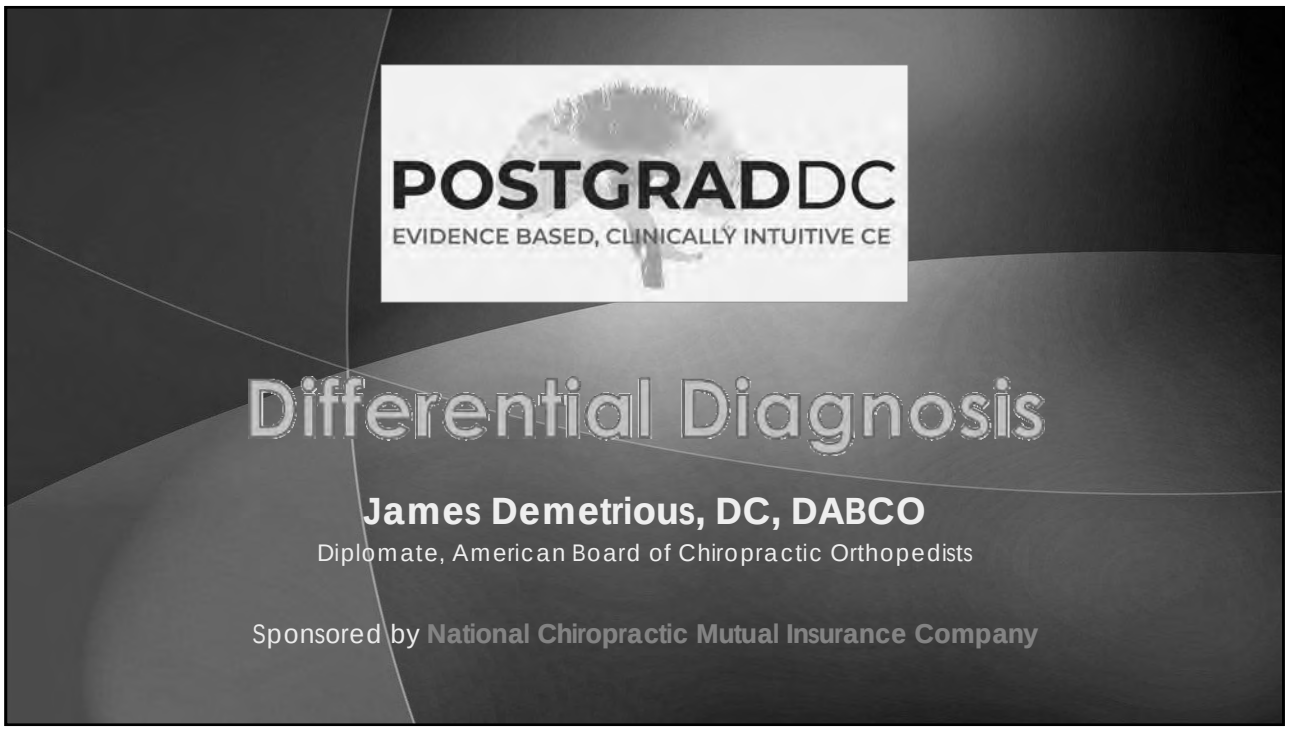
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Differential Diagnosis
James Demetrious, DC, DABCO
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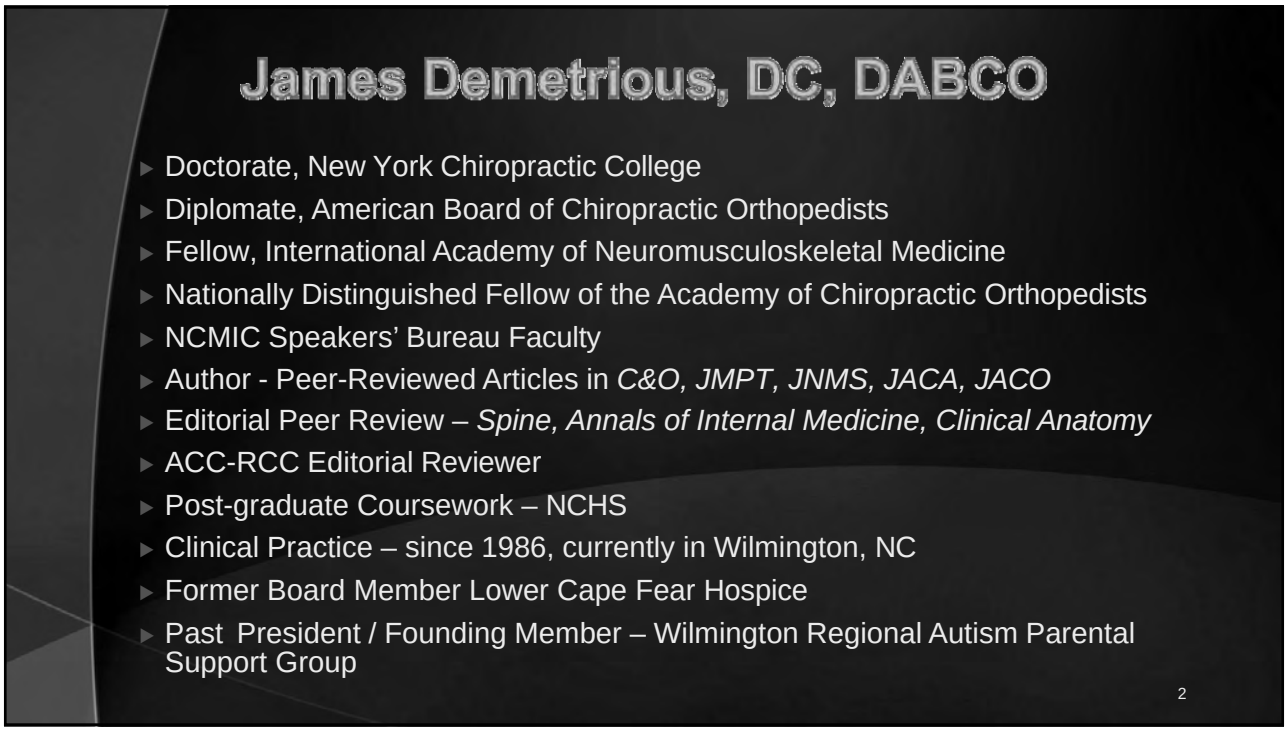
James Demetrious, DC, DABCO
Doctorate, New York Chiropractic College
Diplomate, American Board of Chiropractic Orthopedists
Fellow, International Academy of Neuromusculoskeletal Medicine
Nationally Distinguished Fellow of the Academy of Chiropractic Orthopedists
NCMIC Speakers' Bureau Faculty
Author - Peer-Reviewed Articles in C&O, JMPT, JNMS, JACA, JACO
Editorial Peer Review – Spine, Annals of Internal Medicine, Clinical Anatomy
ACC-RCC Editorial Reviewer
Post-graduate Coursework – NCHS
Clinical Practice – since 1986, currently in Wilmington, NC
Former Board Member Lower Cape Fear Hospice
Past President / Founding Member – Wilmington Regional Autism Parental Support Group
2

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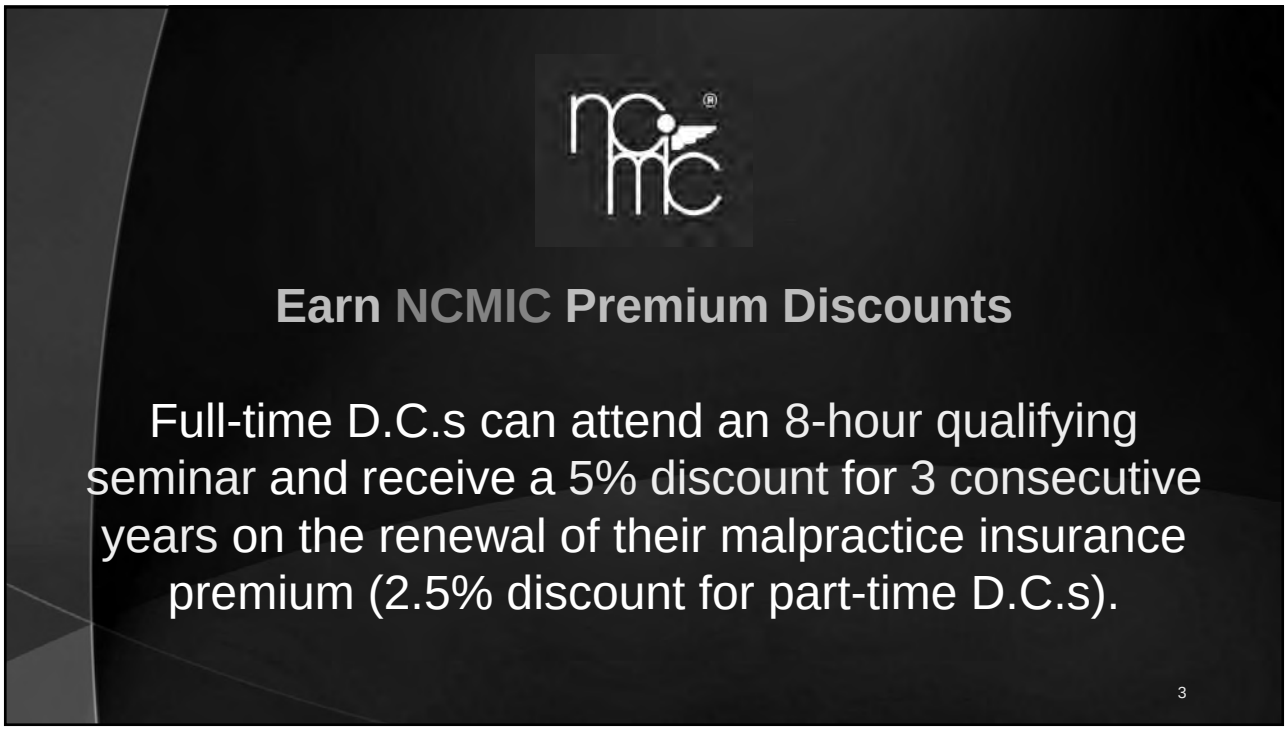
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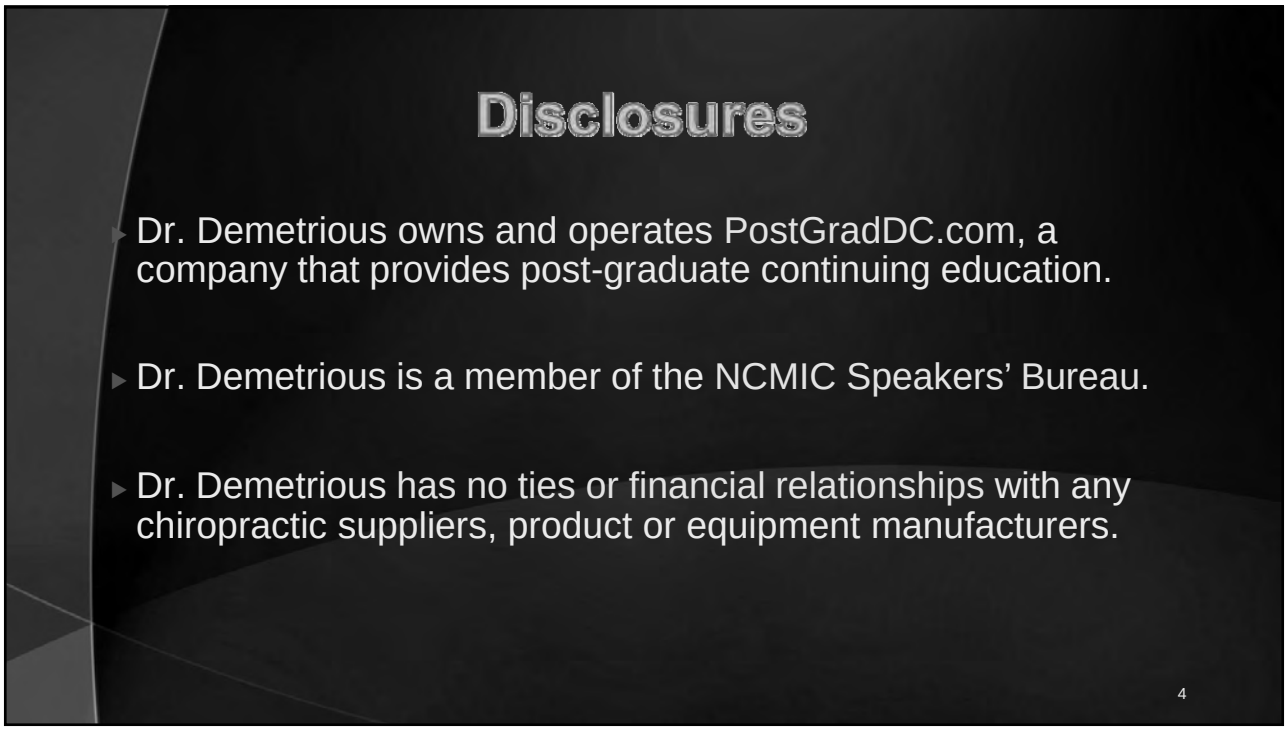
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What Motivates Us?

6

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doi:10.1093/brain/awy275 BRAIN 2018: Page 1 of 10 | 1

BRAIN
A JOURNAL OF NEUROLOGY

Local structural connectivity is associated with social cognition in autism spectrum disorder

Marc-Antoine d'Albis,[1,2,3,4] Pamela Guevara,[5] Miguel Guevara,[5,6] Charles Laidi,[1,2,3,4] Jennifer Boisgontier,[1,2,3] Samuel Sarrazin,[1,2,3,4] Delphine Duclap,[6] Richard Delorme,[3,7,8] Federico Bolognani,[9] Christian Czech,[9] Céline Bouquet,[9] Myriam Ly-Le Moal,[10] Stefan Holiga,[9] Anouck Amestoy,[11] Isabelle Scheid,[2,3,4] Alexandru Gaman,[2,3,4] Marion Leboyer,[2,3,4,12] Cyril Poupon,[6] Jean-François Mangin[6] and Josselin Houenou[1,2,3,4,12]

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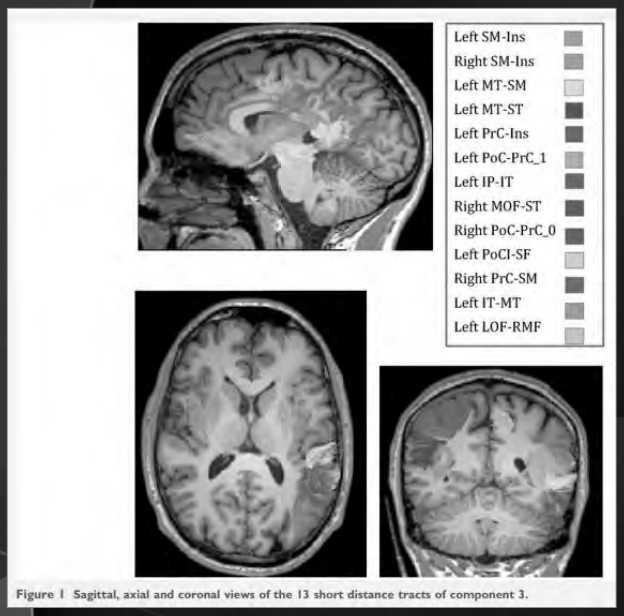

Figure 1 Sagittal, axial and coronal views of the 13 short distance tracts of component 3.

Using Diffusion Imaging, this study revealed that Autism subjects had a decrease of short-range structural connectivity in 13 tracts within the brain associated with social cognitive deficits. These findings might suggest new targets for treatment.

9

9

Chiropractic Differential Diagnosis

- Introduction – What is DDX?
- Trauma/injury/Dose Response?
- Biologic concepts of connective tissue
- Connective tissue matrices
- Myositis/myopathies
- Tendinitis/tendinopathy/enthesopathies
- Capsulitis
- Discogenic issues/discitis
- Radiculitis/neuritis/myelitis
- Spine/trunk
- Upper extremities
- Lower extremities
- Conclusion

10

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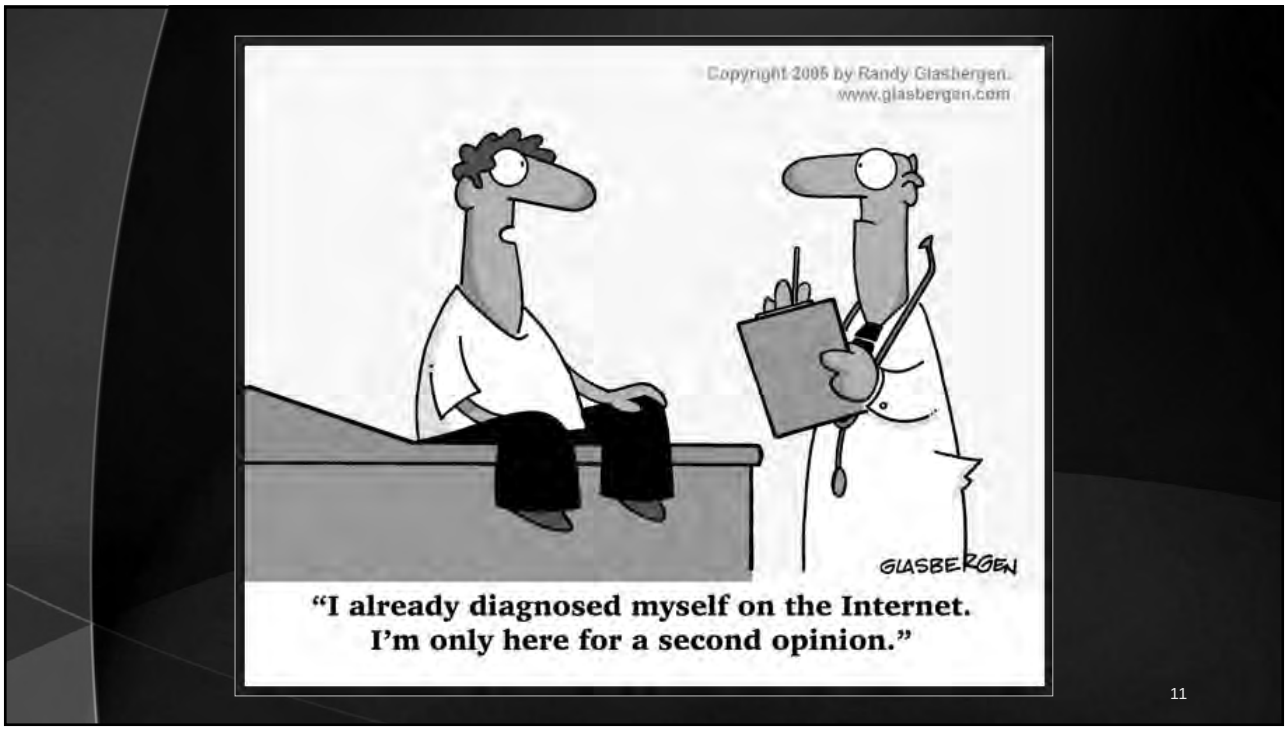
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GLASBERGEN
"I already diagnosed myself on the Internet.
I'm only here for a second opinion."

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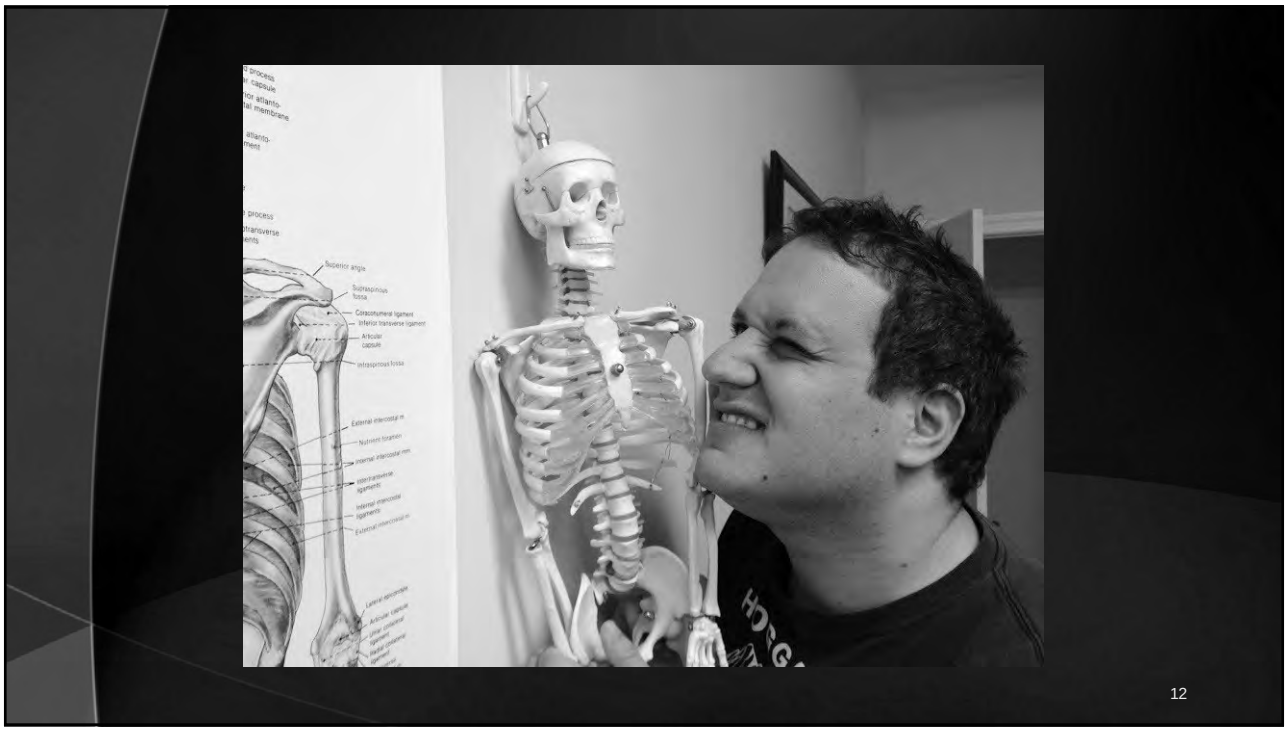

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"One sees what one knows."
~Daniel Rieu, MD
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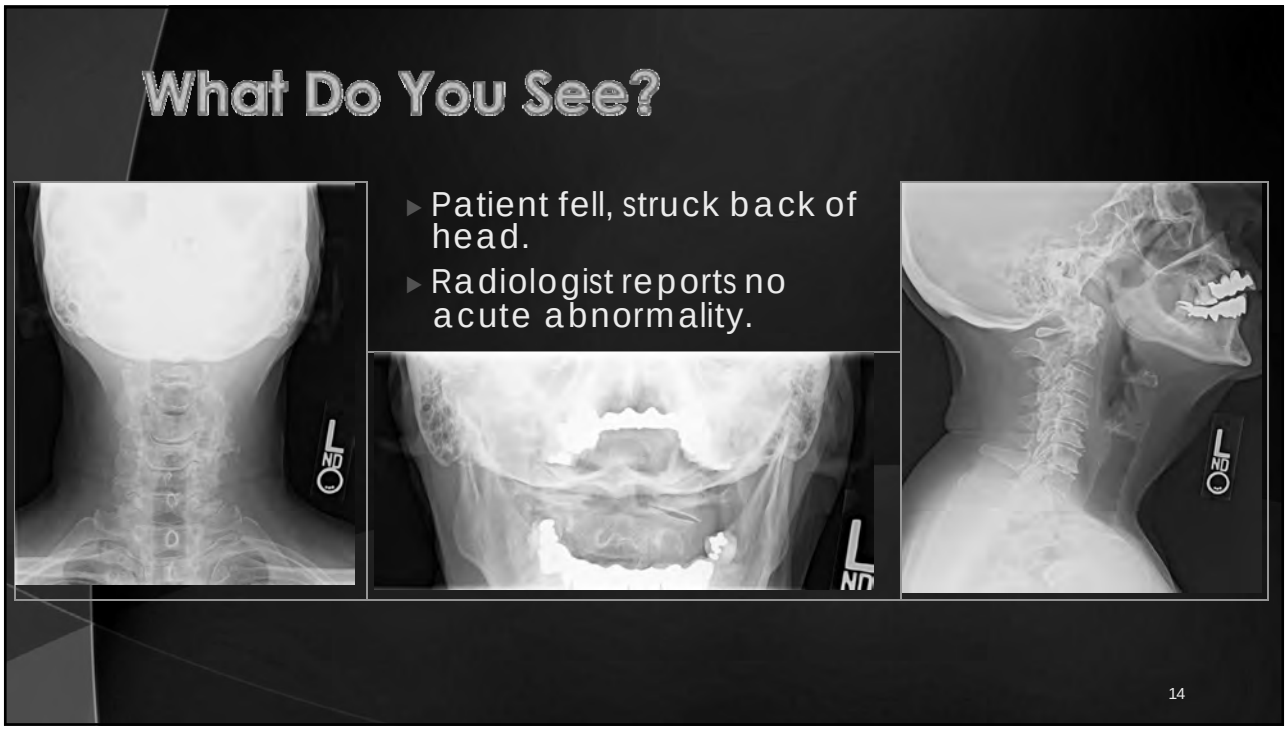
What Do You See?
Patient fell, struck back of head.
Radiologist reports no acute abnormality.
14

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NCMIC

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Integrative Care Confirms Fracture in Elderly Patient

Madge Peterson, 77, fell in her garage and struck the back of her head on the concrete floor. She did not lose consciousness. Due to head and neck pain, she sought the care of her primary care physician (PCP).

