body height
3. Alignment
4. **Disc Spaces**
 ✓ Wider @ Lower Levels
 ❖ L5-S1 variable
 ✓ **L4-L5 widest**
 ❖ **DDD starts L4-L5**



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Story of the Lumbar Spine:2 When Things Break Down

DDD: My Grading System

DDD
 Radiograph
 MRI
 HNP
 Stenosis
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 Fx Patterns
 Comp/Burst
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 AS/DISH
 Rigidity Fxs

If I have to convince the resident the disc is narrow = MILDLY NARROWED

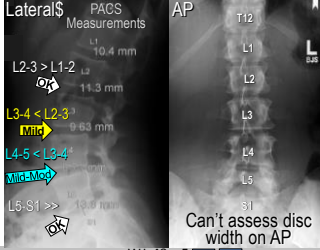
If we agree it's narrow = MODERATELY NARROWED

Vacuum phenomenon = SEVERELY NARROWED

Lateral Measurements
 L2-3 > L1-2
 L3-4 < L2-3
 L4-5 < L3-4
 L5-S1 >>

PACS Measurements
 L1: 10.4 mm
 L2: 11.3 mm
 L3: 9.63 mm
 L4: 10.4 mm
 L5: 10.4 mm

AP
 Can't assess disc width on AP



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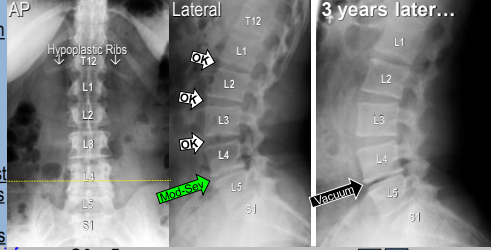
DDD: Common & Progressive

DDD
 Radiograph
 MRI
 HNP
 Stenosis
 Rx
 Post-Op
 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

AP
 Hypoplastic Ribs
 T12

Lateral
 T12
 L1
 L2
 L3
 L4
 L5
 S1

3 years later...
 Vacuum



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Story of the Lumbar Spine:2 When Things Break Down

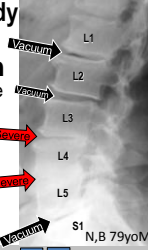
"Vacuum Phenomenon"

DDD
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 Rx
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 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

Cannot be a vacuum in your body
 > "horror vacui"
 Aristotle (384-322 BCE)?
 Parmenides (540 BCE)?

Nature Abhors a Vacuum
 ✓ Nature requires every space to be filled with something

What's in these black lines?
 > **91% Nitrogen!**
 ✓ 1977: Gilula et al. aspirated one!
 ✓ Room Air: 78% Nitrogen, 21% O₂
 > Lack of disk material fills with N₂



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Story of the Lumbar Spine:2 When Things Break Down

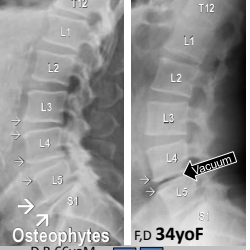
DDD: Osteophytes

DDD
 Radiograph
 MRI
 HNP
 Stenosis
 Rx
 Post-Op
 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

Just as osteophytes are a key feature of DJD, osteophytes are a key feature of DDD.

Usually Unimportant
 > **Clinically unimportant**
 ✓ Anterior osteophytes don't impinge anything

Imaging unimportant
 ✓ Don't correlate with degree of narrowing



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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down How I Look at L-Spine Radiographs

DDD	AP & Lateral side-by-side on PACS	AP	Lateral
Radiograph	1. Label the vertebrae!	T12	T12
MRI	2. Vertebral body <i>height</i>	L1	L1
HNP	3. Alignment	L2	L2
Stenosis	4. Disc space <i>narrowing</i>	L3	L3
Rx	> Like joint space narrowing	L4	L4
Post-Op	-----	L5	L5
Fx Patterns	Compare with MRI	S1	S1
Comp/Burst			
Chance/Dis			
AS/DISH			
Rigidity Fxs			

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Story of the Lumbar Spine:2 When Things Break Down Spine Imaging: Radiographs vs MRI