Posted in Examiner Publication on Wednesday, May 12, 2021

About the Author

Dr. James Demetrious is a distinguished Fellow of the International Academy of Neuromusculoskeletal Medicine and Chiropractic Orthopedic Diplomate. He teaches advanced post-graduate chiropractic coursework throughout the U.S. on behalf of the NCMIC Speakers' Bureau. He conducts a private practice in Wilmington, North Carolina.

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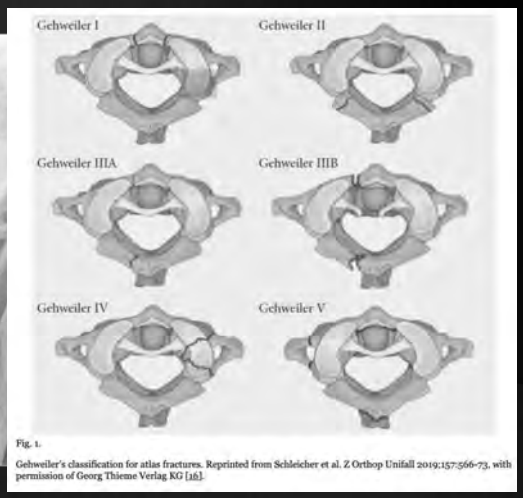

Fig. 1.

Gehweiler's classification for atlas fractures. Reprinted from Schleicher et al. Z Orthop Unfall 2019;157:566-73, with permission of Georg Thieme Verlag KG [16].

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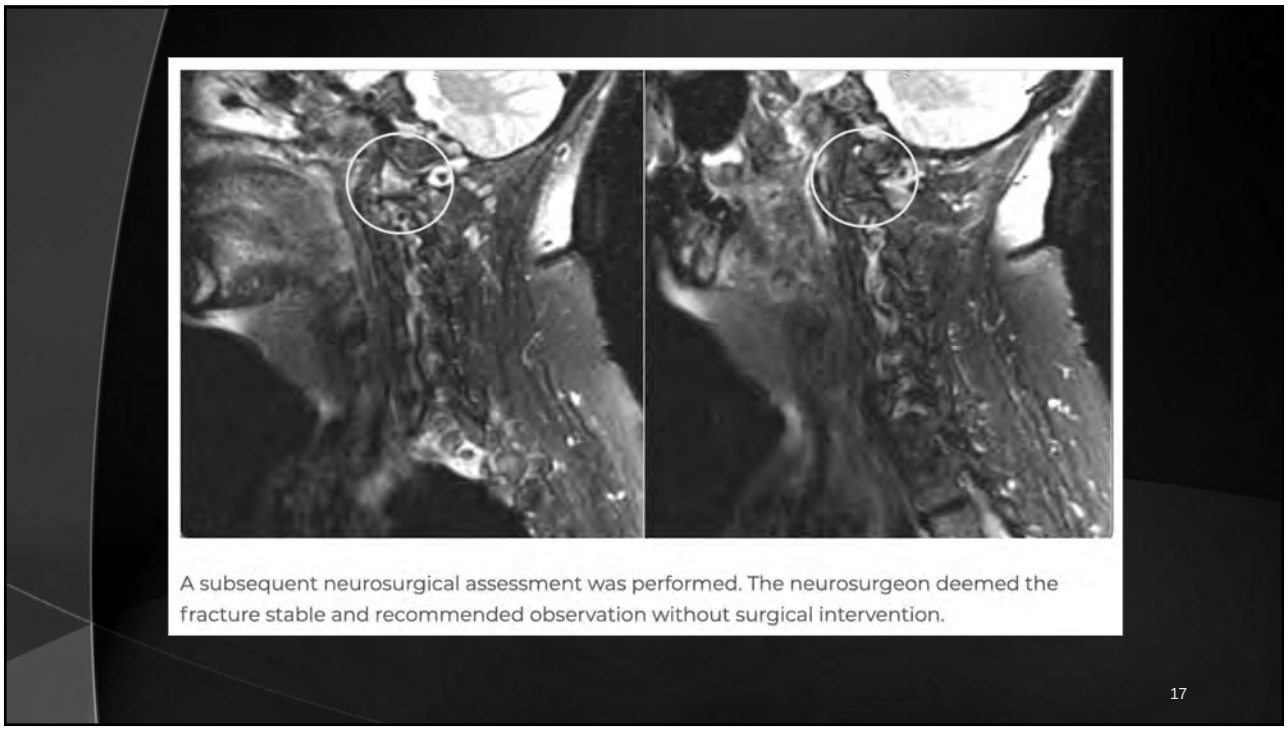
A subsequent neurosurgical assessment was performed. The neurosurgeon deemed the fracture stable and recommended observation without surgical intervention.
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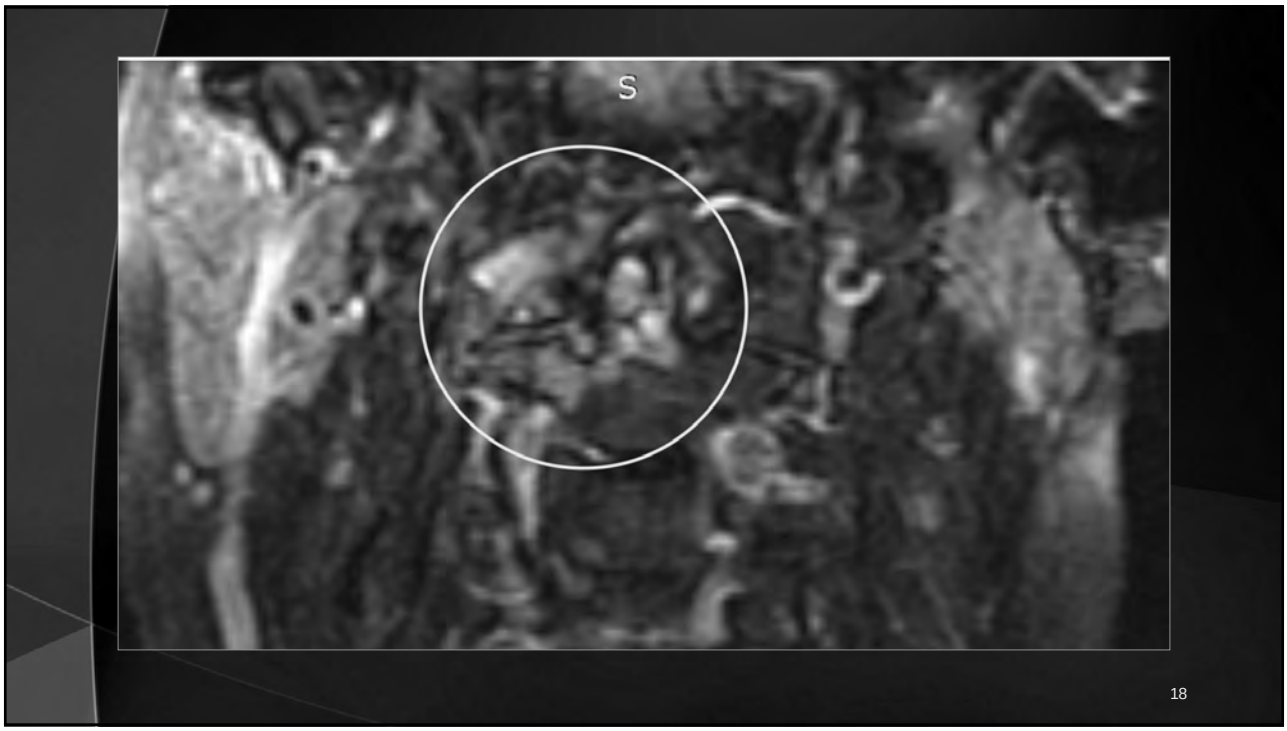
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Interesting Case...
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ASTR
Ann Surg Treat Res. 2015 Feb; 88(2): 111–113.
Published online 2015 Jan 27. doi: 10.4174/astr.2015.88.2.111
PMCID: PMC4325849
PMID: 25692123
A rare nonincisional lateral abdominal wall hernia
Dong-Ju Kim and Jin-Woo Park
Fig. 1
Radiologic findings of lateral abdominal wall defect. Abdominopelvic CT scan showed omental fat herniation through lateral abdominal wall defect of transversus abdominis muscle and internal oblique muscle (A) at right flank just below costal margin (B).
H
C
L
Fig. 2
Laparoscopic view of lateral abdominal wall defect. Laparoscopic exploration of abdomen revealed omental herniation through lateral abdominal wall defect measuring 6.5 cm × 6 cm. Peritoneal lining of hernia sac was smooth and there was no evidence of inflammation or adhesion. L, liver; C, costal margin; H, hernia sac.
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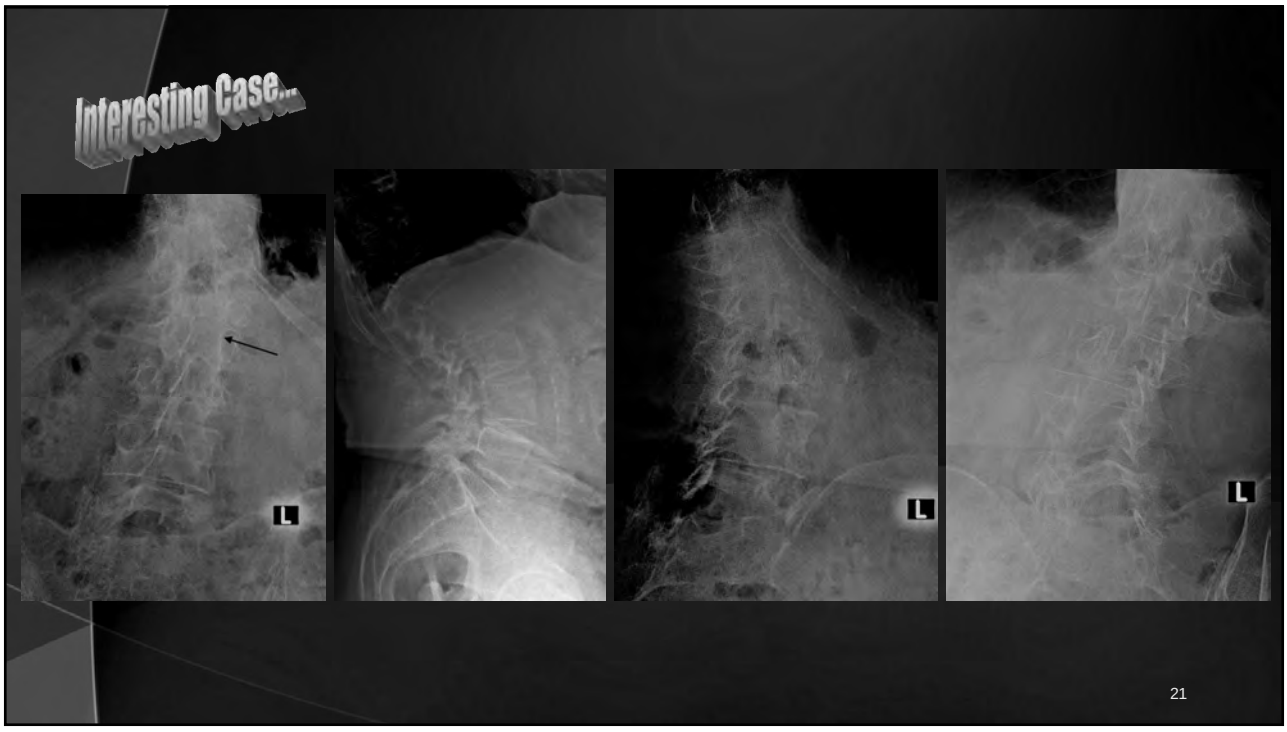
Interesting Case...
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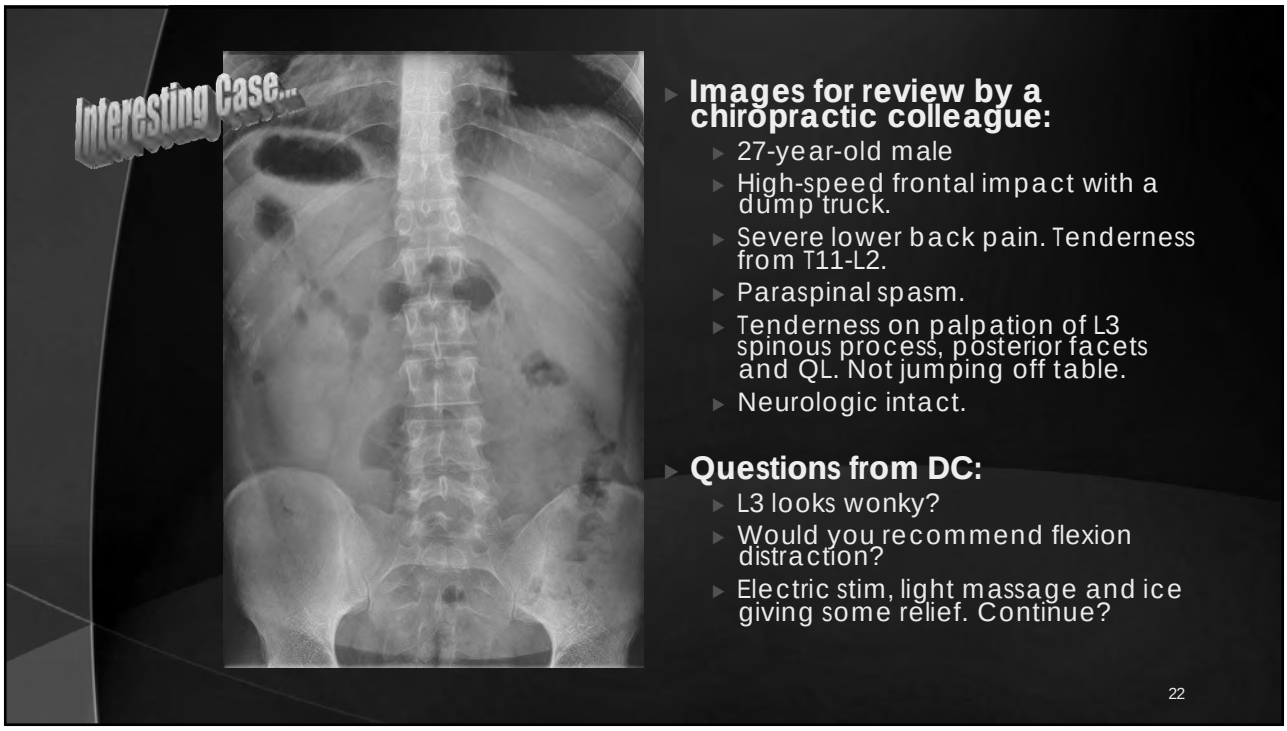
Interesting Case...
Images for review by a chiropractic colleague:
27-year-old male
High-speed frontal impact with a dump truck.
Severe lower back pain. Tenderness from T11-L2.
Paraspinal spasm.
Tenderness on palpation of L3 spinous process, posterior facets and QL. Not jumping off table.
Neurologic intact.
Questions from DC:
L3 looks wonky?
Would you recommend flexion distraction?
Electric stim, light massage and ice giving some relief. Continue?
22

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Variant 9: **Age greater than or equal to 16 years. Blunt trauma meeting criteria for thoracic and lumbar imaging. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
CT thoracic and lumbar spine without IV contrast	Usually Appropriate	☢☢☢
Radiography thoracic and lumbar spine	May Be Appropriate	☢☢☢
CT myelography thoracic and lumbar spine	Usually Not Appropriate	☢☢☢☢
CT thoracic and lumbar spine with IV contrast	Usually Not Appropriate	☢☢☢
CT thoracic and lumbar spine without and with IV contrast	Usually Not Appropriate	☢☢☢☢
MRI thoracic and lumbar spine without and with IV contrast	Usually Not Appropriate	O
MRI thoracic and lumbar spine without IV contrast	Usually Not Appropriate	O

Variant 10: **Age greater than or equal to 16 years. Acute thoracic or lumbar spine injury detected on radiographs or noncontrast CT. Neurologic abnormalities. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI thoracic and lumbar spine without IV contrast	Usually Appropriate	O
CT myelography thoracic and lumbar spine	May Be Appropriate	☢☢☢☢
CT thoracic and lumbar spine with IV contrast	Usually Not Appropriate	☢☢☢
CT thoracic and lumbar spine without and with IV contrast	Usually Not Appropriate	☢☢☢☢
MRI thoracic and lumbar spine without and with IV contrast	Usually Not Appropriate	O

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Revised 2018

American College of Radiology
ACR Appropriateness Criteria®
Suspected Spine Trauma

Table 4. Comparison of Suggested Criteria for Imaging of Thoracolumbar Spine in Trauma Patients

Hsu et al (2003) [19]	Holmes et al (2003) [20]	Inaba et al (2015) [21]
• Back or midline tenderness	• Complaint of thoracolumbar pain	• Positive physical examination*
• Local signs of thoracolumbar injury	• Thoracolumbar tenderness to palpation	• High-risk mechanism of injury**
• Abnormal neurologic signs	• Neurologic deficit	• Neurologic deficit
• GCS <15	• GCS <15	• GCS <15†
• Major distracting injury	• Major distracting injury	• Painful distracting injury†
• Intoxication	• Intoxication	• Intoxication†
• Cervical spine fracture		• Age >60 years

* Positive physical examination findings defined as pain, tenderness to palpation, or deformity.
** High-risk mechanism of injury defined as fall, crush injury, motor vehicle collision with rollover and/or ejection, unenclosed vehicle crash, and automobile vs pedestrian.
† Patients with GCS <15, painful distracting injury, and intoxication were excluded from the study because of their inability to perform adequate examination.

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- **My chiropractic orthopedic recommendations:**
  - Refer to medical orthopedist.
  - Recommend CT-lumbar spine without contrast per ACR criteria.
  - Immediately discontinue all chiropractic care, pending CT.
- **Follow-up with patient's primary care physician:**
  - PCP recommended no follow-up CT. Did not see L3 superior end plate disruption.
  - Upon Chiropractor and attorney urging, PCP acquiesced and ordered CT scan.

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- **CT Lumbar Spine:**
  - Radiologist's report:
    - Comminuted fracture of L3vertebral body.
  - Orthopedic surgeon:
    - Comminuted fracture of L3 vertebral body.
    - L2 posterior body fracture without intrusion into posterior column.
    - Recommended:
      - **Pain medications**, Brace, Light duty, no lifting >5#.
- **Chiropractic Orthopedic Recommendation?**
  - Discuss case with medical orthopedist.
  - Evaluate and treat neuromusculoskeletal issues distal from fracture sites.
  - Spinal care >3 months of fracture site if neuro/ortho stabile?

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Revised 2018

American College of Radiology
ACR Appropriateness Criteria®
Suspected Spine Trauma

Variant 1: **Age greater than or equal to 16 years and less than 65 years. Suspected acute blunt cervical spine trauma; imaging not indicated by NEXUS or CCR clinical criteria. Patient meets low-risk criteria. Initial imaging.**

National Emergency X-Radiography Utilization Study (NEXUS)

Table 1. NEXUS Criteria for Cervical Spine Imaging [4]
• Focal neurologic deficit
• Midline spinal tenderness
• Altered level of consciousness
• Intoxication
• Distracting injury

Table 2. CCR High-Risk Factors for Cervical Spine Injury [5]
• Age >65 years
• Paresthesias in extremities
• Dangerous mechanism
▪ Falls from ≥3 feet/5 stairs
▪ Axial load to head
▪ Motor vehicle crash with high speed, rollover, or ejection
▪ Bicycle collision
▪ Motorized recreational vehicle accident

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Introduction

"Successful health care hinges upon a thorough history and carefully performed examination. There are no shortcuts."

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Myth exploded

CASE REPORT

Vertebral artery dissection in evolution found during chiropractic examination

Dan Futch,[1] Michael J Schneider,[2] Donald Murphy,[3] Allison Grayev[4]

"Based on the history of sudden onset of **severe upper cervical pain and headache with visual disturbance and ocular numbness**, the DC was concerned about the possibility of early VAD. Urgent MR angiography (MRA) of the neck and head, along with MRI of the head, was ordered. No cervical spine examination or manipulation was performed…"

Futch D, et al. BMJ Case Rep 2015. doi:10.1136/bcr-2015-212568

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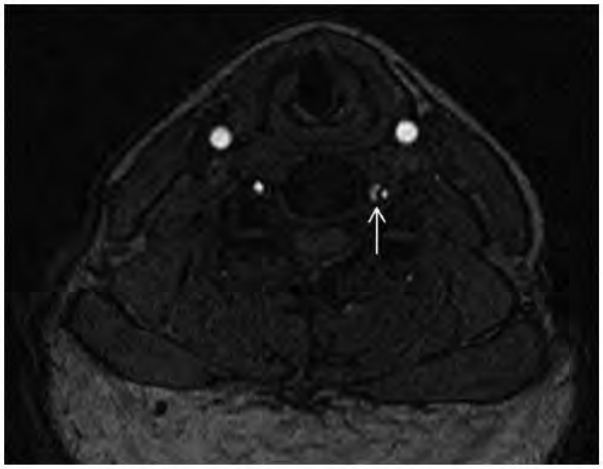

Figure 2 Axial image from three-dimensional time-of-flight MRA demonstrates T1 hypointense dissection flap separating the true lumen (lateral) from the false lumen (medial). MRA, MR angiography.

Futch D, et al. BMJ Case Rep 2015. doi:10.1136/bcr-2015-212568

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Journal of Chiropractic Medicine (2015) 14, 183–190

ELSEVIER

JOURNAL of CHIROPRACTIC MEDICINE

www.journalchiromed.com

Topics in Diagnostic Imaging

Chiropractic Response to a Spontaneous Vertebral Artery Dissection

Gary Tarola DC [a], Reed B. Phillips DC, PhD [b,*]

[a] *Private Practice, Lehigh Valley Medical Network, Allentown, PA*
[b] *Adjunct Faculty, Southern California University of Health Sciences, Whittier, CA*

Received 28 March 2015; received in revised form 13 October 2015; accepted 13 October 2015

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- A 34-year old white woman reported to a chiropractic clinic with a constant burning pain at the right side of her neck and shoulder with a limited ability to turn her head from side to side, periods of **blurred vision, and muffled hearing.**
- **Dizziness, visual and auditory disturbances, and balance difficulty** abated within 1 hour of onset and were not present at the time of evaluation.
- A pain drawing indicated burning pain in the suboccipital area, neck, and upper shoulder on the right and a pins and needles sensation on the dorsal surface of both forearms.
- Turning her head from side-to-side aggravated the pain, and the application of heat brought temporary relief.
- The Neck Disability Index score of 44 placed the patient's **pain in the most severe category.**

Journal of Chiropractic Medicine (2015) 14, 183–190

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Journal of Chiropractic Medicine (2014) 13, 90–95

ELSEVIER

JOURNAL of CHIROPRACTIC MEDICINE

www.journalchiromed.com

Recognition of Spontaneous Vertebral Artery Dissection Preempting Spinal Manipulative Therapy: A Patient Presenting With Neck Pain and Headache for Chiropractic Care

Ross Mattox DC [a,*], Linda W. Smith DC [b], Norman W. Kettner DC, DACBR, FICC [c]

[a] *Diagnostic Imaging Resident, Department of Radiology, Logan University, Chesterfield, MO*
[b] *Chiropractic Physician, Private Practice, St. Louis, MO*
[c] *Chair, Department of Radiology, Logan University, Chesterfield, MO*

Received 22 January 2014; received in revised form 13 April 2014; accepted 16 April 2014

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- A 45-year-old otherwise healthy female presented for evaluation and treatment of neck pain and headache.
- Within minutes, non-specific musculoskeletal symptoms progressed to **neurological deficits, including limb ataxia and cognitive disturbances.**
- Suspicion was raised for cerebrovascular ischemia and emergent referral was initiated.