DDD	Vertebrae	Radiographs	MRI
Radiograph	> Numbering	👍👍	👎 (no ribs)
MRI	> Alignment	👎👎 Standing, Big picture	👍 (small picture)
HNP	> Fractures	👍 Wedging, Kyphosis	👎👎 Occult!
Stenosis	> N.F.	👍	👍👍
Rx	> Canal	👎	👍👍
Post-Op	Non-Bones		
Fx Patterns	> Spinal Cord	👎	👍👍
Comp/Burst	> Nerves	👎	👍👍
Chance/Dis	> Discs	👎	👍👍
AS/DISH			
Rigidity Fxs			

MRI is the Gold Standard

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Story of the Lumbar Spine:2 When Things Break Down MRI: Imaging Planes

DDD	Coronal Plane (scout)	Sagittal Plane (Big Picture)	Axial Plane (to Discs)
Radiograph	Liver, Spleen, Kidneys	Like AP view	Canal, Nerves
MRI	SPINE	Like Lat view	NF, Nerves
HNP			
Stenosis			
Rx			
Post-Op			
Fx Patterns			
Comp/Burst			
Chance/Dis			
AS/DISH			
Rigidity Fxs			

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Story of the Lumbar Spine:2 When Things Break Down MRI: T2-weighted Images

DDD	Fluid is Bright	Sagittal	Axial
Radiograph	> CSF	CSF, Disc	CSF
MRI	Cerebral Spinal Fluid		
HNP	✓ Bathes/surrounds		
Stenosis	✘ Spinal Cord		
Rx	✘ Spinal Nerves		
Post-Op	✘ (Brain)		
Fx Patterns	> Hydrated Discs		
Comp/Burst			
Chance/Dis			
AS/DISH			
Rigidity Fxs			

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Story of the Lumbar Spine:2 When Things Break Down Intervertebral Disc: 2 Components

DDD	1. Outside	Disc
Radiograph	> Annulus Fibrosus	
MRI	✓ Fibrous collagen ring	
HNP	2. Inside	
Stenosis	> Nucleus Pulposus	
Rx	✓ Jelly-like substance	
Post-Op	Sandwiched between vertebral body endplates	
	Allows for flexible motion between vertebral bodies	

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Story of the Lumbar Spine:2 When Things Break Down Intervertebral Disc: Jelly Donut Model

DDD	Fresh Donut:	Jelly Donut Model
Radiograph	> Jelly is moist	
MRI	> Bounces back when squished	
HNP	> Just like hydrated disc	
Stenosis		
Rx		
Post-Op		
Fx Patterns		
Comp/Burst		
Chance/Dis		
AS/DISH		
Rigidity Fxs		

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down Intervertebral Disc: Jelly Donut Model

Old Donut:
Jelly dries out
✓ Desiccated
Becomes less squishy

DDD:
1st: Disc Desiccation
2nd: Disc Narrowing

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Story of the Lumbar Spine:2 When Things Break Down Progression of DDD

Progression of DDD

1. Disc desiccation
2. Disc narrowing
3. Small tear in annular fibrosis
 - "Annular tear"
 - "High Intensity Zone (HIZ)"
 - Usually posterior

Like jelly just starting to squeeze out of donut

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Story of the Lumbar Spine:2 When Things Break Down Progression of DDD

Progression of DDD

1. Disc desiccation
2. Disc narrowing
3. Annular tear
4. HNP
Herniated Nucleus Pulposus
Jelly leaks out

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Story of the Lumbar Spine:2 When Things Break Down HNP Terminology: Bulge

Broad-Based Disc Bulge (BBB)
➢ Extends from one NF to the other

Potentially contacting/impinging
✓ Exiting Nerves in NF
✓ Traversing Nerves in Canal

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Story of the Lumbar Spine:2 When Things Break Down HNP Terminology: Protrusion

More focal than a Broad-Base Bulge
➢ Wider R<=L than A>P

1 disc can cause symptoms at >1 level

Central Disc Protrusion
Not touching any nerves
✓ CSF around nerves in canal
✓ Fat around nerves in NF

Lateral Recess Protrusion
Can touch exiting nerve in NF
Can touch traversing nerve canal

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Story of the Lumbar Spine:2 When Things Break Down HNP Terminology: Extrusion

Tend to be larger than protrusions
➢ Wider A>P than R<=L
➢ Mushroom shaped

Extrusions can hang down behind vertebral bodies
If this HNP were to become detached, it would be a "Sequestered" disc

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HNP → Stenosis

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

[Gr] "Narrowing in a tubular structure"

Stenosis can effect canal and/or NF

Pinched nerves → radiculopathy

➤ "Dysfunction of one or more spinal nerve"