Journal of Chiropractic Medicine (2014) **13**, 90–95

35

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CAD Risk Factors?

- Open Neurol J. 2010; 4: 50–55. Cervical Artery Dissection: Emerging Risk Factors
  - Primary disease of arterial wall (fibrodysplasia), Ehlers Danlos-syndrome IV, Marfan's syndrome, vessel tortuosity, recent respiratory tract infection, migraine, hyperhomocysteinemia, major head/neck trauma like chiropractic maneuver, coughing or hyperextension injury associated to car.
- Lancet Neurol. 2009 Jul;8(7):668-78. Cervical-artery dissections: predisposing factors, diagnosis, and outcome.
  - Trauma to the neck, infection, migraine, hyperhomocysteinaemia, underlying arteriopathy
- Stroke. 2005 Jul;36(7):1575-80. A systematic review of the risk factors for cervical artery dissection.
  - aortic root diameter >34 mm, trauma, homocysteine, and recent infection.

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Journal of Athletic Training 2014;49(3):422–427
doi: 10.4085/1062-6050-49.2.09

www.natajournals.org

systematic review

Fluoroquinolones and Tendinopathy: A Guide for Athletes and Sports Clinicians and a Systematic Review of the Literature

Trevor Lewis, MSc, MCSP*; Jill Cook, PhD†

*Physiotherapy Department, Aintree University Hospital National Health Service Foundation Trust, University Hospital Aintree, Liverpool, United Kingdom; †Department of Physiotherapy, Monash University–Peninsula Campus, Frankson, Victoria, Australia

Key Points

- Tendinopathy can be a complication of treatment with fluoroquinolone antibiotics and usually is linked with 1 or more synergistic factors.
- Symptoms of fluoroquinolone-related tendinopathy can present within hours of starting treatment or up to 6 months after ceasing treatment, and recovery can be slower and require a less aggressive approach early in rehabilitation than for other types of tendinopathy.
- Treatment with fluoroquinolones should be discontinued and treatment with a nonquinolone antibiotic should be considered in patients who present with tendinopathy.
- Clinicians, athletes, athletic trainers, and medical support teams should be aware of and alert to the potential adverse effects of fluoroquinolones.

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Unidentified Etiology of Cervical Artery Dissection?...
Fluoroquinolones...

Open Access Research

BMJ Open

Fluoroquinolones and collagen associated severe adverse events: a longitudinal cohort study

Nick Daneman,[1,2,3,4] Hong Lu,[1] Donald A Redelmeier[1,2,3,5]

To cite: Daneman N, Lu H, Redelmeier DA. Fluoroquinolones and collagen associated severe adverse events: a longitudinal cohort study. *BMJ Open* 2015;5:e010077. doi:10.1136/bmjopen-2015-010077

► Prepublication history for this paper is available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2015-010077).

ABSTRACT

Objectives: Fluoroquinolone-associated tendon ruptures are a recognised complication, but other severe collagen-associated adverse events may also be possible. Our objectives were to confirm the association of fluoroquinolones and tendon rupture, to clarify the potential association of fluoroquinolones and retinal detachment, and to test for a potentially lethal association between fluoroquinolones and aortic aneurysms.

Setting: Population-based longitudinal cohort study in Ontario, Canada.

Participants: Older adults turning 65 years between April 1 1997 and March 31 2012 were followed until primary outcome, death, or end of follow-up (March 31

Strengths and limitations of this study

- This study reports a novel and important association of fluoroquinolone prescriptions with aortic aneurysms.
- The study design involves a population-based, longitudinal analysis of 1.7 million older adults.
- The findings are robust across multiple sensitivity, subgroup and tracer analyses.
- Misclassification of fluoroquinolone exposure is possible, if some patients did not use their dispensed prescriptions.
- Underdetection of mild or asymptomatic outcome events is possible.

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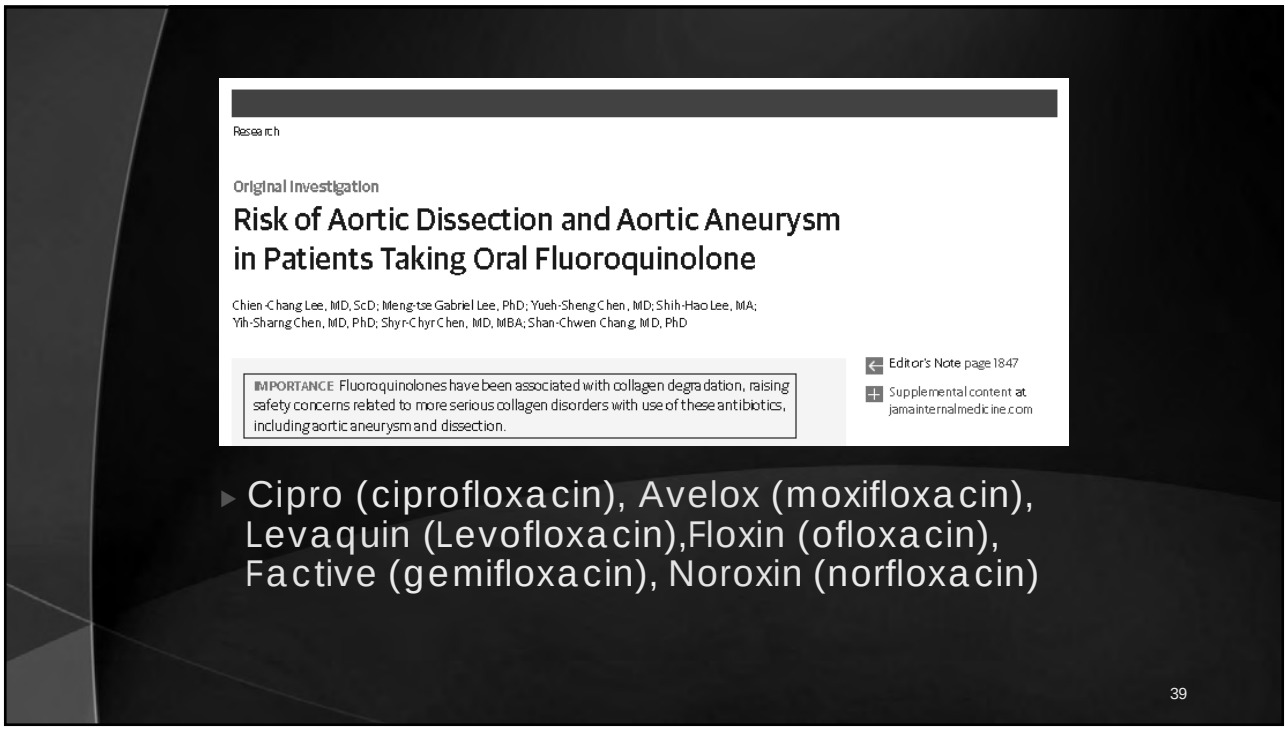

Research

Original Investigation

Risk of Aortic Dissection and Aortic Aneurysm in Patients Taking Oral Fluoroquinolone

Chien-Chang Lee, MD, ScD; Meng-tse Gabriel Lee, PhD; Yueh-Sheng Chen, MD; Shih-Hao Lee, MA; Yih-Sharng Chen, MD, PhD; Shyr-Chyr Chen, MD, MBA; Shan-Chwen Chang, MD, PhD

IMPORTANCE Fluoroquinolones have been associated with collagen degradation, raising safety concerns related to more serious collagen disorders with use of these antibiotics, including aortic aneurysm and dissection.

Editor's Note page 1847

Supplemental content at jamainternalmedicine.com

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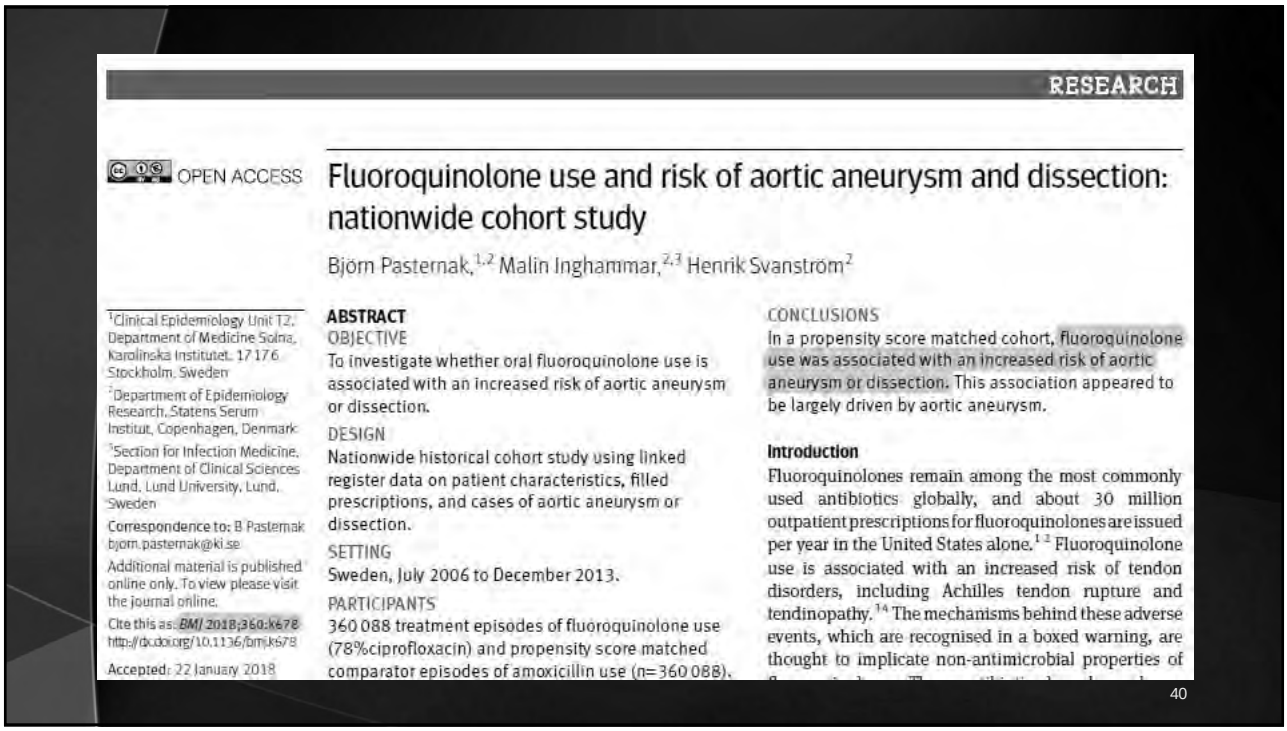

RESEARCH

OPEN ACCESS

Fluoroquinolone use and risk of aortic aneurysm and dissection: nationwide cohort study

Björn Pasternak,[1,2] Malin Inghammar,[2,3] Henrik Svanström[2]

[1]Clinical Epidemiology Unit T2, Department of Medicine Solna, Karolinska Institutet, 17176 Stockholm, Sweden
[2]Department of Epidemiology Research, Statens Serum Institut, Copenhagen, Denmark
[3]Section for Infection Medicine, Department of Clinical Sciences Lund, Lund University, Lund, Sweden
Correspondence to: B Pasternak bjorn.pasternak@ki.se

Additional material is published online only. To view please visit the journal online.
Cite this as: BMJ 2018;360:k678 http://dx.doi.org/10.1136/bmj.k678
Accepted: 22 January 2018

ABSTRACT

OBJECTIVE
To investigate whether oral fluoroquinolone use is associated with an increased risk of aortic aneurysm or dissection.

DESIGN
Nationwide historical cohort study using linked register data on patient characteristics, filled prescriptions, and cases of aortic aneurysm or dissection.

SETTING
Sweden, July 2006 to December 2013.

PARTICIPANTS
360 088 treatment episodes of fluoroquinolone use (78% ciprofloxacin) and propensity score matched comparator episodes of amoxicillin use (n=360 088),

CONCLUSIONS
In a propensity score matched cohort, fluoroquinolone use was associated with an increased risk of aortic aneurysm or dissection. This association appeared to be largely driven by aortic aneurysm.

Introduction

Fluoroquinolones remain among the most commonly used antibiotics globally, and about 30 million outpatient prescriptions for fluoroquinolones are issued per year in the United States alone.[1 2] Fluoroquinolone use is associated with an increased risk of tendon disorders, including Achilles tendon rupture and tendinopathy.[3 4] The mechanisms behind these adverse events, which are recognised in a boxed warning, are thought to implicate non-antimicrobial properties of

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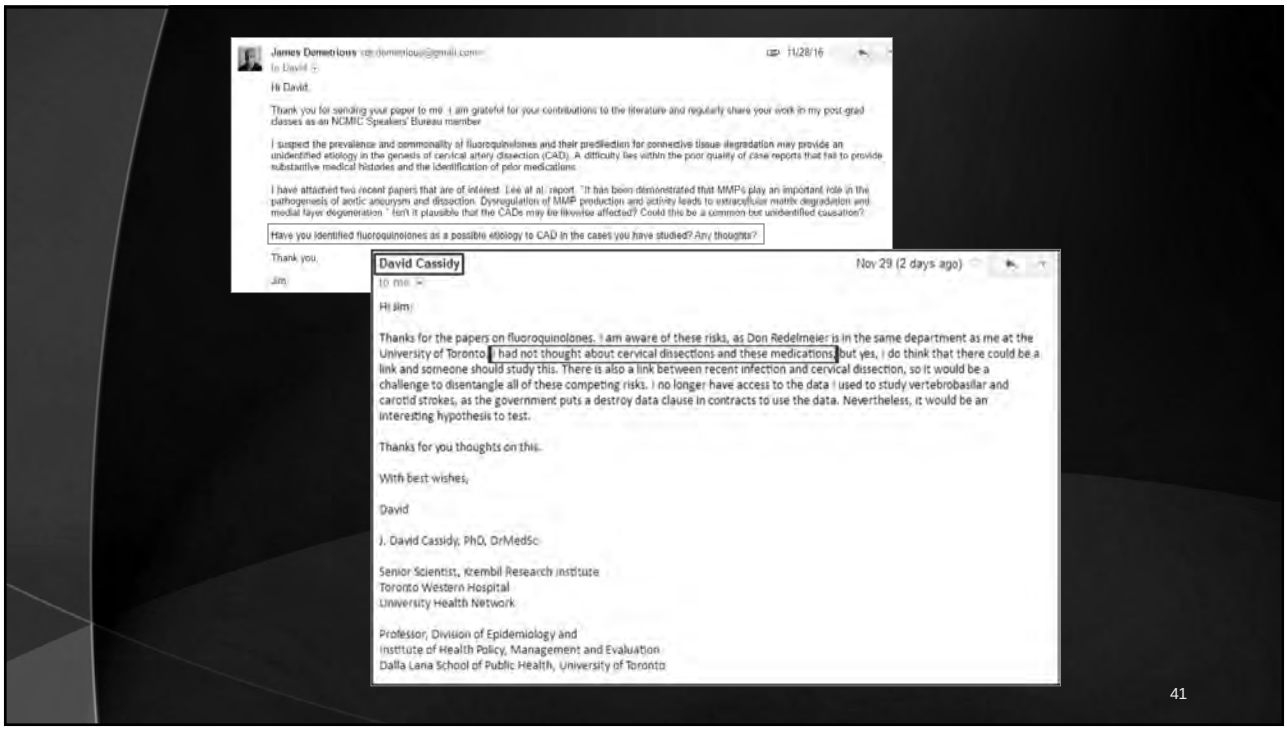
James Demetrious
11/28/16
to David
Hi David,
Thank you for sending your paper to me. I am grateful for your contributions to the literature and regularly share your work in my post-grad classes as an NCMIC Speakers' Bureau member.
I suspect the prevalence and commonality of fluoroquinolones and their predilection for connective tissue degradation may provide an unidentified etiology in the genesis of cervical artery dissection (CAD). A difficulty lies within the poor quality of case reports that fail to provide substantive medical histories and the identification of prior medications.
I have attached two recent papers that are of interest. Lee et al. report: "It has been demonstrated that MMP4 play an important role in the pathogenesis of aortic aneurysm and dissection. Dysregulation of MMP production and activity leads to extracellular matrix degradation and medial layer degeneration." Isn't it plausible that the CADs may be likewise affected? Could this be a common but unidentified causation?
Have you identified fluoroquinolones as a possible etiology to CAD in the cases you have studied? Any thoughts?
Thank you.
Jim
David Cassidy
Nov 29 (2 days ago)
to me
Hi Jim,
Thanks for the papers on fluoroquinolones. I am aware of these risks, as Don Redelmeier is in the same department as me at the University of Toronto. I had not thought about cervical dissections and these medications, but yes, I do think that there could be a link and someone should study this. There is also a link between recent infection and cervical dissection, so it would be a challenge to disentangle all of these competing risks. I no longer have access to the data I used to study vertebrobasilar and carotid strokes, as the government puts a destroy data clause in contracts to use the data. Nevertheless, it would be an interesting hypothesis to test.
Thanks for you thoughts on this.
With best wishes,
David
J. David Cassidy, PhD, DrMedSc
Senior Scientist, Krembil Research Institute
Toronto Western Hospital
University Health Network
Professor, Division of Epidemiology and
Institute of Health Policy, Management and Evaluation
Dalla Lana School of Public Health, University of Toronto
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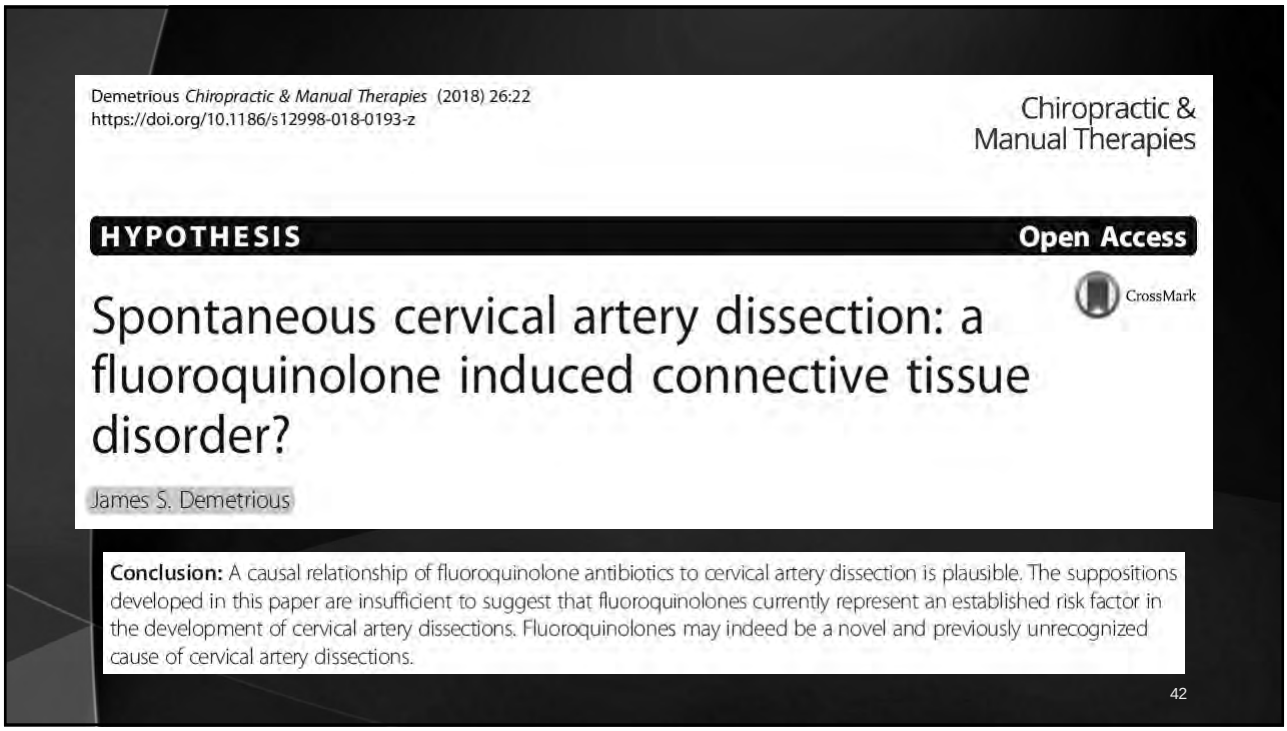
Demetrious Chiropractic & Manual Therapies (2018) 26:22
https://doi.org/10.1186/s12998-018-0193-z
Chiropractic & Manual Therapies
HYPOTHESIS
Open Access
CrossMark
Spontaneous cervical artery dissection: a fluoroquinolone induced connective tissue disorder?
James S. Demetrious
Conclusion: A causal relationship of fluoroquinolone antibiotics to cervical artery dissection is plausible. The suppositions developed in this paper are insufficient to suggest that fluoroquinolones currently represent an established risk factor in the development of cervical artery dissections. Fluoroquinolones may indeed be a novel and previously unrecognized cause of cervical artery dissections.
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Eur J Neurol. 2019 Jul;26(7):1028-1031. doi: 10.1111/ene.13917. Epub 2019 Mar 5

Use of fluoroquinolones and the risk of spontaneous cervical artery dissection.

Del Zotto E[1], Pezzini A[1,2].

Author information

Abstract

BACKGROUND AND PURPOSE: Because of their potential to alter the integrity of collagen and other components of the extracellular matrix, fluoroquinolone antibiotics might be involved in the pathogenesis of spontaneous cervical artery dissection (sCeAD).

METHODS: In the setting of a single-centre case-control study, whether fluoroquinolone use in the 30-day period before the index event is associated with sCeAD (cases) in comparison with a group of age- and sex-matched patients who suffered a first-ever acute cerebral infarction from a cause other than CeAD (non-CeAD IS, controls) was assessed.

RESULTS: Overall, 284 cases (mean age 43.2 ± 10.4 years; 58.5% men) and 568 controls qualified for the analysis. Thirty (10.6%) patients in the sCeAD group and 16 (2.8%) in the non-CeAD IS group were fluoroquinolone users ($P \leq 0.001$). The use of these antibiotics was associated with a more than two-fold increased risk of sCeAD [odds ratio (OR) 2.31; 95% confidence interval (CI) 1.00-5.30] after adjusting for confounders. The risk was more substantial in the subgroup of patients with dissection involving the carotid artery (OR 2.78; 95% CI 1.14-6.78), in females (OR 4.58; 95% CI 1.04-20.1) and compared to that conferred by other antibiotics (OR 2.42; 95% CI 1.02-5.75).

CONCLUSIONS: Fluoroquinolones may represent a novel contributing factor involved in the pathogenesis of sCeAD.

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Introduction

- **T or F** The standard of care in chiropractic requires careful intake, examination, testing utilizing appropriateness criteria/clinical intuitiveness, differential diagnosis, treatment plan, prognosis, informed consent and documentation.
- **T or F** Cranial nerve abnormalities may signify a developing CAD.

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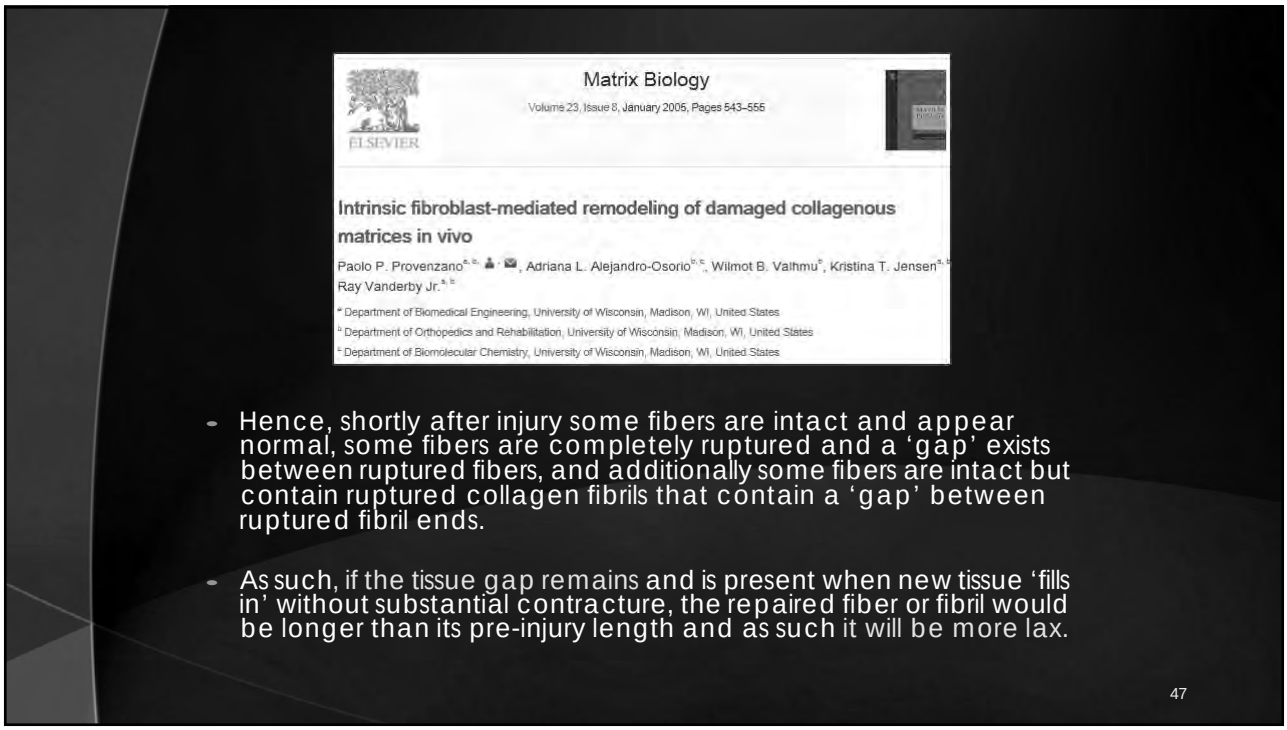
Matrix Biology
Volume 23, Issue 8, January 2005, Pages 543–555
ELSEVIER
Intrinsic fibroblast-mediated remodeling of damaged collagenous matrices in vivo
Paolo P. Provenzano, Adriana L. Alejandro-Osorio, Wilmot B. Valhmu, Kristina T. Jensen, Ray Vanderby Jr.
Department of Biomedical Engineering, University of Wisconsin, Madison, WI, United States
Department of Orthopedics and Rehabilitation, University of Wisconsin, Madison, WI, United States
Department of Biomolecular Chemistry, University of Wisconsin, Madison, WI, United States
Hence, shortly after injury some fibers are intact and appear normal, some fibers are completely ruptured and a 'gap' exists between ruptured fibers, and additionally some fibers are intact but contain ruptured collagen fibrils that contain a 'gap' between ruptured fibril ends.
As such, if the tissue gap remains and is present when new tissue 'fills in' without substantial contracture, the repaired fiber or fibril would be longer than its pre-injury length and as such it will be more lax.
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A
(A) Control tissue.
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(B) Tissue stretched to 7.7% strain showing collagen fiber damage.

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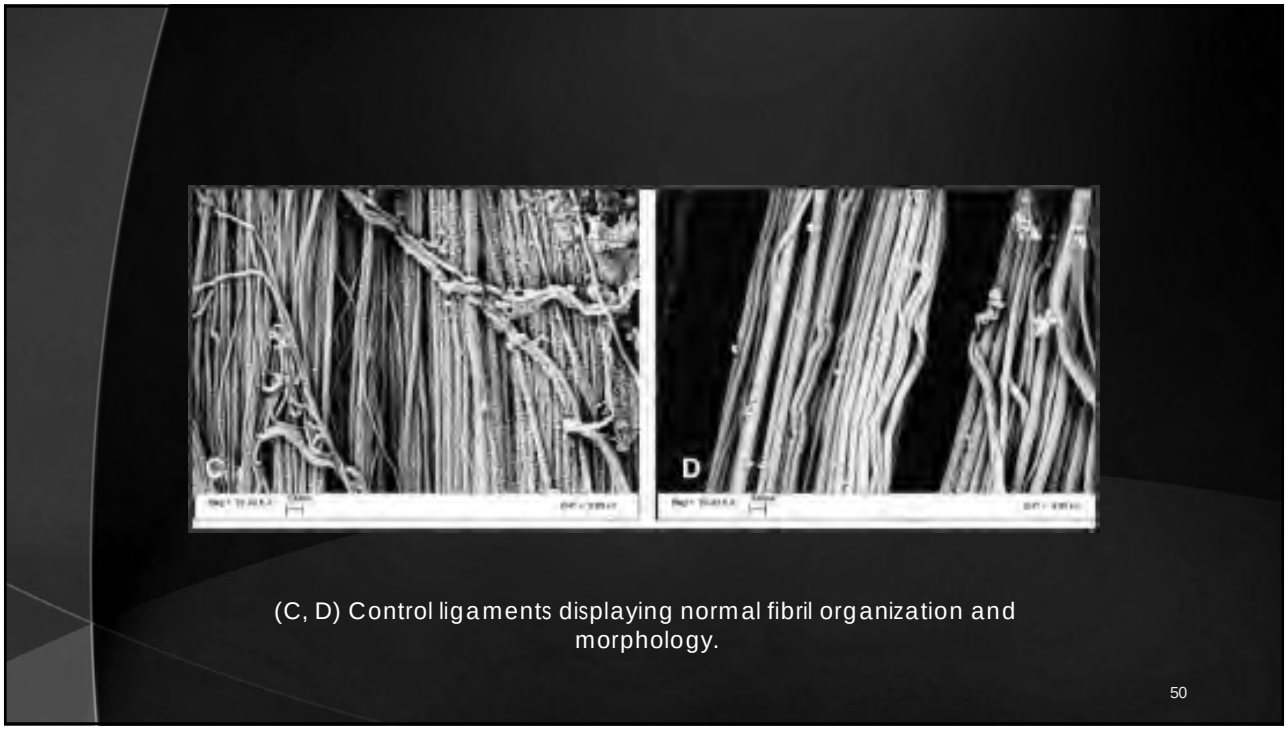

(C, D) Control ligaments displaying normal fibril organization and morphology.

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(E) Tissue stretched to 7.7% strain revealing a region in which collagen fibril morphology and organization appear normal (the collagen fiber that contains this region appeared intact).

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(F) Tissue stretched to 6.7% strain showing substantial fibril disorganization (the fiber that contains this region was ruptured indicating a possible retraction of fibrils).

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(G–H) Tissue stretched to 5.8% strain displaying collagen fibril rupture (the fiber containing this region appeared intact).

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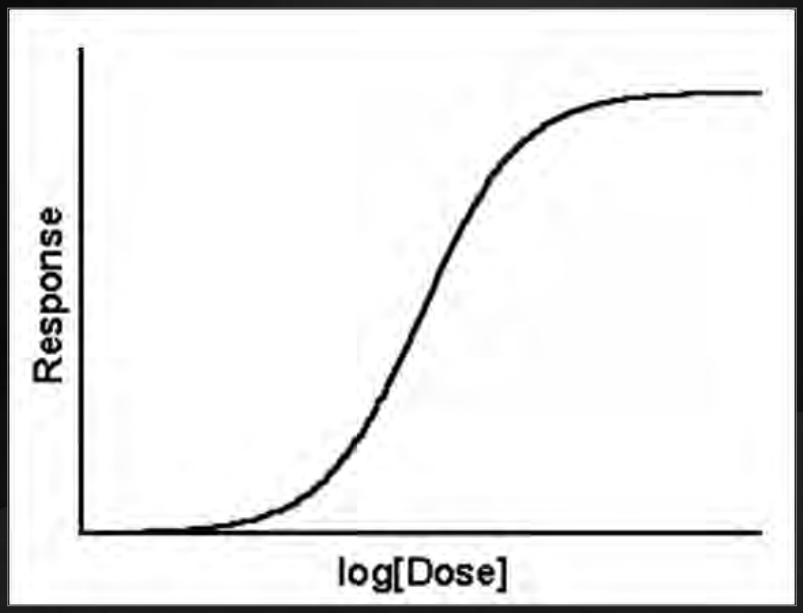

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Tendon Healing: Repair and Regeneration

Pramod B. Voleti,* Mark R. Buckley,*
and Louis J. Soslowsky

McKay Orthopaedic Research Laboratory, Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6081; email: soslowsk@upenn.edu

Annu. Rev. Biomed. Eng. 2012.14:47-71.

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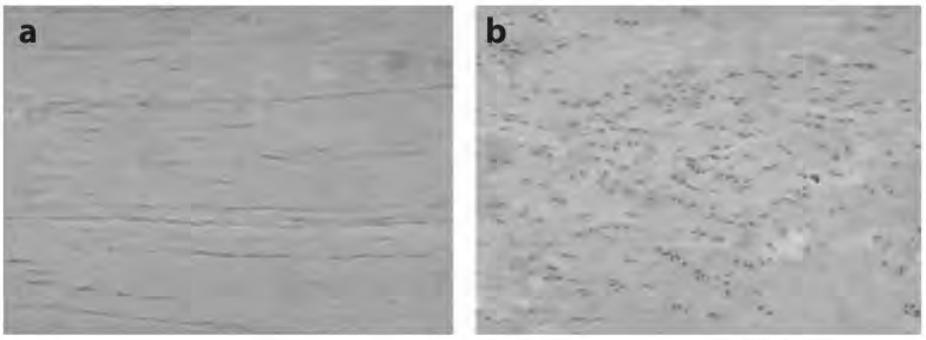

Figure 2

Representative histological sections of rat tendons subject to (*a*) normal cage activity and (*b*) 8 weeks of overuse exercise. The overuse group exhibited typical signs of tendinopathy including increased cellularity and decreased collagen alignment. Reproduced with permission from Reference 27.

Annu. Rev. Biomed. Eng. 2012.14:47-71.

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Stages of Healing in Tendon

The response to tendon injury can be divided into three overlapping stages.

- In the **inflammatory stage**, which typically spans a few days, the wound site is infiltrated by red blood cells, white blood cells (leukocytes), and platelets equipped with important growth factors and endothelial chemo attractants.

- Whereas a fibrin clot is formed to provide temporary stiffness, macrophages digest necrotic debris, and tenocytes are recruited to the wounded area and stimulated to proliferate, particularly in the epitenon.

Annu. Rev. Biomed. Eng. 2012.14:47-71.

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- The **proliferative or repair stage**, begins roughly two days into the injury response.

- This phase of healing is characterized by profuse synthetic activity and is directed by macrophages and tenocytes.

- Macrophages, whose role shifts from phagocytic to reparative a few days after injury, release growth factors and direct cell recruitment.

- Meanwhile, tenocytes deposit a temporary, mechanically inferior matrix composed mostly of collagen III.

Annu. Rev. Biomed. Eng. 2012.14:47-71.

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- The **remodeling phase**, collagen I synthesis begins to dominate, and the extracellular matrix (ECM) becomes more aligned.
- In addition, cell density and general synthetic activity are gradually decreased.
- This phase begins 1–2 months after injury and can last more than a year. The repaired tissue appears scar-like and **never completely regains the biomechanical properties it had prior to injury.**

Annu. Rev. Biomed. Eng. 2012.14:47-71.

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Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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ELSEVIER

FASCIA SCIENCE AND CLINICAL APPLICATIONS: HISTORICAL PERSPECTIVE

Fascia Research Congress Evidence from the 100 year perspective of Andrew Taylor Still

CrossMark

Thomas W. Findley, MD PhD [a,b,*], Mona Shalwala, MS-IV [c]

[a] VA Medical Center East Orange NJ, Mailstop 129, 385 Tremont St., East Orange, NJ 07018, USA
[b] Physical Medicine, UMDNJ-New Jersey Medical School, Newark, NJ, USA
[c] Touro College of Osteopathic Medicine, 230 W 125th St. #1, New York, NY 10027, USA

Received 5 May 2013; accepted 8 May 2013

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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- Manual therapy techniques treat the fascial layers by altering density, tonus, viscosity, and the arrangement of fascia (Crane et al., 2012; Pohl, 2010; Simmonds et al., 2012).
- The fascial system is now being recognized as the etiology of pain and proprioception.
- Myofascial trigger points are local thickenings of individual muscle fibers that are caused by contractions of a small group of sarcomeres (Siegfried Mense, 2008).

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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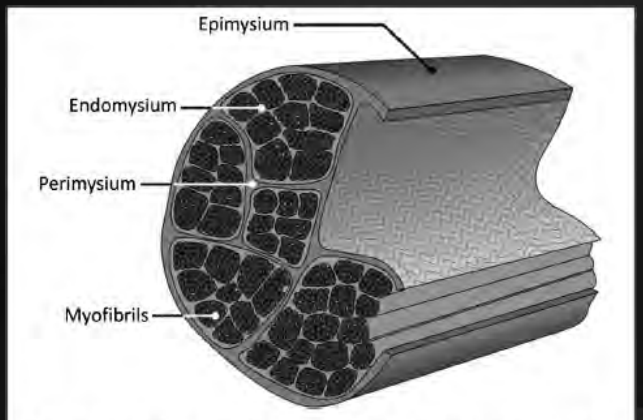

Figure 1 Schematic diagram of Intramuscular-extracellular matrix (IM-ECM) structures in a skeletal muscle. Epimysium delineates the surface of the muscle, perimysium separates muscle fascicles and endomysium separates individual muscle fibres. Also depicted are the contractile myofibrils within each muscle fibre. (Artwork: Dr. L.-T. Lim). From Purslow (2010).

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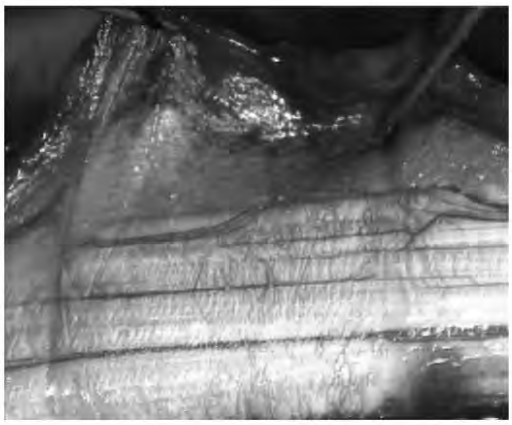

Figure 4 When the tendon moves, its movement is barely discernible in the neighboring tissue. The tendon may go far and fast without any hindrance. There is a micro-anatomical network between the tendon and the peripheral system which prevents a clear field of dissection between the para-tendon and the tendon while at the same time it allows sliding. From Guimberteau et al. (2010).

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Figure 2

(a) Scar modelling technique based in axial and compressive vectors.

(b) Contact phase: initial vector compression maintained by the finger flexor tone of the second, third and fourth fingers.

(c) Stimulation phase using spiroid/circular vector to generate a maintained tension against a sense of resistance.

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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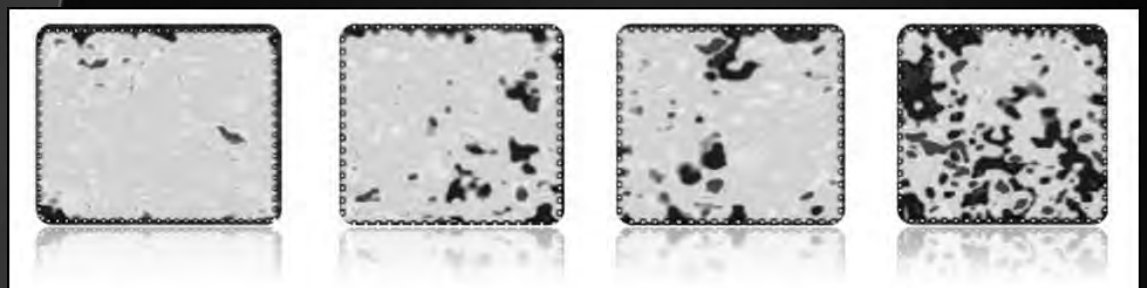

Figure 6 Images of the degrees of liver fibrosis compared with fibrosis stages Images become more uniform, and hard zones increase, as the disease progresses.

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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Real-time sonoelastography (RTSE)

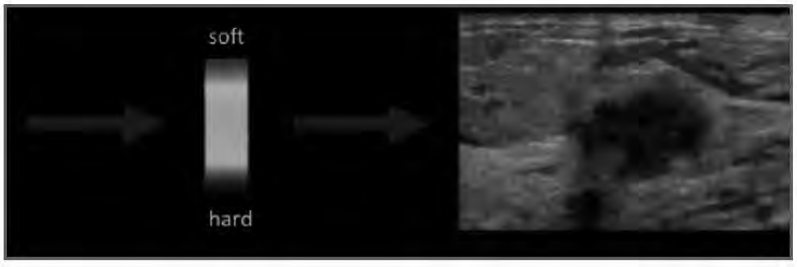

Figure 3 Elastography evaluates the deformation produced by an injury. Tissue hardness is indicated by a color scale.

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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Figure 10 Sonoelastographic control images of a muscle injury over a 3-week evolution taken after 50 min of myofascial treatment. Note the large change in local elasticity as indicated by the color scale.

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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[RESEARCH REPORT]

M. TERRY LOCHMANN, PT, MS1 • STUART J. WARDEN, PT, PhD2

Instrument-Assisted Cross-Fiber Massage Accelerates Knee Ligament Healing

journal of orthopaedic & sports physical therapy | volume 39 | number 7 | july 2009 68

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[RESEARCH REPORT]

M. TERRY LOGHMANI, PT, MS1 • STUART J. WARDEN, PT, PhD

Instrument-Assisted Cross-Fiber Massage Accelerates Knee Ligament Healing

- **CONCLUSION:** IACFM-accelerated ligament healing, possibly via favorable effects on collagen formation and organization, but had minimal effect on the final outcome of healing. These findings are clinically interesting, as there are few established interventions for ligament injuries, and IACFM is a simple and practical therapy technique. *J Orthop Sports Phys Ther 2009;39(7):506-514.*

journal of orthopaedic & sports physical therapy | volume 39 | number 7 | july 2009 69

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Author Manuscript

Published in final edited form as:
Birth Defects Res C Embryo Today. 2013 September ; 99(3): 203–222. doi:10.1002/bdrc.21041.

Tendon and Ligament Regeneration and Repair: Clinical Relevance and Developmental Paradigm

Guang Yang#, Benjamin B. Rothrauff#, and Rocky S. Tuan[1]
Center for Cellular and Molecular Engineering, Department of Orthopaedic Surgery, University of Pittsburgh School of Medicine, Pittsburgh, PA 15219, USA

- At present, injuries to these tissues are treated by surgical repair and/or conservative approaches, including biophysical modalities such as physical rehabilitation and cryotherapy.
- Unfortunately, the healing tissue forms fibrovascular scar and possesses inferior mechanical and biochemical properties as compared to native tendon and ligament.

Birth Defects Res C Embryo Today. 2013 September ; 99(3): 203–222. 70

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Trauma, Biologic Concepts, Connective Tissue

- **T or F** Despite remodeling, the biochemical and mechanical properties of healed tendon tissue never match those of intact tendon.
- **T or F** The stages of tendon healing include in temporal order: Inflammatory, Repair and Remodeling.

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Myositis/Myopathies

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REVIEW

Role of Magnesium in Vitamin D Activation and Function

Anne Marie Uwitonze, BDT, MS; Mohammed S. Razzaque, MBBS, PhD

Table.
Recommended Daily Allowance of Magnesium[49]

Age	Male	Female	Pregnancy
≤6 mo	30 mg	30 mg	...
7-12 mo	75 mg	75 mg	...
1-3 y	80 mg	80 mg	...
4-8 y	130 mg	130 mg	...
9-13 y	240 mg	240 mg	...
14-18 y	410 mg	360 mg*	400 mg
19-30 y	400 mg	310 mg*	350 mg
31-50 y	420 mg	320 mg*	360 mg
≥51 y	420 mg	320 mg	...

* Recommended daily allowance for females who are not pregnant and for females who are lactating.

Electrolyte Disturbance
Hypocalcemia
Hypokalemia
Neuromuscular and Central Nervous System
Athetoid movements & choreiform movements
Carpopedal spasm
Convulsions
Depression, psychosis
Muscle cramps
Muscle weakness, tremors
Nystagmus
Vertigo
Cardiovascular System
Atrial tachycardia, fibrillation
Digoxin sensitivity
Supraventricular arrhythmias
Ventricular arrhythmias
Complications of Magnesium Deficiency
Altered glucose homeostasis
Atherosclerotic vascular disease
Hypertension
Myocardial infarction
Osteoporosis
Miscellaneous
Asthma
Chronic fatigue syndrome
Impaired athletic performance
Migraine

The Journal of the American Osteopathic Association March 2018 | Vol 118 | No. 3

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ORIGINAL RESEARCH

American Heart Association | American Stroke Association.

Serum Magnesium and the Risk of Death From Coronary Heart Disease and Sudden Cardiac Death

Brenda C. T. Kieboom, MD, MSc; Maartje N. Niemeijer, MD, MSc; Maarten J. G. Leening, MD, MSc; Marten E. van den Berg, MD; Oscar H. Franco, MD, PhD, FESC, FFPH; Jaap W. Deckers, MD, PhD, FESC; Albert Hofman, MD, PhD; Robert Zietse, MD, PhD; Bruno H. Stricker, MMed, PhD; Ewout J. Hoorn, MD, PhD

Background—Low serum magnesium has been implicated in cardiovascular mortality, but results are conflicting and the pathway is unclear. We studied the association of serum magnesium with coronary heart disease (CHD) mortality and sudden cardiac death (SCD) within the prospective population-based Rotterdam Study, with adjudicated end points and long-term follow-up.

Methods and Results—Nine-thousand eight-hundred and twenty participants (mean age 65.1 years, 56.8% female) were included with a median follow-up of 8.7 years. We used multivariable Cox proportional hazard models and found that a 0.1 mmol/L increase in serum magnesium level was associated with a lower risk for CHD mortality (hazard ratio: 0.82, 95% CI 0.70–0.96). Furthermore, we divided serum magnesium in quartiles, with the second and third quartile combined as reference group (0.81–0.88 mmol/L). Low serum magnesium (≤0.80 mmol/L) was associated with an increased risk of CHD mortality (N=431, hazard ratio: 1.36, 95% CI 1.09–1.69) and SCD (N=217, hazard ratio: 1.54, 95% CI 1.12–2.11). Low serum magnesium was associated with accelerated subclinical atherosclerosis (expressed as increased carotid intima-media thickness: +0.013 mm, 95% CI 0.005–0.020) and increased QT-interval, mainly through an effect on heart rate (RR-interval: −7.1 ms, 95% CI −13.5 to −0.8). Additional adjustments for carotid intima-media thickness and heart rate did not change the associations with CHD mortality and SCD.

Conclusions—Low serum magnesium is associated with an increased risk of CHD mortality and SCD. Although low magnesium was associated with both carotid intima-media thickness and heart rate, this did not explain the relationship between serum magnesium and CHD mortality or SCD. Future studies should focus on why magnesium associates with CHD mortality and SCD and whether intervention reduces these risks. (*J Am Heart Assoc.* 2016;5:e002707 doi: 10.1161/JAHA.115.002707)

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Review

J Appl Physiol 115: 892–899, 2013.
First published July 18, 2013; doi:10.1152/japplphysiol.00053.2013.

HIGHLIGHTED TOPIC | *Role of Inflammation in Skeletal Muscle, Connective Tissue, and Exertional Injuries: To Block or Not to Block?*

NSAID therapy effects on healing of bone, tendon, and the enthesis

Bailey Su and J. Patrick O'Connor
Rutgers, the State University of New Jersey, New Jersey Medical School, Department of Biochemistry and Molecular Biology, Newark, New Jersey

- Experimental and clinical evidence indicates that NSAID therapy can impair bone fracture healing and tendon to bone (enthesis) healing.
- The effects of NSAIDs on bone and enthesis healing is likely affected by the NSAID used, the initiation, and duration of therapy.