Subjective Stenosis Grading (Axial T2):

- If CSF surrounds nerves: **Not Stenotic**
- No surrounding CSF: **Mild Stenosis**
- Nerves/cord flattened: **Moderate Stenosis**
- Can't get any worse: **Severe Stenosis**

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Story of the Lumbar Spine:2 When Things Break Down

HNP → Stenosis Canal best seen: Axial T2

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Sagittal T2+FS

Normal Concavity
Canal Widely Patent

Slight Convexity
Canal Widely Patent

Large Left-Sided Disc Extrusion
Causing Severe Canal Stenosis

Small Central Disc Protrusion...
Not Causing Canal Stenosis

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Story of the Lumbar Spine:2 When Things Break Down

Spinal Stenosis: Causes

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

HNP Osteophytes

- Not so much from vertebral bodies → Anterior
- From Facets → Neural Foramen

Posterior element hypertrophy

- Facets, Lamina, Ligamentum Flavum

Congenitally short pedicles

- "Congenital Spinal Stenosis"
- ✓ Even small HNPs in patients with short pedicles can cause stenosis

Epidural Lipomatosis

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Story of the Lumbar Spine:2 When Things Break Down

Redundant Nerves = Severe Stenosis

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Sagittal T1 Sagittal T2+FS

Caused by combination of small HNP + marked PEH (Posterior Element Hypertrophy)

To me looks like spaghetti

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Story of the Lumbar Spine:2 When Things Break Down

Congenital Spinal Stenosis = Short Pedicles

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Sagittal T1 Sagittal T2+FS

Redundant Nerves = Severe Stenosis

Very Tight CSF space

Laminectomy

Intra-Op Post-Op

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Story of the Lumbar Spine:2 When Things Break Down

Epidural Lipomatosis

DDD Radiograph MRI HNP

- Stenosis
- Rx
- Post-Op
- Fx Patterns
- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

* Too Much Epidural Fat

Very Tight CSF space

Axial T2 Canal widely patent

CSF surrounds Spinal cord/nerves

* Too Much Epidural Fat

Compresses thecal sac to star shape

Sagittal T1 Fat is Bright Sagittal T2+FS Fluid is Bright

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Story of the Lumbar Spine:2 When Things Break Down

DDD: Treatment Options

Conservative treatment

- Good first option
 - ✓ Much LBP resolves within 6 weeks
 - ✦ ACR Guidelines: Image LBP after 6 weeks
- Pain Medication as needed
- Physical Therapy always good idea
- HNP's can resolve spontaneously!
 - ✓ *It helps if you're young...*

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Story of the Lumbar Spine:2 When Things Break Down

HNP can resolve with time & PT

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

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DDD: Treatment Options

Image Guided Pain Injections

- Performed in MSK Fluoroscopy suite @ CSC
- Requires no sedations, IV's, ...
 - ✓ Patients don't even get undressed
- We do use local anesthetic, generously
 - ✓ *We are the painless pain service!*
- Administer steroids (Triamcinolone) + Lidocaine
- Patients NEED to bring a driver
 - ✓ Occasionally patient's leg is numb for a few hours
- Patients NEED to stop Coumadin for 3 days
 - www.radiology.wisc.edu/sections/msk/forReferring.php

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Story of the Lumbar Spine:2 When Things Break Down

DDD: Treatment Options

Image Guided Pain Injections

- **Epidural Steroid Injections**
 - (This is what most PCPs should order)
 - ✓ Midline: For multi-level, bilateral, radiculopathy
 - ✓ Transforaminal: Single level/sided radiculopathy
- **Nerve Root Block**
 - (This is what some Surgeons order)
 - ✓ Targeted injection to one specific nerve
 - ✓ Ordered mostly for surgical planning
- **Facet Injection**
 - ✓ For facet pain (Infrequently ordered)

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Story of the Lumbar Spine:2 When Things Break Down

Parts of Vertebra: Neural Foramen

Side View Top (Axial) View

Neural Foramen: Keyhole-shaped opening Under pedicle Front of facet Behind Disc

Lumbar Nerves: Travel thru canal Exit at NF under pedicles

Disc Posterior Epidural Fat

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Story of the Lumbar Spine:2 When Things Break Down

Midline Epidural Steroid Injection

Side View Top (Axial) View

Disc

Good for treating several levels, as steroids tend to flow bilaterally, up/down several levels

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down Transforaminal Epidural Steroid Injection

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Side View Top (Axial) View

Disc

Steroids go 1/2 Epidural & 1/2 along the selected nerve

Good for treating one level centrally and peripherally

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Story of the Lumbar Spine:2 When Things Break Down Selective Nerve Root Block

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Side View Top (Axial) View

Disc

All steroids delivered to one nerve
No steroids go epidural

Used to confirm pain is from that one nerve

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Story of the Lumbar Spine:2 When Things Break Down Facet Injection

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Side View Top (Axial) View

Disc

Used to treat facet pain from OA
Used for synovial cyst rupture...