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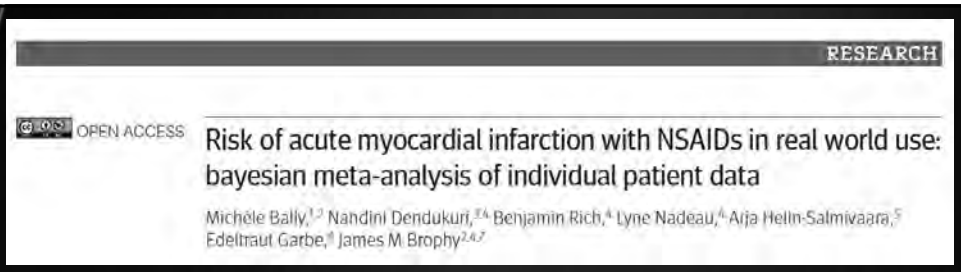
RESEARCH

OPEN ACCESS

Risk of acute myocardial infarction with NSAIDs in real world use: bayesian meta-analysis of individual patient data

Michèle Bally,[1,2] Nandini Dendukuri,[3,4] Benjamin Rich,[4] Lyne Nadeau,[4] Arja Helin-Salmivaara,[5] Edeltraut Garbe,[6] James M Brophy[2,4,7]

- NSAIDs can increase the risk of acute myocardial infarction
- All traditional NSAIDs, including naproxen, appear to be associated with an increased risk of acute myocardial infarction
- Onset of risk occurs in the first week is associated with the
- greatest harms:
  - 8-30 days at a high daily dose (celecoxib >200 mg, diclofenac >100 mg, ibuprofen >1200 mg, and naproxen >750 mg.

BMJ 2017;357:j1909 | the bmj

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- With use for 1 to 7days the probability of increased myocardial infarction risk was:
  - 92% for celecoxib (Celebrex),
  - 97% for ibuprofen (Motrin),
  - 99% for diclofenac (Voltaren), naproxen (Alleve), and rofecoxib (Vioxx).

BMJ 2017;357:j1909 | the bmj

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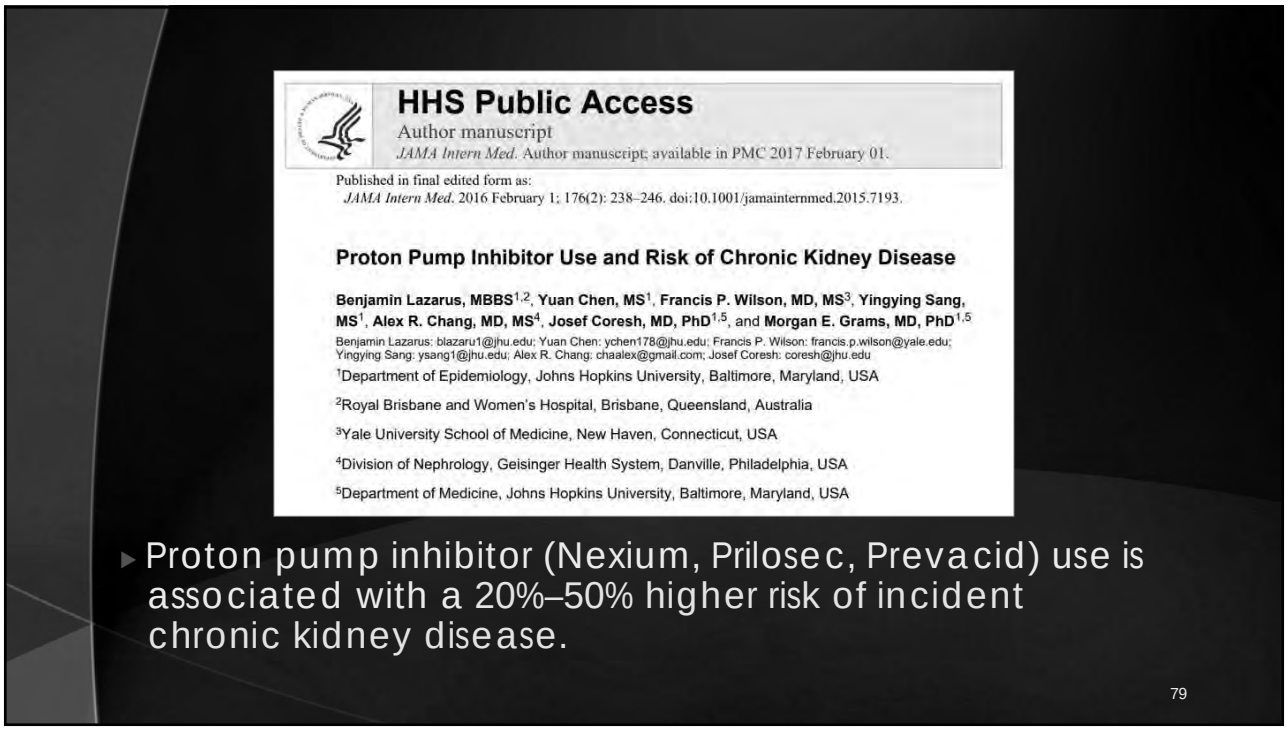

HHS Public Access

Author manuscript

JAMA Intern Med. Author manuscript; available in PMC 2017 February 01.

Published in final edited form as:

JAMA Intern Med. 2016 February 1; 176(2): 238–246. doi:10.1001/jamainternmed.2015.7193.

Proton Pump Inhibitor Use and Risk of Chronic Kidney Disease

Benjamin Lazarus, MBBS[1,2], Yuan Chen, MS[1], Francis P. Wilson, MD, MS[3], Yingying Sang, MS[1], Alex R. Chang, MD, MS[4], Josef Coresh, MD, PhD[1,5], and Morgan E. Grams, MD, PhD[1,5]

Benjamin Lazarus: blazaru1@jhu.edu; Yuan Chen: ychen178@jhu.edu; Francis P. Wilson: francis.p.wilson@yale.edu; Yingying Sang: ysang1@jhu.edu; Alex R. Chang: chaalex@gmail.com; Josef Coresh: coresh@jhu.edu

[1]Department of Epidemiology, Johns Hopkins University, Baltimore, Maryland, USA

[2]Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia

[3]Yale University School of Medicine, New Haven, Connecticut, USA

[4]Division of Nephrology, Geisinger Health System, Danville, Philadelphia, USA

[5]Department of Medicine, Johns Hopkins University, Baltimore, Maryland, USA

- Proton pump inhibitor (Nexium, Prilosec, Prevacid) use is associated with a 20%–50% higher risk of incident chronic kidney disease.

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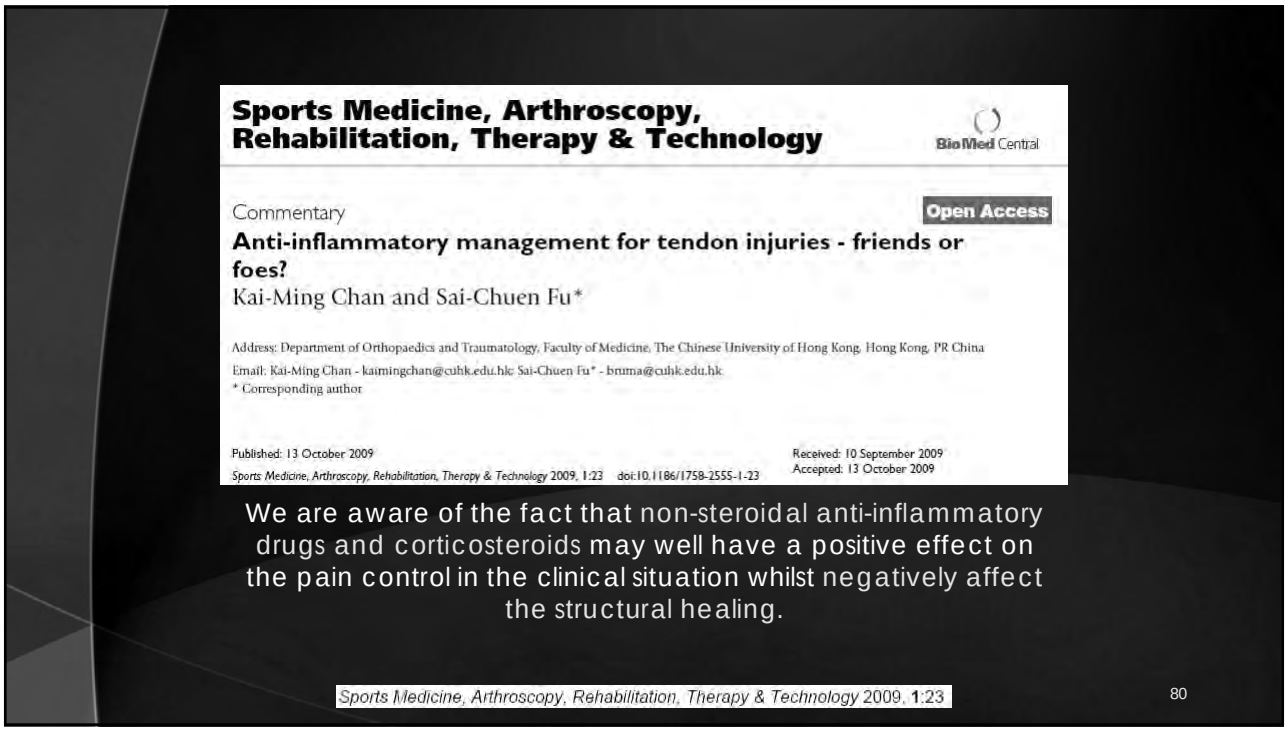

Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology

BioMed Central

Commentary

Open Access

Anti-inflammatory management for tendon injuries - friends or foes?

Kai-Ming Chan and Sai-Chuen Fu*

Address: Department of Orthopaedics and Traumatology, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, PR China

Email: Kai-Ming Chan - kaimingchan@cuhk.edu.hk; Sai-Chuen Fu* - bruma@cuhk.edu.hk

* Corresponding author

Published: 13 October 2009

Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2009, 1:23 doi:10.1186/1758-2555-1-23

Received: 10 September 2009

Accepted: 13 October 2009

We are aware of the fact that non-steroidal anti-inflammatory drugs and corticosteroids may well have a positive effect on the pain control in the clinical situation whilst negatively affect the structural healing.

Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2009, **1**:23

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- Interestingly, both beneficial and deleterious effects of NSAIDs on tendon healing were reported.
- It appears that NSAIDs exerted beneficial effects, if any, by influencing the remodeling of collagen matrix, resulting in reduction of cross-sectional area of the healing tendons but tensile strength may or may not be affected.
- NSAID may also negatively affect early tendon healing, as prostaglandin E2 (PGE2) is essential for early tendon healing such as control of vascular flow.

Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2009, **1**:23

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- The use of corticosteroid may increase risk of spontaneous ruptures and the deleterious effects of corticosteroid were demonstrated on culture human tendon fibroblasts, including cell viability, proliferation and matrix synthesis.
- In spite of its potential hazards, corticosteroid injections are still given indiscriminately in many sport clinics!!
- There is no doubt that the adverse effect of corticosteroids on tendon cells would affect the healing responses to degenerative injuries, corticosteroid injection should be considered as a last resort with careful control on the dosages.

Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2009, **1**:23

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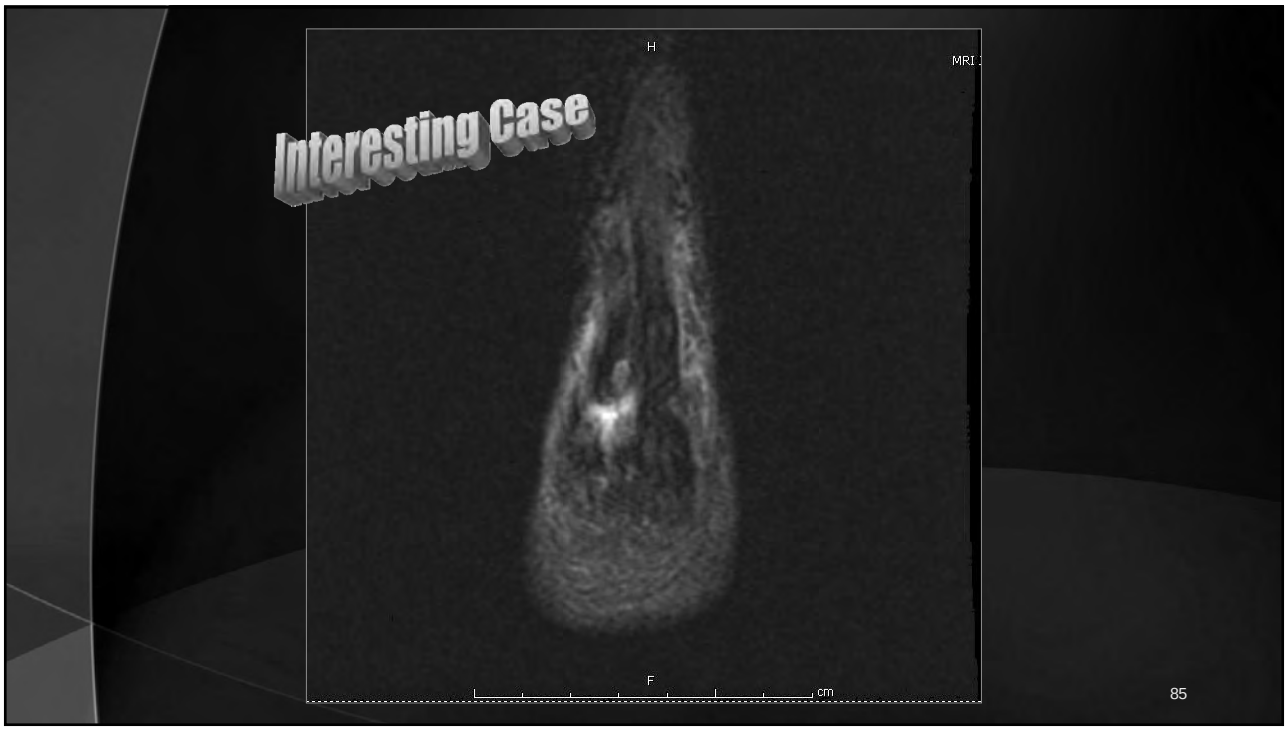

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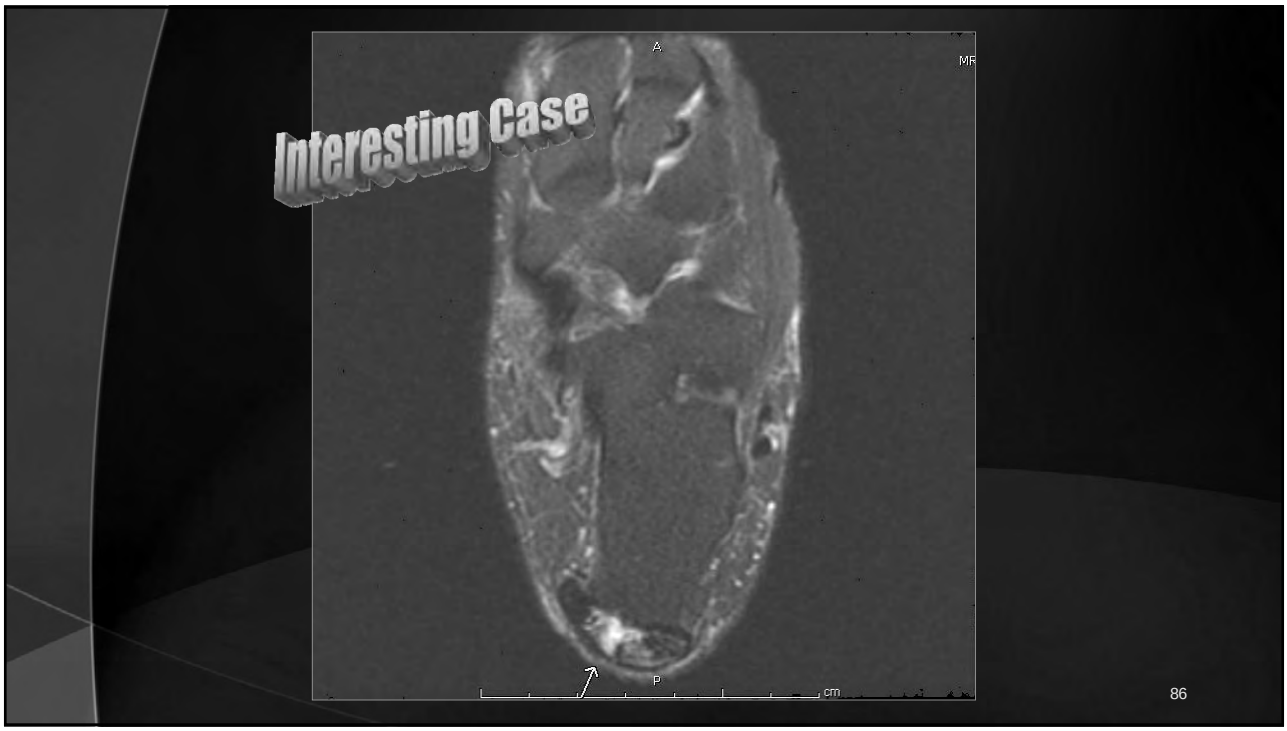

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e-Journal

Quarterly Journal of ACO – March 2008 – Volume 5; Issue 1

Original Articles

Iatrogenic Tendinopathy Associated with Levaquin (levofloxacin)

Ronald C Evans, DC, FACO, FICC

Senior Orthopedist. ICON Whole Health 1441 29th Street. Suite 100. West Des Moines. Iowa. 50266

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Case Report

- A 52-year old male elite-level body builder, runner, and athlete, with no known co-morbidities, was prescribed a five-day course of Levaquin (levofloxacin), 750 mg per day, by his General Practitioner, for acute pneumonia.
- He had no other regular medication. Ten days after commencing the primary dosing, and in the absence of trauma, the patient developed an acute, persistent sharp pain in his left lower leg and at the Achilles tendon insertion on the heel.
- The patient developed a limp, as well as notable swelling of the Achilles tendon. (**Fig. 1)**

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Figure 1. Localized swelling at the 3-6 cm level (from the calcaneal insertion) in the left Achilles tendon.

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- Dorsiflexion of the foot was painful, worse on stairs or incline surfaces.
- Two weeks after ending primary dosing, he reported to the ICON Whole Health facility for chiropractic orthopedic evaluation.
- Physical and orthopedic examination confirmed left Achilles tendinopathy of probable iatrogenic quinolone-therapy origin.
- The tendon remained intact, and advanced imaging was deferred.

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Acute care continued for six weeks, with sub-acute rehabilitative management continuing for another six weeks. The patient demonstrated good return to function, but incomplete recovery of the Achilles peritendinous tissues. The patient returned to running, with protective taping of the part, primarily on flat or low incline terrain. Strengthening exercises and ROM exercises continue. He continues to experience post inertial dyskinesia, limited to the tendon and peritenon tissues, which dissipates with activity. Morning stiffness and soreness persists. Granulomatous tissue persists and complicates return to elite-level athletic training activities.

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Cholesterol Medications

- "Statin" drugs have been associated with development of myositis :
  - Lipitor
  - Zocor
  - Lescol
  - Pravachol
  - Mevacor

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Cholesterol Medications

- **Symptoms of Myositis:**
  - Muscle tenderness
  - Weakness
  - Fatigue
  - Sore joints
  - Stiffness of the muscles
  - Odd urine color

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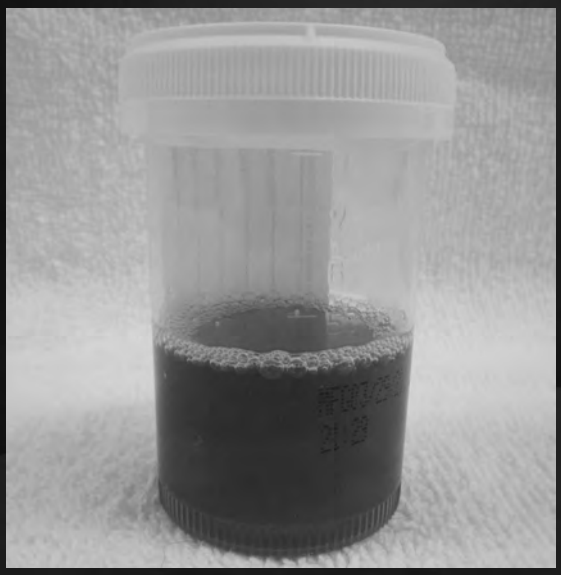

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Rhabdomyolysis

- A severe muscle disorder that can lead to kidney and other organ failure and death.
- Can be confirmed with CK MM fraction.

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MRI in Lipid-Lowering Agent–Associated Myopathy: A Retrospective Review of 21 Cases

Soeren A. Peters[1]
Rudolf Kley[2]
Martin Tegenthoff[2]
Matthias Vorgerd[2]
Volkmar Nicolas[1]
Christoph M. Heyer[1]

OBJECTIVE. The objective of our study was to identify disease-specific patterns of myopathic changes in patients with lipid-lowering agent (LLA)–associated myopathy using a dedicated MRI protocol.

MATERIALS AND METHODS. Axial T1- and T2-weighted STIR images were obtained for the detection of lipomatosis and edema, respectively, of the thighs and legs. Information about patient age, sex, duration of dyslipidemia and of medication use, latency of symptom onset, maximum creatine kinase (CK) level, presence of myalgia and muscle weakness, and LLA or LLAs used was collected.

RESULTS. Significant correlations resulted for the radiologic diagnosis of LLA-associated myopathy and maximum CK level; the presence of edema and maximum CK level; edema and weakness in the ventral thigh muscle group, thigh adductors, or deep dorsal muscle group of the legs; and lipomatosis and weakness of the deep dorsal muscle group of the legs and peroneal muscle group, respectively.

CONCLUSION. MRI is a method that helps detect active pathologic processes in patients with suspected LLA-associated myopathy but does not reveal disease-specific patterns.

AJR:194, April 2010

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TABLE 1: Clinical Parameters in 21 Patients With Lipid-Lowering Agent–Associated Myopathy

Clinical Characteristic	Value	Mean	Range
Age (y)		59.4	17–78
Sex (no. of patients)			
Female	9		
Male	12		
Duration of hyperlipidemia (mo)		26.7	9–84
Duration of medication use (mo)		20.9	0.25–48
Latency of symptom onset (mo)		9.9	0.25–36
Myalgia (% of patients)	76.2		
Weakness (% of patients)	23.8		
Maximum creatine kinase level (U/L)		6,260	66–65,914

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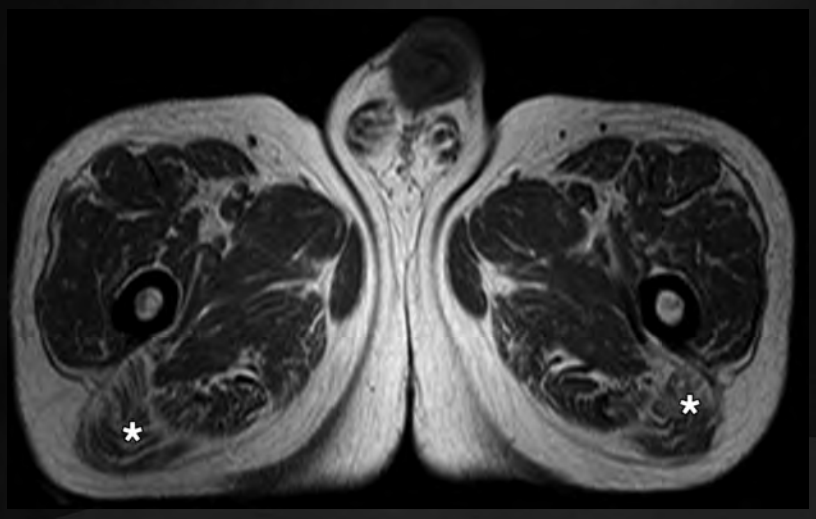

Fig. 1A —56-year-old man who presented with myalgia after having been on simvastatin (Zocor) for 12 months. Latency of symptom onset was 11 months, and maximum creatine kinase level was 2,700 U/L. Axial T1-weighted spin-echo image shows fatty replacement (*asterisks*) primarily of dorsal thigh muscle group.