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Story of the Lumbar Spine:2 When Things Break Down Anterior Synovial Cysts → Focal Stenosis

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Side View Top (Axial) View

Disc

Even small cysts ANTERIOR to facets can impinge nerves

Even large cysts POSTERIOR to facets do not touch nerves

OA → Joint Effusion
Effusion → Out pouch synovium
Knee: "Bakers Cyst"
Facet: "Synovial Cyst"

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Story of the Lumbar Spine:2 When Things Break Down Anterior Synovial Cysts → Focal Stenosis

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Lateral Sagittal T2+FS Axial T2

L1 L2 L3 L4 L5 S1

Body →

Facet Joint Fluid in Facets Facet Joint

Synovial Cyst

Spinous Process

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Story of the Lumbar Spine:2 When Things Break Down Synovial Cysts can be Ruptured

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

PA Fluoroscopic View 14:31 PA Fluoroscopic View 14:32

Contrast in synovial cyst

Contrast leaving ruptured cyst

Contrast no longer in cyst

J.J 50yoF

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

DDD: Treatment Options

DDD
 Radiograph
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Surgery

- Microdiscectomy
 - Remove the HNP and very little bone
- Decompressive Surgery
 - Laminectomy (Remove Lamina, Spinous Process)
 - Fusion
 - Posterior: Pedicle Screws
 - Anterior: Bone graft between vertebral bodies
- HNPs can recur!
 - MRIs on Post-Op L-spines: WITH IV CONTRAST!**
 - Need Pre & Post Contrast to see recurrent discs!
 - Spinal fixation hardware is NOT a contraindication for MRI

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Story of the Lumbar Spine:2 When Things Break Down

Recurrent HNP: Pre-Op

DDD
 Radiograph
 MRI
 HNP
 Stenosis
 Rx
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 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

Recurrent HNP: Pre-Op

Localizing Needle

Displaced Nerves
 Lateral Recess Protrusion
 Traversing Right S1
 Traversing Left S1 Posteriorly Displaced
 Discogenic Edema

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Story of the Lumbar Spine:2 When Things Break Down

Recurrent HNP: 10 days Post-Op

DDD
 Radiograph
 MRI
 HNP
 Stenosis
 Rx
 Post-Op
 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
 Rigidity Fxs

Recurrent HNP: 10 days Post-Op

Enhancing post-surgical granulation tissue
 Epidural Para-Spinous
 Non-Enhancing Recurrent Disc Extrusion!

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Story of the Lumbar Spine:2 When Things Break Down

Recurrent HNP: 10 days Post-Op

DDD
 Radiograph
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 Rigidity Fxs

Recurrent HNP: 10 days Post-Op

Hard to tell normal post-operative granulation tissue from abnormal recurrent disc
 Non-Enhancing Recurrent Disc Extrusion!
 Normal post-op Epidural Enhancement
 Normal post-op Para-Spinous Enhancement

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Story of the Lumbar Spine:2 When Things Break Down

Questions?

DDD
 Radiograph
 MRI
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 Rx
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 Fx Patterns
 Comp/Burst
 Chance/Dis
 AS/DISH
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That's enough about DDD as a cause of chronic Low Back Pain...

Advanced Spinal Care

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Story of the Lumbar Spine:2 When Things Break Down

WOW: Imaging Low Back Pain (LBP)

DDD
 Radiograph
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 Chance/Dis
 AS/DISH
 Rigidity Fxs

Chronic LBP

- >6 weeks, other Red Flags
- Get Radiographs today
- Probably schedule MRI with IV Contrast if prior surgery
- Maybe refer to Spine Clinic?

Acute LBP

- Worried about a fracture

BREAK YOU!
 CRACK!