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Observational Study

Medicine

OPEN

Rhabdomyolysis revisited

Detailed analysis of magnetic resonance imaging findings and their correlation with peripheral neuropathy

Jun Ho Kim, MD[a], Yeo Ju Kim, MD[a,*], Sung Hye Koh, MD[b], Bom Soo Kim, MD[c], Sun Young Choi, MD[d], Seong Eun Cho, MD[a], Joon Ho Song, MD[a], Chang-Hwan Kim, MD[f], Kyung Hee Lee, MD[a], Soon Gu Cho, MD[a]

Abstract

The objective is to evaluate the magnetic resonance imaging (MRI) findings in rhabdomyolysis in detail and determine their correlation with the development of peripheral neuropathy.

Magnetic resonance images for 23 patients with confirmed rhabdomyolysis with (n = 11) or without (n = 12) peripheral neuropathy were retrospectively reviewed for the signal intensity on T1- and T2-weighted images, intramuscular hemorrhage, enhancement pattern, shape and margin in the longitudinal plane, edema in the deep fascia and overlying subcutaneous layer, multiplicity, and bilateral limb involvement. The collected data were statistically analyzed and the relationship between the imaging findings and the development of peripheral neuropathy was determined.

Abnormal signal intensities on T1- or T2-weighted images were observed for all patients except one. Fourteen patients (60.9%) showed intramuscular hemorrhage. Stippled enhancement (11/23; 47.8%) was the most common enhancement pattern. Nineteen patients (86.4%) showed a well-defined rectangular shape with a ragged margin in the longitudinal plane. The affected muscle volume usually increased (17/23; 73.9%), with edema in the deep fascia and the overlying subcutaneous layer (13/23; 56.5%). Multiplicity within a muscle, compartment, and limb was observed in 7 (31.8%), 18 (81.8%), and 16 (72.7%) patients, respectively. Bilateral involvement was observed in 7 patients (30.4%). Only multiplicity within a compartment showed a statistically significant correlation with peripheral neuropathy development.

Common MRI findings in rhabdomyolysis include intramuscular hemorrhage, stippled enhancement, a well-defined rectangular shape with a ragged margin in the longitudinal plane, and multiplicity. Multiplicity within a compartment may be a predictor of the development of peripheral neuropathy.

Abbreviations: CK = creatine kinase, DTI = diffusion tensor imaging, DWI = diffusion-weighted imaging, EMG = electromyography, FOV = field of view, MRI = magnetic resonance imaging, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging, TE = echo time, TR = repetition time.

Keywords: MR, neuropathy, rhabdomyolysis

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Table 1

Data collected from the medical records of patients with rhabdomyolysis with or without peripheral neuropathy.

	Total (n = 23)	Patient (n = 23)		P value
		Complication − (n = 12)	Complication + (n = 11)	
Mean age (SD)	51.22 (16.41)	57.11 (18.1)	41.67 (11.84)	.91
Sex				.712
Men	18 (78.3)	9 (75)	9 (81.8)	
Women	5 (21.7)	3 (25)	2 (18.2)	
Mean duration from onset of symptoms to measurement of serum CK level (SD)	3.37 (8.06)	1.54 (1.2)	5.36 (11.53)	.211
Mean duration from onset of symptoms to MRI scan (SD)	10.09 (16.18)	13.33 (20.83)	6.56 (8.49)	.235
Involvement site				.0.129
Upper arm	7 (30.4)	6 (50)	1 (9.1)	
Forearm	1 (4.3)	0 (0)	1 (9.1)	
Hand	2 (8.7)	0 (0)	2 (18.2)	
Gluteal region	4 (17.4)	3 (25)	1 (9.1)	
Thigh	3 (13)	1 (8.3)	2 (18.2)	
Lower leg	6 (26.1)	2 (16.7)	4 (36.4)	
Etiology				.150
Toxic and drug (including alcohol)	11 (47.8)	3 (25)	8 (72.7)	
Trauma/compression	5 (21.7)	3 (25)	2 (18.2)	
Excessive exercise	3 (13)	3 (25)	0 (0)	
CO intoxication	1 (4.3)	1 (8.3)	0 (0)	
Peripheral arterial disease	1 (4.3)	1 (8.3)	0 (0)	
Heart attack	1 (4.3)	0 (0)	1 (9.1)	
Burn	1 (4.3)	1 (8.3)	0 (0)	
Underlying chronic disease				.173
None	7 (30.4)	4 (33.3)	3 (27.3)	
Brain lesion	3 (13)	3 (25)	0 (0)	
Chronic alcoholism	10 (43.5)	3 (25)	7 (63.6)	
DM	1 (4.3)	1 (8.3)	0 (0)	
Atherosclerosis	1 (4.3)	1 (8.3)	0 (0)	
Heart disease	1 (4.3)	0 (0)	1 (9.1)	
Mean peak serum CK level (SD)	29450.39 (48227.91)	21743.33 (SD:37621.74)	37858.09 (58404.44)	.449

Data are expressed as mean (SD) or number (percentage) of patients. The percentages are based on a total of 23 patients.
CK = creatine kinase, CO = carbon monoxide, DM = diabetes Mellitus, MRI = magnetic resonance imaging, SD = standard deviation.

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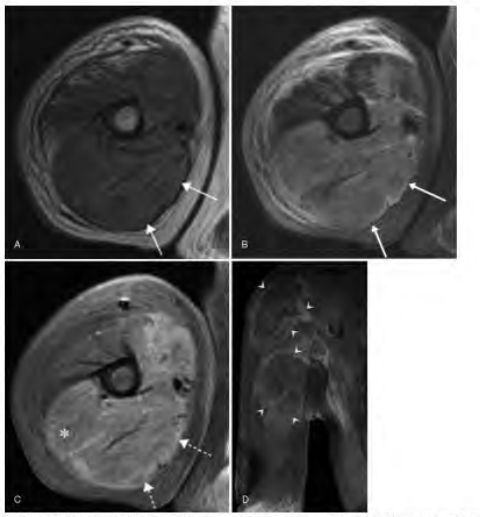

Figure 6. Axial T1-weighted (A), fat-suppressed T2-weighted (B), contrast-enhanced, fat-suppressed T1-weighted (C), coronal contrast-enhanced, fat-suppressed T1-weighted (D) images fora 43-year-old man with rhabdomyolysis caused by excessive exercise. Heterogeneous signal intensity in the posterior compartment and medial portion of the anterior compartment in the upper arm, with increased muscle volume (arrows), can be seen on T1-weighted (A) and fat-suppressed T2-weighted (B) images. Note the edema in the subcutaneous layer. On a contrast-enhanced, fat-suppressed T1-weighted image (C), diffuse enhancement is noted in not only the area with heterogeneous high signal intensity (dashed arrows) but also the area with iso-signal intensity on aprecontrastT1-weighted image (*). On a coronal contrast-enhanced, fat-suppressed T1-weighted image (D), the lesions show a well-defined rectangular shape with a ragged margin (arrowheads).

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Review

Autoimmune/inflammatory syndrome induced by adjuvants (ASIA) 2013: Unveiling the pathogenic, clinical and diagnostic aspects

Carlo Perricone [a,b], Serena Colafrancesco [a,b], Roei D. Mazor [a], Alessandra Soriano [a,c], Nancy Agmon-Levin [a], Yehuda Shoenfeld [a,d,*]

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Table 2
Proposed criteria for the diagnosis of 'ASIA'.

Major criteria:
Exposure to an external stimuli (Infection, vaccine, silicone, adjuvant) prior to clinical manifestations.
The appearance of 'typical' clinical manifestations:
• Myalgia, Myositis or muscle weakness
• Arthralgia and/or arthritis
• Chronic fatigue, un-refreshing sleep or sleep disturbances
• Neurological manifestations (especially associated with demyelination)
• Cognitive impairment, memory loss
• Pyrexia, dry mouth
• Removal of inciting agent induces improvement
• Typical biopsy of involved organs
Minor Criteria:
The appearance of autoantibodies or antibodies directed at the suspected Adjuvant
Other clinical manifestations (i.e. irritable bowel syn.)
Specific HLA (i.e. HLA DRB1, HLA DQB1)
Evolvement of an autoimmune disease (i.e. MS, SSc)

Table 4
A list of the vaccines more likely to be associated with autoimmune diseases.

Vaccine	Autoimmune disorder
HBV [113,114]	Polyarteritis nodosa, lichen planus, bullous, pemphigoid, Henoch-Schonlein Purpura, Polyneuropathy, Erythema nodosum, ITP, Myasthenia gravis, MS, Uveitis, reactive arthritis, RA, SLE, CNS demyelination, TM, pemphigus, UCTD, CFS
Anthrax [114]	SLE
DTP/Dtap/TT [113]	Optic neuritis, myelitis, GBS, SLE
Influenza [113]	SLE, RA, vasculitis, reactive arthritis, GBS
MMR [113]	ITP
Mumps [113]	T1D
Rabies [113]	Neuritis, GBS
HAV [113]	ITP
Oral polio [114]	GBS
Rubella [114]	Fibromyalgia
Swine flu [113]	MS
BCG [113,114]	Reactive arthritis, polymyositis/dermatomyositis
HiB [114]	T1D
HPV [114]	Vasculitis, cerebral vasculitis, primary ovarian failure

Abbreviations: ITP: idiopathic thrombocytopenic purpura; MS: multiple sclerosis; RA: Rheumatoid arthritis; SLE: systemic lupus erythematosus; CNS: central nervous system; TM: transverse myelitis; CFS: chronic fatigue syndrome; GBS: Guillain–Barré Syndrome; T1D: Type 1 diabetes mellitus, UCTD: undifferentiated connective tissue disease.

C. Perricone et al. / Journal of Autoimmunity 47 (2013) 1–16

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HALMS: HALMS665883

Macrophagic myofasciitis: characterization and pathophysiology

Romain K. Gherardi* and François-Jérôme Authier

Lupus. 2012 Feb; 21(2): 184–189.

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Macrophagic myofasciitis

Epidemiology

- Male = Female
- Onset age: 3rd to 5th Decade
- Disease duration: 3 to 48 months
- Associated with injections of aluminum-containing vaccines
  - Timing: 3 months to 8 years before onset of symptoms
  - Immunization type: Hepatitis B (86%); Tetanus (58%); Hepatitis A (19%)

•Pathogenesis

- Persistence of vaccine-derived aluminum hydroxide at site of IM injection
- MMF patients may be of HLA-DRB1*01 group
- ? Protracted low level immune stimulation due to persistence of adjuvant in antigen presenting cells

Lupus. 2012 Feb; 21(2): 184–189.

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•Clinical

- Pain & Discomfort
  - Myalgias (80%): Proximal > Distal
  - Arthralgias (60%): Especially large joints
- Weakness (43%): Mild; Proximal
- CNS (9% symptomatic)
  - Pyramidal signs (7%)
  - Hemisensory or sensory-motor symptoms (5%)
  - Cerebellar (5%)
  - Visual loss (3%)
  - Other: Cognitive or Bladder dysfunction
- Systemic
  - General (43%): Fatigue; Asthenia; Fever
  - Pulmonary: Dyspnea; Cough
  - Skin: Normal
  - Concurrent autoimmune disorder (34%)

Lupus. 2012 Feb; 21(2): 184–189.

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- Lab
  - Serum CK: Normal 60%, 3x to 5x Increased 35%, Very high 5%
  - Hematologic
    - Sedimentation rate: Normal (55%) to 115
    - C-reactive protein: 40% Increased
    - Anemia (25%)
  - EMG: Normal (55%); Myopathic (30%); Neuropathic (15%)
  - CNS testing
    - MRI: Multifocal or single regions of CNS demyelination (12%)
    - Sensory evoked potentials: Often abnormal
    - CSF: High protein; Oligoclonal bands; Cells (5-29/mm^3)

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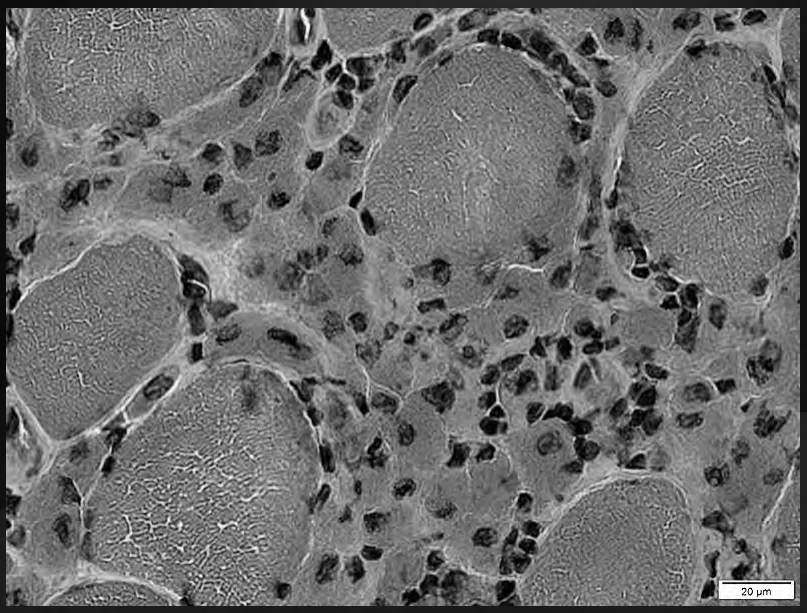

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- Myofascial trigger points are local thickenings of individual muscle fibers that are caused by contractions of a small group of sarcomeres (Siegfried Mense, 2008).

Journal of Bodywork & Movement Therapies (2013) 17, 356–364

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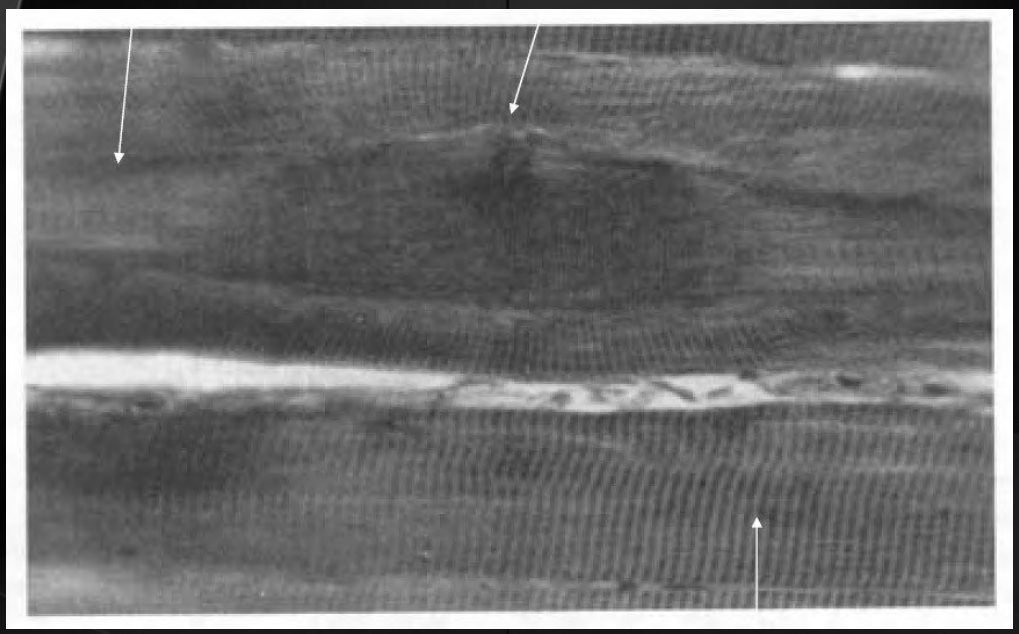

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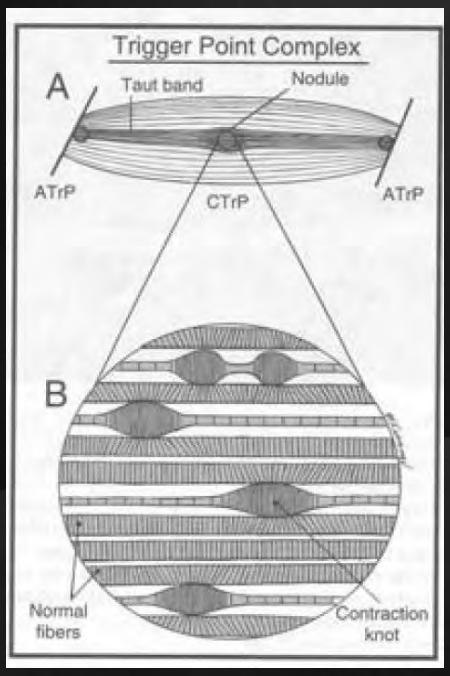

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Myositis/Myopathies

- **T or F** Fluoroquinolones, NSAIDs, cortisone, statins and vaccines containing aluminum are have been associated with increased morbidity related to the musculoskeletal system.
- **T or F** Creatinine kinase MM fraction is associated with rhabdomyolysis.

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ELSEVIER

European Journal of Radiology 50 (2004) 134–158

EJR

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Acquired degenerative changes of the intervertebral segments at and suprajacent to the lumbosacral junction A radioanatomic analysis of the nondiscal structures of the spinal column and perispinal soft tissues

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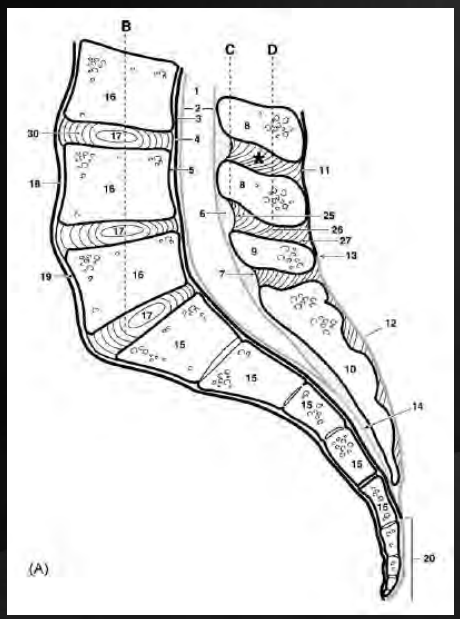

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

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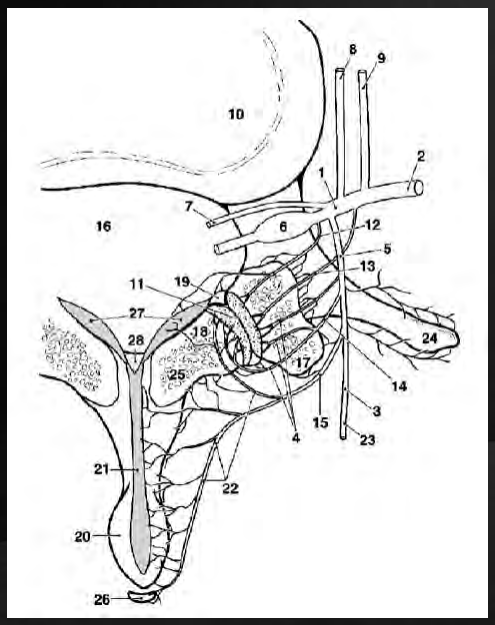

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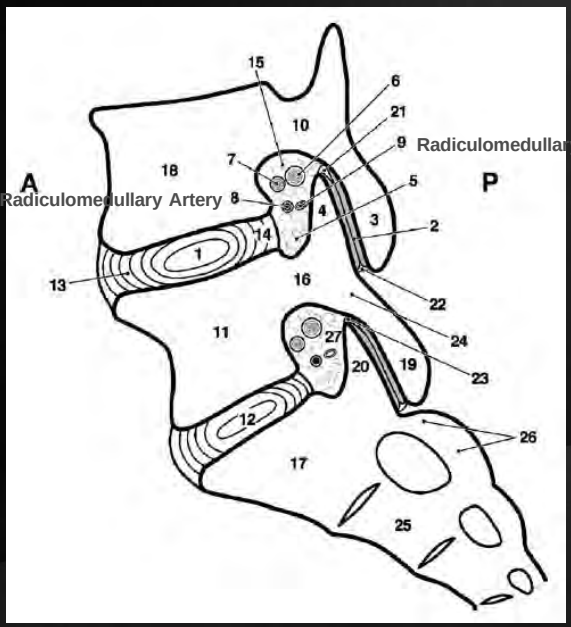

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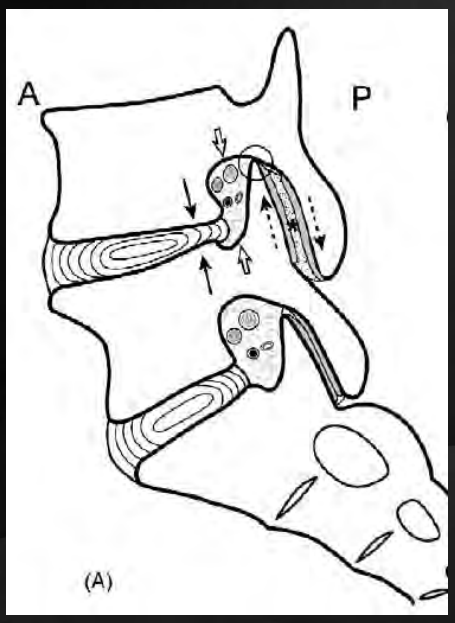

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Facet Subluxation and Synovitis

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Interexaminer Reliability of T2-Weighted Magnetic Resonance Imaging for Lumbar Bright Facet Sign

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Abstract

Objective: The aims of this study were to characterize the bright facet response within the lumbar spine, to identify a constellation of findings associated with the response, and to quantify the interexaminer agreement on the previous objectives.

Methods: A retrospective study of lumbar magnetic resonance images obtained on 105 (N = 105) adult subjects (62 men and 43 women; age range, 18-84 years; mean age, 46.51 ± 16.01 years) were reviewed by 2 musculoskeletal radiologists for the presence of high signal within the facet articulations (bright facet response) on fast spin echo T2-weighted images.

Results: Of the 630 lumbar facet articulations imaged (L3/L4 through L5/S1), 340 (54%) and 346 (55%) respectively, per examiner, did show a bright facet response. Interexaminer agreement with respect to the level and grading of a bright facet response was almost perfect with κ ranging from 0.85 to 0.91 (SE, 0.06). Prevalence of bright facet responses averaged 40.5% at L5/S1, 56.5% at L3/L4, and 66.5% at the L4/L5 level. There was an association with degenerative facet and disk changes.