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

Acute Traumatic Fractures

DDD	Major Trauma	Minor Trauma
Radiograph	> MVC, Fall from height	> Fall from standing
MRI	Present to ED	Present to PCP
HNP	> Acute (on backboard)	> Sub-acute, walk-in
Stenosis	Screen: with CT	with Radiographs
Rx	1) Is fracture present?	1) Is fracture present?
Post-Op	2) Retropulsed frags?	2) Is it old?
Fx Patterns	3) Call Surgery?	✓ c/w Hx & PE ✓ c/w Priors (CXR, Scout CT)
Comp/Burst	Patients with fusions throughout spine (AS, DISH) who have pain after even minor trauma MUST get spine CT urgently to screen for non-displaced fractures!	
Chance/Dis		
AS/DISH		
Rigidity Fxs		

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Story of the Lumbar Spine:2 When Things Break Down

Acute Major Spine Trauma? CT!

DDD	Eastern Association for the Surgery of Trauma (EAST.org)
Radiograph	> 2007: Practice Management Guidelines TL-spine fractures
MRI	✓ Reviewed 500 articles, recommendations based upon 27 most relevant
HNP	> 2012: Included 12 new articles published since '07 guidelines
Stenosis	TL-spine Fractures are Common in Trauma
Rx	> 5% Level 1 trauma patients have TL-spine fractures
Post-Op	> 50% of all vertebral fractures are in the TL-spine
Fx Patterns	Important to Detect these in the ED
Comp/Burst	> 20-50% of these patients have neurologic injuries
Chance/Dis	> Delay in Dx of TL-spine Fx → 8X ↑ neurologic deficits
AS/DISH	Sensitivity: ⊗RG (22-75%) ⊙CT (95-100%)
Rigidity Fxs	

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Francis Denis, MD, FRSC(C)

The Three Column Spine and Its Significance in the Classification of Acute Thoracolumbar Spinal Injuries

412 TL-spine injuries

- Minor Fxs (17%)
 - Transverse Process (14%)
 - Spinous Process (2%)
 - Articular Process (1%)
 - Pars Interarticularis (1%)
- Major Fxs (83%)
 - Disrupt Columns

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Francis Denis, MD, FRSC(C)

4 Major Fx Patterns:

- Compression (48% of all)
 - Ant. column compressed
 - Mid. & Post. maintained
- Burst (14%)
 - Ant. & Mid. compressed
 - Post. column maintained
- Fx/Dislocation (16%)
 - Ant. column compressed
 - Mid. & Post. distracted
- Seat-belt type (5%)
 - Ant. column maintained
 - Post. & Mid. distracted

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Distribution (Major Fx)

Fx/Dislocation 20%
Seat-belt type 6%
Burst 17%
Compression 58%

24% of Major TL Fxs @ L1

68% @ TL Junction (L1:2)

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Compression (Wedge)

Most Common Spine Fx

- Anterior Column
 - Compression
- Middle Column
 - Intact (act as hinge)
- Posterior Column
 - Intact (tension on ISL)

Usually Superior End Plate

- > 62%: Superior End Plate only
- > 31%: Superior & Inferior
- > 6%: Inferior End Plate only

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Compression vs Not

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns

- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Acute pain after being knocked down

Chronic, diffuse spine pain, no trauma

Right trapezoid = Fx

Keystone = Congenital Wedge

Of course, history helps...

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Compression → CT

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns

- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Lateral MRI HNP Stenosis Rx Post-Op Fx Patterns

Sagittal CT

1 month later in a brace

2 months Out of brace

Body Ped. TP S1

Canal Intact Facets

SP1

YL 66yoM

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Axial Load → Burst Fx

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns

- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Fall from height, landing on feet

- Leap from window
- ✓ Lover's fracture
- ✓ Don Juan fracture
- Wl: Fall from Deer Stand

When fall from height landing on feet: If calcaneus Fx Then need to CT L-spine for burst Fx!

Courtesy of William Morrison, MD 2014 President skeletalrad.org

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Burst Fracture

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns

- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

Due to Axial Load

- Anterior Column
- ✓ Compression
- Middle Column
- ✓ Compression
- Posterior Column
- ✓ Intact

Retropulsed Post Wall

- Narrows canal
- Compresses Cord/Nerves

Anterior

Post

BURST

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Burst Fracture → CT

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns

- Comp/Burst
- Chance/Dis
- AS/DISH
- Rigidity Fxs

P T12 P

Scout AP

Scout Lateral

Retropulsed Post Wall

BURST

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Burst Fracture → CT

Post-Op AP Coronal CT Sagittal CT

Post-Op Lat

T12

L2

L3

L4

L5

Retropulsed Post Wall

Normal Canal

Severe Stenosis

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Seat-belt type (Chance)

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

Courtesy of William Morrison, MD

Anterior Mid Post

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Seat-belt type (Chance)

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

Anterior Column
➢ Intact (act as hinge)

Middle Column
➢ Distraction

Posterior Column
➢ Distraction

Described by GQ Chance, 1948
Associated with Lap seat belts
➢ Less common since 1980s shoulder belts
50% also intraabdominal injuries
➢ Pancreas, Duodenum, Mesentery

Anterior Mid Post

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Chance GQ: Br J Radiol 1948; 21: 452-3.

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Story of the Lumbar Spine:2 When Things Break Down

Chance

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

NOTES ON A TYPE OF FLEXION FRACTURE OF THE SPINE
BY G. Q. CHANCE, M.B., B.S., B.A.C., D.M.B.E.
BRITISH MEDICAL JOURNAL, 1948

When flexion of the spine exceeds normal limits something has to give way. True flexion fracture, though a rarer type, (3) Horizontal splitting spine & neural arch ending in upward curve just in front of NF. In good radiographs recognition is easy. As there is no major ligamentous damage, simple hyperextension of the spine must inevitably bring the two halves into perfect anatomical apposition, and give a near 100% prognosis. I cannot think of any anatomical explanation of the peculiar site & direction of the fracture.

September 1948.
1958: Saab 1st to make seat belts standard
2007: Shoulder & Lap belt center rear seat

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Chance GQ: Br J Radiol 1948; 21: 452-3.

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Seat-belt type → CT

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

Lateral Radiograph
Sagittal CT
Axial CT
Post-Op Lat

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5,6 21yoM

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Fracture Dislocation

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

Most Severe Spine Fx (20%)

- Anterior Column
 - ✓ Compression, rotation/shear
- Middle Column
 - ✓ Distraction, rotation/shear
- Posterior Column
 - ✓ Distraction, rotation/shear

90% of dislocations above T10 result in complete paraplegia
60% of dislocations below T10 result in complete neurologic deficit.

Anterior Mid Post

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medicine.medscape.com

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Story of the Lumbar Spine:2 When Things Break Down

Fracture Patterns: Fracture Dislocation

DDD
Radiograph
MRI
HNP
Stenosis
Rx
Post-Op
Fx Patterns
Comp/Burst
Chance/Dis
AS/DISH
Rigidity Fxs

Scout Lateral
Sagittal CT, Bone Settings
Sagittal CT, Soft Tissue Settings
Post-Op Lat

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T.S 23yoF

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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

Major Spine Fxs May Be Unstable

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>Major Trauma</p> <ul style="list-style-type: none"> ➢ MVC, Fall from ht. <p>➔ Major Spine Fxs</p> <ul style="list-style-type: none"> ➢ Destabilize columns <p>Require Urgent:</p> <ul style="list-style-type: none"> ➢ Spine CT ➢ Call to Surgery <p><i>But before we can talk AS/DISH we need to talk about:</i></p> <ul style="list-style-type: none"> ✓ Osteophytes ✓ Syndesmophytes ✓ Enthesophytes 	<p>Minor Trauma</p> <ul style="list-style-type: none"> ➢ Fall from standing <p>➔ Major Spine Fxs</p> <ul style="list-style-type: none"> ➢ Destabilize columns <p>Require Urgent:</p> <ul style="list-style-type: none"> ➢ Spine CT ➢ Call to Surgery <p>In patients with:</p> <ul style="list-style-type: none"> ➢ Ankylosing Spondylitis (AS) ➢ Diffuse Idiopathic Skeletal Hyperostosis (DISH)
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Story of the Lumbar Spine:2

Let's Talk about "Phyte Club"

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>Suffix <i>phyte</i>:</p> <p>"abnormal growth"</p> <p>3 Types of <i>phytes</i>:</p> <ul style="list-style-type: none"> ➢ Osteophytes @ Joints (DJD/DDD) ➢ Syndesmophytes @ Disks (Annulus Fibrosis) ➢ Enthesophytes @ Ligament/Tendon insertions (A.L.L.)
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Story of the Lumbar Spine:2 When Things Break Down