Conclusion: The bright facet response was a common phenomenon on T2-weighted magnetic resonance imaging of the lumbar spine in these cases. There was sufficient agreement with respect to the presence and extent of the bright facet response to conclude that the examiners' determinations were not made by random chance. There exist sufficient repeatability and reliability that a single descriptive term can be applied to unify the bright facet response, the bright facet sign. (J Manipulative Physiol Ther 2008;31:593-601)

Key Indexing Terms: *Hydrarthrosis; Radiography; Diagnostic Imaging; Chiropractic*

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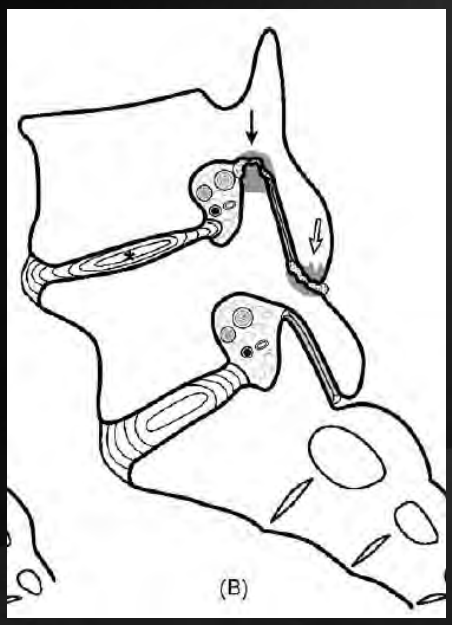

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Collision Erosion DJD

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Facet Remodeling / Neo-Arthrosis

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Degenerative Foraminal Stenosis

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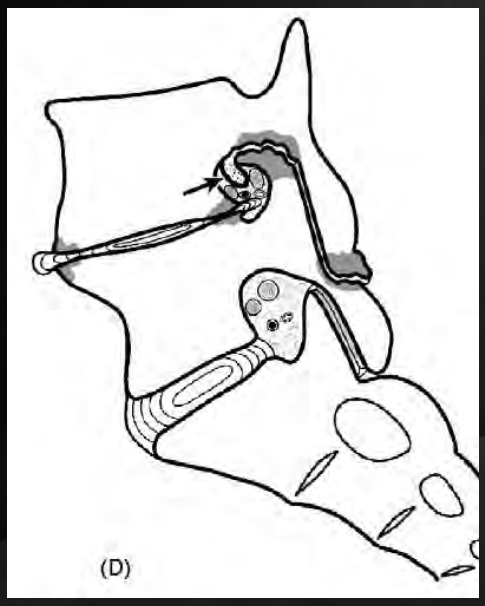

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Neocyst formation with Neo-Arthrosis

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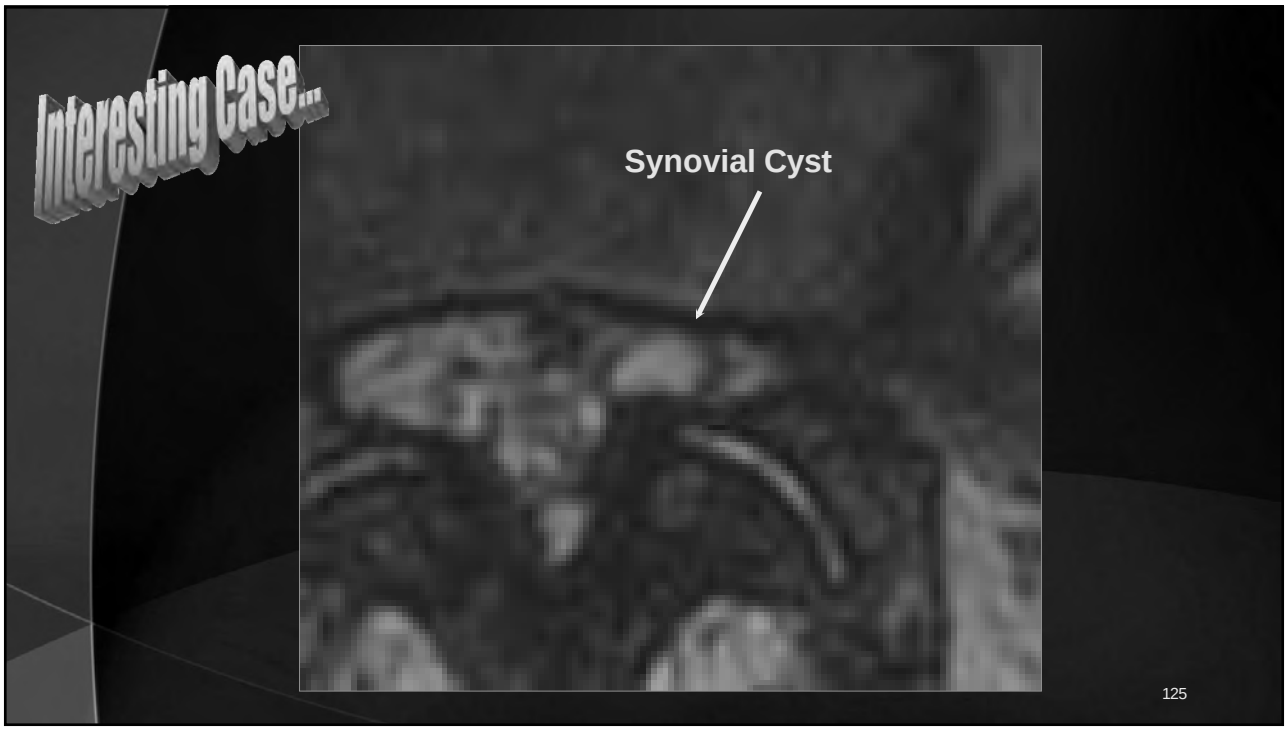
Interesting Case...
Synovial Cyst
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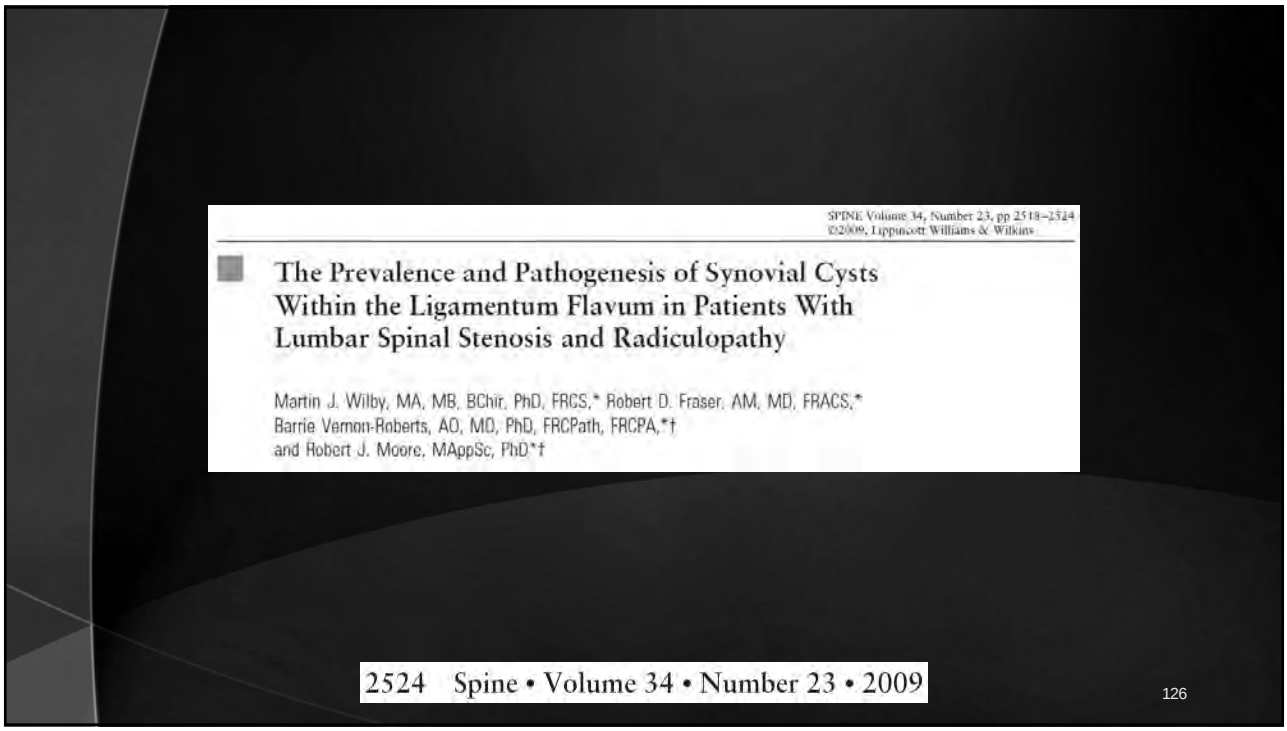
SPINE Volume 34, Number 23, pp 2518–2524
©2009, Lippincott Williams & Wilkins
The Prevalence and Pathogenesis of Synovial Cysts Within the Ligamentum Flavum in Patients With Lumbar Spinal Stenosis and Radiculopathy
Martin J. Wilby, MA, MB, BChir, PhD, FRCS,* Robert D. Fraser, AM, MD, FRACS,*
Barrie Vernon-Roberts, AO, MD, PhD, FRCPath, FRCPA,*†
and Robert J. Moore, MAppSc, PhD*†
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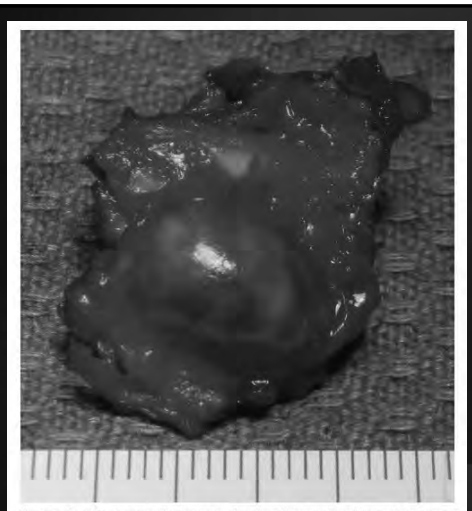

Figure 1. Macroscopic image of a freshly excised intact synovial cyst forming a dome-shaped swelling, which bulged into the spinal canal. It can be seen that the smooth intraspinal surface of the cyst is continuous with the inner surface of the ligamentum flavum cranial and caudal to the cyst. The cyst contained xanthochromic fluid, which was fluctuant when compressed.

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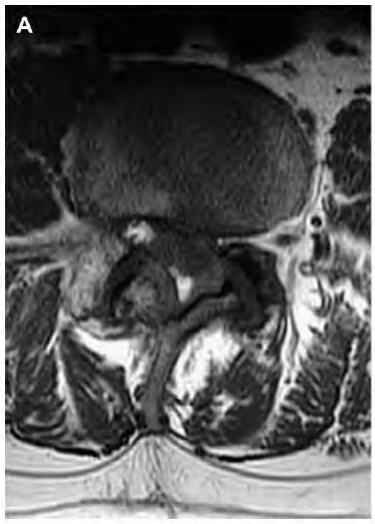

Fig. 10. Hemorrhagic synovial cyst. A 56-year-old man presents with acute left leg and back pain. Axial T1-weighted (*A*) MR image demonstrates bilateral L4-L5 facet osteoarthrosis, but the synovial cyst is difficult to identify because it is isointense to cerebrospinal fluid. Axial T2-weighted MR image (*B*) clearly shows bilateral joint effusions and a well-defined synovial cyst (*white arrow*), with a fluid-blood level (*arrowhead*) arising from the left-sided joint and low-intensity fibrotic rim.

Radiol Clin N Am 50 (2012) 705–730.

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ORIGINAL RESEARCH

The "Thickened" Ligamentum Flavum: Is It Buckling or Enlargement?

F.H. Chokshi
R.M. Quencer
W.R.K. Smoker

BACKGROUND AND PURPOSE: Thickening of the LF is ascribed to buckling due to DSN. Uncertainty exists as to whether this can occur without DSN. Our primary hypothesis was that facet degenerative changes alone, independent of DSN, can thicken the LF. Our secondary hypothesis was that inflammatory changes surrounding degenerative facet joints may incite thickening.

MATERIALS AND METHODS: Fifty-two patients were divided into 1 of 3 groups: group 1 (normal lumbar spine, $n = 21$), group 2 (LF thickening and FH with normal height of the L4–5 disk, $n = 18$), and group 3 (LF thickening and FH with decreased height of the L4–5 disk, $n = 13$). LF thickness measured on axial T1WI at the midpoint of the LF length was compared with that in group 1. Facet joints were evaluated for spurring, joint fluid, and cortical irregularity, indicating facet degeneration. Enhancement of the facet joints and LF thickening were also evaluated ($n = 2$). The Student t test was used to compare groups.

RESULTS: Normal LF thickness (group 1) was 3.1 mm, whereas LF thickness averaged 4.9 mm in group 2 and 5.3 mm in group 3 (both $P < .001$). Patients with asymmetric LF thickness showed greater LF thickness on the side with greater FH. There was more LF enhancement on the side with greater facet degenerative disease.

CONCLUSIONS: LF thickening can be secondary to facet degenerative changes, independent of DSN. Inflammatory changes may be an inciting factor for LF thickening.

ABBREVIATIONS: DDD = degenerative disk disease; DSN = disk space narrowing; FH = facet hypertrophy; LF = ligamentum flavum; T1WI = T1-weighted imaging

AJNR Am J Neuroradiol 31:1813–16 | Nov-Dec 2010 | www.ajnr.org

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Conclusions

- Our investigation supports our primary hypothesis that adjacent facet degenerative changes alone, in the absence of disc space narrowing, can cause thickening of the LF.
- Moreover, post-contrast images of LF thickening and FH support our secondary hypothesis that inflammatory changes surrounding the degenerative facet joint may be the inciting etiology of this thickening.

AJNR Am J Neuroradiol 31:1813–16 | Nov-Dec 2010 | www.ajnr.org

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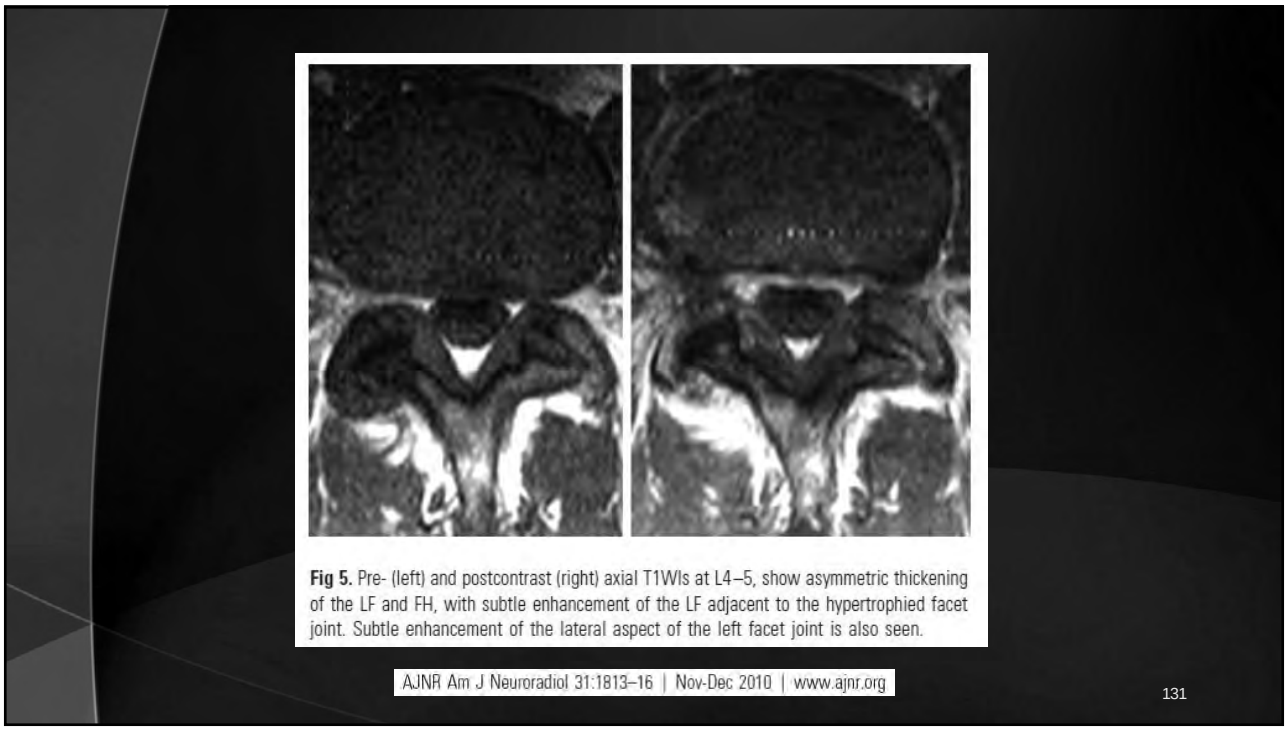

Fig 5. Pre- (left) and postcontrast (right) axial T1WIs at L4–5, show asymmetric thickening of the LF and FH, with subtle enhancement of the LF adjacent to the hypertrophied facet joint. Subtle enhancement of the lateral aspect of the left facet joint is also seen.

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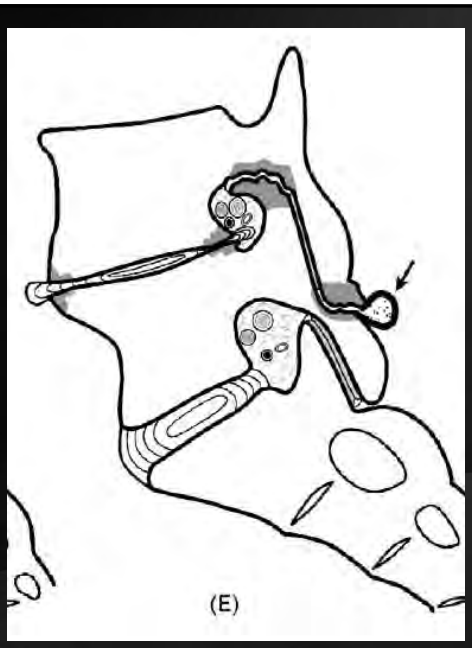

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Posterior Synovial Cyst

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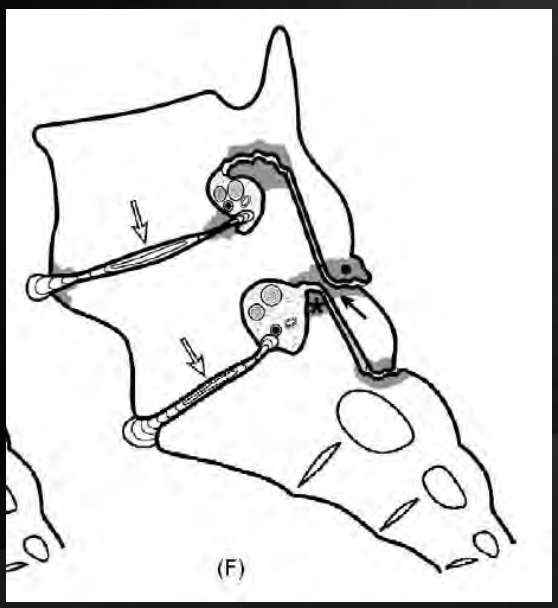

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Erosive Pars Interarticularis

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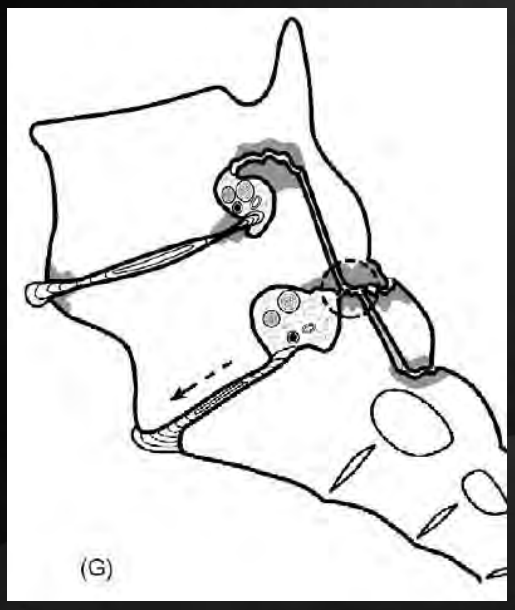

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Degenerative Insufficiency Fx. of Pars Interarticularis

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Interesting Case...

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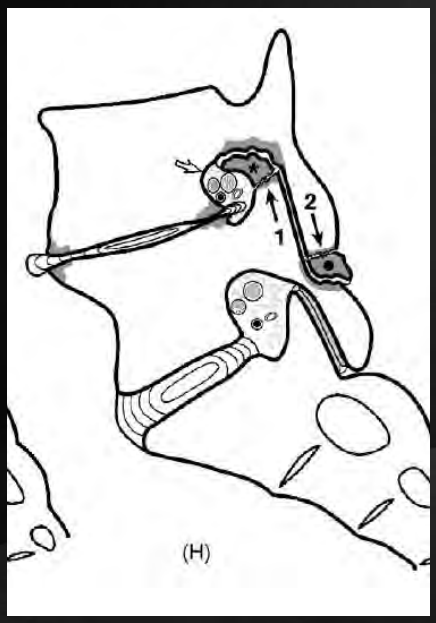

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Collisional Articular Process Fracture

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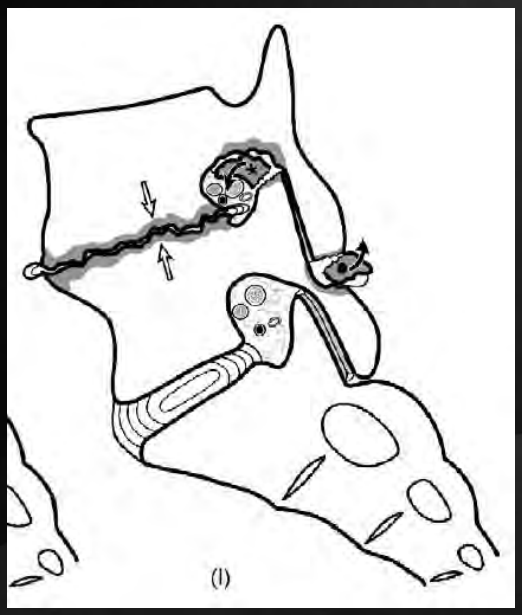

Jinkins. ***European Journal of Radiology;*** 50 (2004) 134-158.