Osteophytes

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>Occur at Joints in DJD (Degenerative Joint Disease)</p> <ul style="list-style-type: none"> ➢ Extend from joint edges <p>Occur at Disks in DJD (Degenerative Disk Disease)</p> <ul style="list-style-type: none"> ➢ Extend from vertebral bodies corners ✓ In DJD disk bulges outward ✓ Osteophytes extend out around bulging disk <p>➔ Extend horizontally</p> <ul style="list-style-type: none"> ✓ Typically extend anteriorly 	<p>PowerPoint Model: Spine</p>
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Story of the Lumbar Spine:2 When Things Break Down

Spine: Osteophytes Horizontal ↔

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>Lumbar Spine Lateral view</p>	<p>PowerPoint Model: Spine</p>
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Story of the Lumbar Spine:2 When Things Break Down

Osteophytes vs Syndesmophytes

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>While Osteophytes</p> <ul style="list-style-type: none"> ➢ Extend <i>horizontally</i> from corners of vertebral body <p>Syndesmophytes</p> <ul style="list-style-type: none"> ➢ Extend <i>vertically</i> along Annulus Fibrosus ➢ Thin ➢ Cover multiple levels ✓ Cervical ✓ Thoracic ✓ Lumbar 	<p>PowerPoint Model: Spine</p>
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Story of the Lumbar Spine:2 When Things Break Down

Syndesmophytes Vertical ↑

<ul style="list-style-type: none"> DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs 	<p>Lumbar Spine Lateral view</p>	<p>PowerPoint Model: Spine</p>
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Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

Syndesmophytes Vertical ↓

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

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Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

Enthesophytes

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

L,E 62yoF

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Enthesophytes are... nothing

- > Bone spurs at ligament/tendon insertions
- > Not osteophytes (which occur at joints)
- > Not pathology
- > Common in calcaneus
- ✓ "Heel spurs"
- ✓ Not plantar fasciitis

@ Achilles tendon insertion ↓
@ plantar fascia →

Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

Diffuse Idiopathic Skeletal Hyperostosis

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Forasier. The Journal of Rheumatology 10:6, 1983

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Diffuse: Everywhere
Idiopathic: IDK?
Skeletal: Bones

- > @ Ligament/Tendons
- ✓ @ ALL

Hyperostosis: Makes Lots of Bone

- > Over MANY levels
- > Enough to fuse bodies

ALL Body Nucleus Body

Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

Diffuse Idiopathic Skeletal Hyperostosis

Modified Ferguson : SI Lateral T12 L1 L2 L3 L4 S1

J,D 75yoM

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← SI Joints →
← NOT →
← Fused →
> Not AS

Chance/Dis AS/DISH Rigidity Fxs

Discs not narrowed
> Not DDD

Body Nucleus Body

Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

In the Spine: DDD v AS v DISH

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

FIGHT CLUB

phytes	Osteo-	Syndesmo-	Entheso-
Appearance	Pointy ↔ ▲	Thin ↑ ↓	Thick ↑ ↓ ◐
Disk Width	Narrowed	Preserved	Preserved
SI Joints	Preserved	FUSED	Preserved

Patients with fusions throughout spine (AS, DISH) who have pain after even minor trauma MUST get spine CT urgently to screen for non-displaced fractures!

Chance/Dis AS/DISH Rigidity Fxs

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Story of the Lumbar Spine:2 **PHYTE CLUB** When Things Break Down

Additional Hx: Fell in snow → 10/10 Pain, can't sleep

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rigidity Fxs

Hx: "pain"
Dx: DISH

Pain free
No neurological deficits

PR 47yoM

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Lateral T-spine Sagittal CT Post-Operative T-spine Coronal CT

D → I → S → H →

Fx thru disc → Fx thru body ↑ Fx thru body ↓

Story of Lumbar Spine: 2) When Things Fall Apart

Story of the Lumbar Spine:2 When Things Break Down

Ankylosing Spondylitis → Fx/Disloc

FIGHT CLUB

No charges in bar-fight death

CT Sagittal C-spine CT T-spine CT L-spine

Wisconsin State Journal 7/16/08 Z,M 46yoM 73 of 75

Story of the Lumbar Spine:2 When Things Break Down

Ankylosing Spondylitis → Fx/Disloc

DDD Radiograph MRI HNP Stenosis Rx Post-Op Fx Patterns Comp/Burst Chance/Dis AS/DISH Rrigidity Fxs

CT Sagittal C-spine MR Sagittal T1 MR Sagittal T2fs

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