Articular process fracture displacement

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Interesting Case...
1.5T GEMSGEMS
Ex: 7153
Sag T2 FRFSE
Se: 4/6
Im: 9 (ASC)
Sag: R8.4
Mag: 0.73
(BSpline)
A
ETL: 23
TR: 3,945.0
TE: 100.2
4.0thk
SL
IR
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1.5T GEMSGEMS
Ex: 7153
Sag T2 FRFSE
Se: 4/6
Im: 10 (ASC)
Sag: R13.4
Mag: 0.73
(BSpline)
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TE: 100.2
4.0thk
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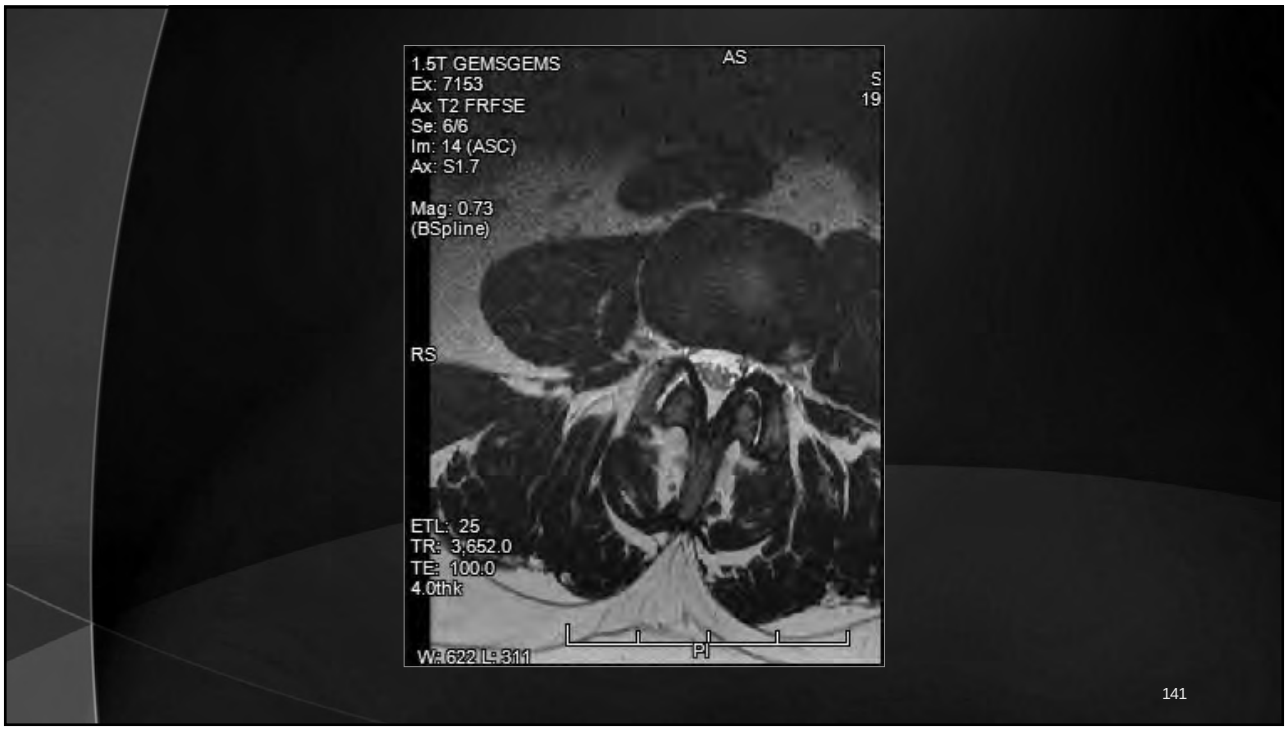
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Ax: S1.7
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RS
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4.0thk
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PI
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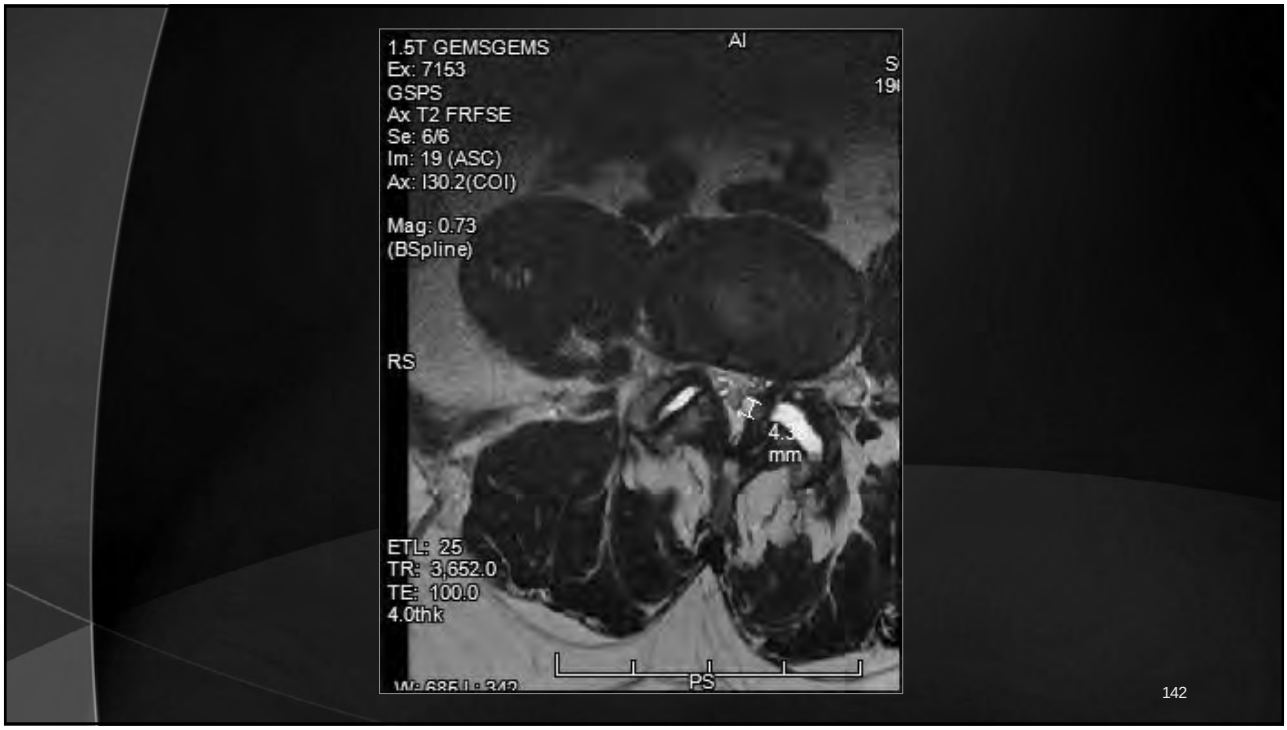
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GSPS
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Ax: I30.2(COI)
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(BSpline)
AI
RS
mm
ETL: 25
TR: 3652.0
TE: 100.0
4.0thk
PS
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PAIN MEDICINE
Volume 9 • Number 4 • 2008

SPINE SECTION

Original Research Article

Fat-Saturated MR Imaging in the Detection of Inflammatory Facet Arthropathy (Facet Synovitis) in the Lumbar Spine

Leo F. Czervionke, MD, and Douglas S. Fenton, MD
Mayo Clinic Jacksonville, Department of Radiology, Jacksonville, Florida, USA

Conclusion. Facet synovitis is a common condition and appears to correlate with the patient's pain. Detection of active inflammatory facet osteoarthropathy (facet synovitis) within and surrounding the facet joints is possible with MR imaging using a fat-saturation technique.

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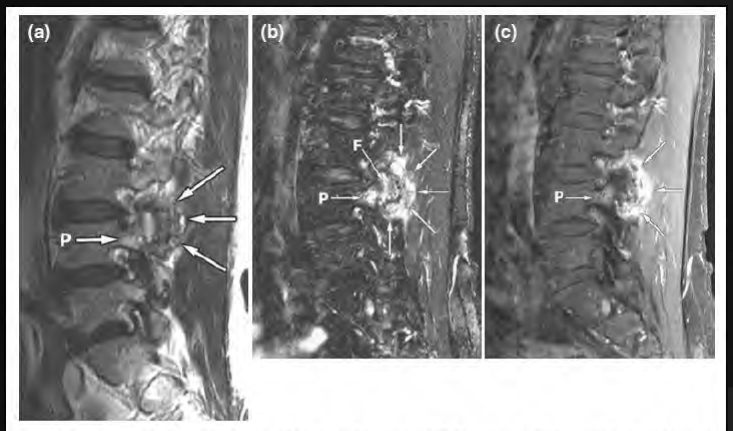

Figure 1 Facet synovitis: the value of sagittal fat-saturated imaging. (a) Right parasagittal T2-weighted spin echo image, obtained without fat saturation, shows enlargement (hypertrophy) of the right L3-4 articular processes and facets (arrows), secondary to osteoarthritis, with thickening of the capsule of the facet joint. Subtle T2 signal hyperintensity is seen in the affected facets as well as in the right L4 pedicle. (b) Right parasagittal T2-weighted fast spin echo image with fat saturation, corresponding to (a). "Hot facet" appearance: intense enhancement in the perifacetal soft tissues (arrows), L3-4 facets (F), and L4 pedicle (P) indicating grade 4 facet synovitis. (c) Right parasagittal contrast-enhanced T1-weighted spin echo image, corresponding to image (a), obtained with fat suppression shows intense enhancement of the right L3-4 perifacetal soft tissues (arrows) adjacent to the enlarged facets and enhancement of the right L4 pedicle (P).

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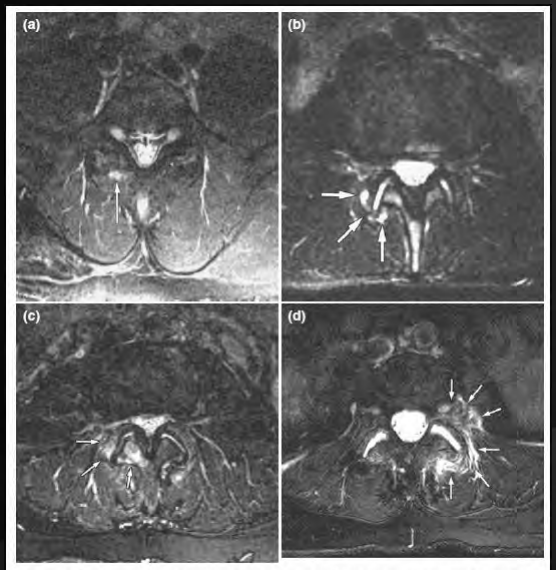

Figure 2 Grading facet synovitis: fat-saturated T2-weighted imaging. (a) Grade 1. Small T2 hyperintensity (arrow) in the posterior-inferior capsule of the right L4-5 facet joint represents earliest sign of facet synovitis. (b) Grade 2. T2 signal hyperintensity (arrows) in posterior portion of right L3-4 facets involves less than 50% of the facet joint perimeter. (c) Grade 3. T2 signal hyperintensity (arrows) involves greater than 50% of facets as well as the right L4 lamina. (d) Grade 4. Extensive abnormal T2 signal (arrows) involves and surrounds the L4-5 facets on the left with abnormal T2 hyperintense tissue within and lateral to the left L5-S1 neural foramen. Note more fluid than normal in both L5-S1 facet joints.

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Table 1 A grading system for facet synovitis as seen by MR fat-suppression techniques

Grade	Criteria
0	No signal abnormality
1	Signal abnormality confined to joint capsule
2	Periarticular signal abnormality involving less than 50% of the perimeter of the joint*
3	Periarticular signal abnormality involving more than 50% of the perimeter of the joint*
4	Grade 3 with extension of signal abnormality into the intervertebral foramen, ligamentum flavum, pedicle, transverse process, or vertebral body

* Signal abnormality may extend into the articular pillar or lamina, but does not contribute to the definition of the grade.
MR = magnetic resonance.

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Imaging of Posterior Element Axial Pain Generators

Facet Joints, Pedicles, Spinous Processes, Sacroiliac Joints, and Transitional Segments

Amy L. Kotsenas, MD

KEYWORDS

• Baastrup disease • Bertolotti syndrome • Facet synovitis • Fat-suppressed MR imaging • ^{18}F-FDG PET/CT • Interspinous bursitis • Posterior elements • SPECT

KEY POINTS

- The role of the posterior elements in generating axial back and neck pain is well established.
- Morphologic imaging findings are nonspecific and are frequently present in asymptomatic patients.
- Edema, inflammation, and hypervascularity are more specific for sites of pain generation.
- Physiologic imaging techniques such as fat-suppressed magnetic resonance imaging, single-photon emission computed tomography (CT), or ^{18}F-fluorodeoxyglucose positron emission tomography combined with CT are more sensitive for edema, inflammation, and hypervascularity than morphologic imaging alone.

Radiol Clin N Am 50 (2012) 705–730.

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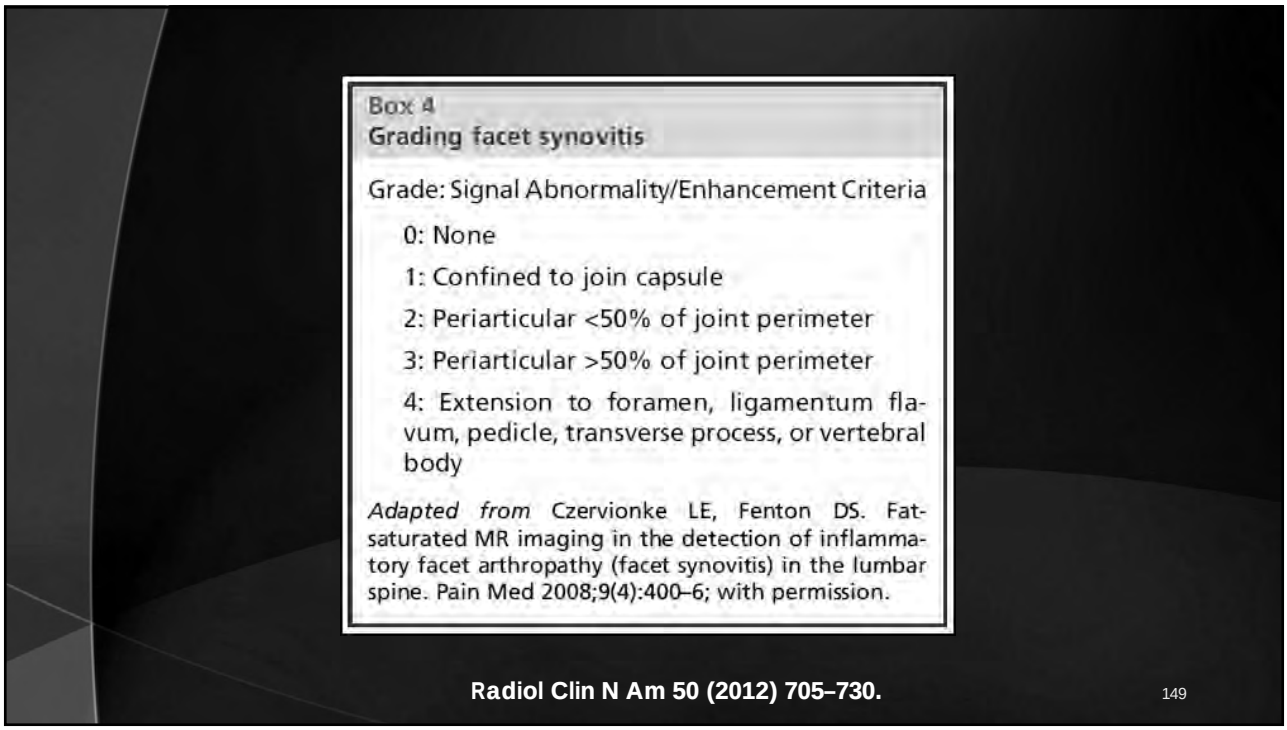
Box 4
Grading facet synovitis
Grade: Signal Abnormality/Enhancement Criteria
0: None
1: Confined to join capsule
2: Periarticular <50% of joint perimeter
3: Periarticular >50% of joint perimeter
4: Extension to foramen, ligamentum flavum, pedicle, transverse process, or vertebral body
Adapted from Czervionke LE, Fenton DS. Fat-saturated MR imaging in the detection of inflammatory facet arthropathy (facet synovitis) in the lumbar spine. Pain Med 2008;9(4):400–6; with permission.
Radiol Clin N Am 50 (2012) 705–730.
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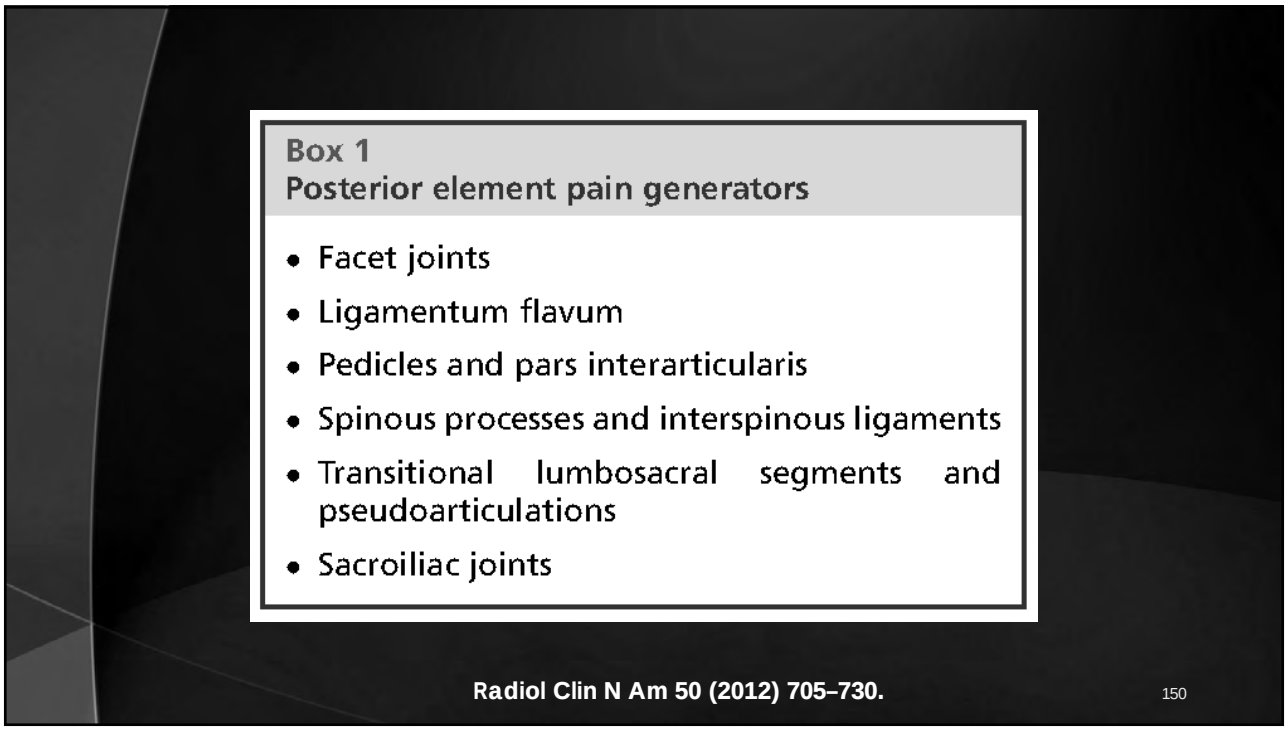
Box 1
Posterior element pain generators
• Facet joints
• Ligamentum flavum
• Pedicles and pars interarticularis
• Spinous processes and interspinous ligaments
• Transitional lumbosacral segments and pseudoarticulations
• Sacroiliac joints
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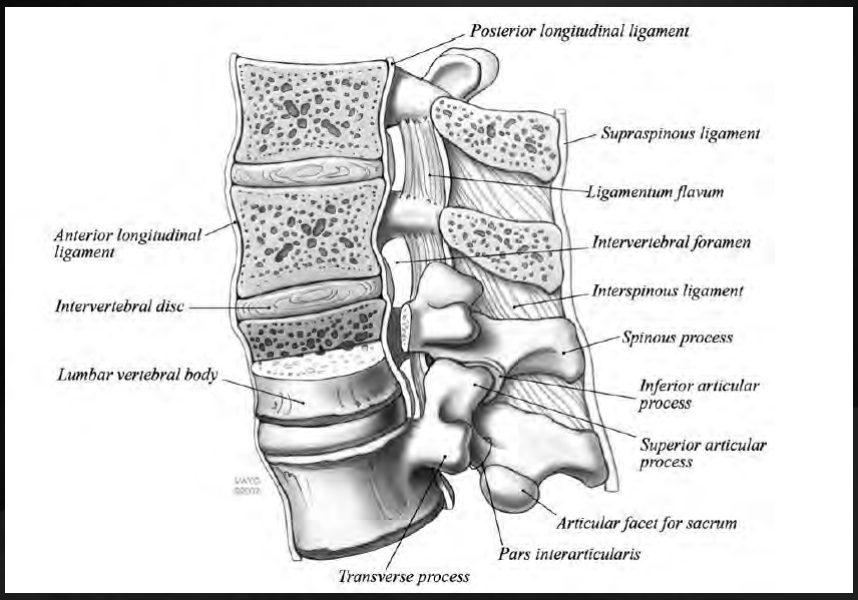

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Box 2
Physiologic imaging techniques

- Fat-suppressed MR imaging techniques
  - Short T1 inversion recovery (STIR)
  - Fat-saturation fast spin-echo (FSE) T2-weighted or contrast-enhanced (CE) T1-weighted
  - Water-excitation FSE T2-weighted or CE T1-weighted
  - 3-point Dixon water-fat separation (IDEAL)
- Nuclear medicine bone scintigraphy
- ^{18}F-fluorodeoxyglucose positron emission tomography combined with CT (FDG-PET/CT)
- Weight-bearing/axial-loading imaging

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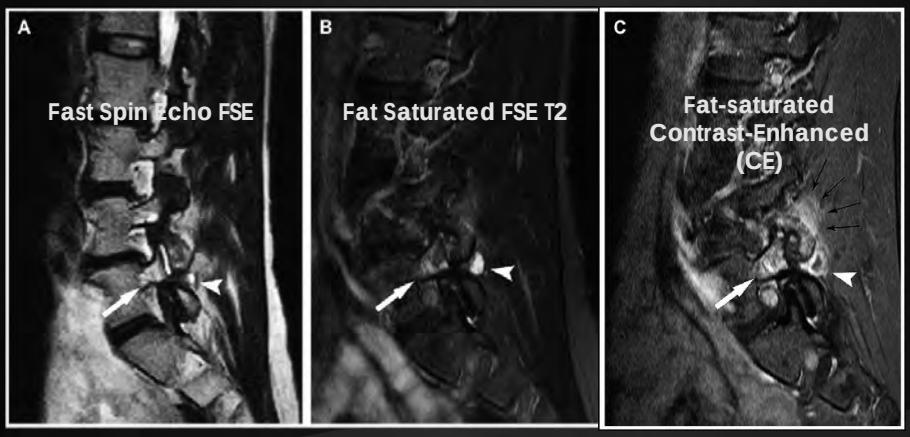

Fat-suppression MR techniques. A 45-year-old woman presents with LBP worse with sitting. L5 pedicle edema (white arrow) and posterior L4-L5 facet synovial cyst (white arrowhead) are poorly visualized on standard fast spin-echo (FSE) T2-weighted sagittal sequence (A), and are much better demonstrated on fat-saturated FSE T2-weighted (B) and fat-saturated contrast-enhanced (CE) T1-weighted sagittal images (C). The fat-saturated CE T1-weighted sagittal sequence (C) best demonstrates facet edema and extensive periarticular soft tissue inflammation (black arrows).

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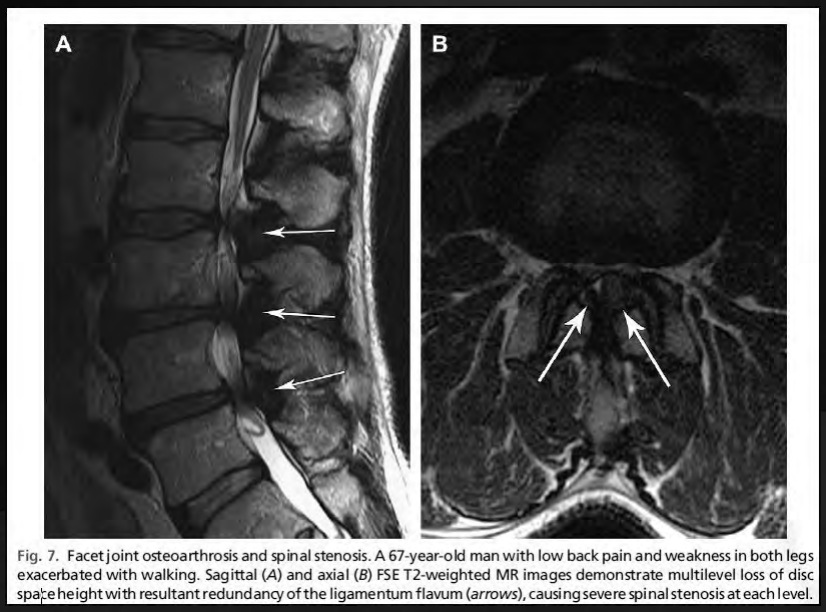

Fig. 7. Facet joint osteoarthrosis and spinal stenosis. A 67-year-old man with low back pain and weakness in both legs exacerbated with walking. Sagittal (*A*) and axial (*B*) FSE T2-weighted MR images demonstrate multilevel loss of disc space height with resultant redundancy of the ligamentum flavum (*arrows*), causing severe spinal stenosis at each level.

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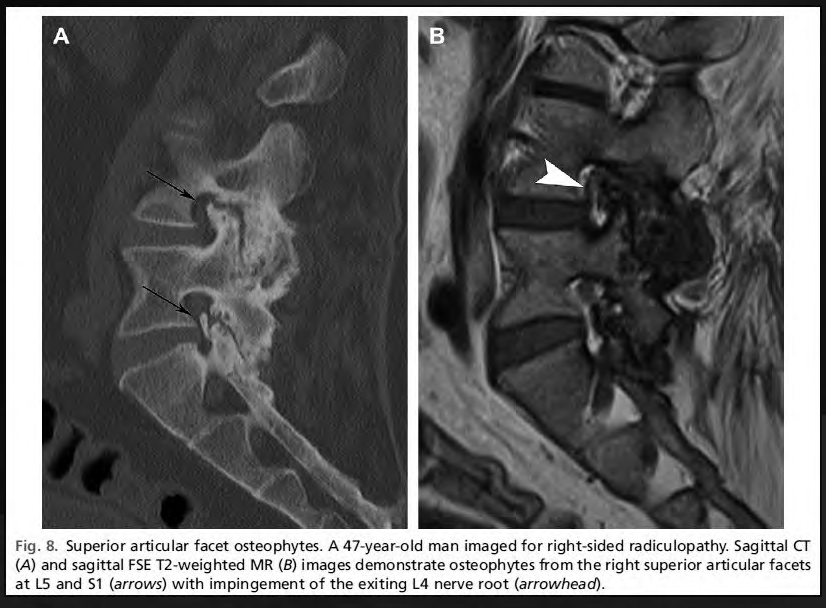

Fig. 8. Superior articular facet osteophytes. A 47-year-old man imaged for right-sided radiculopathy. Sagittal CT (*A*) and sagittal FSE T2-weighted MR (*B*) images demonstrate osteophytes from the right superior articular facets at L5 and S1 (*arrows*) with impingement of the exiting L4 nerve root (*arrowhead*).

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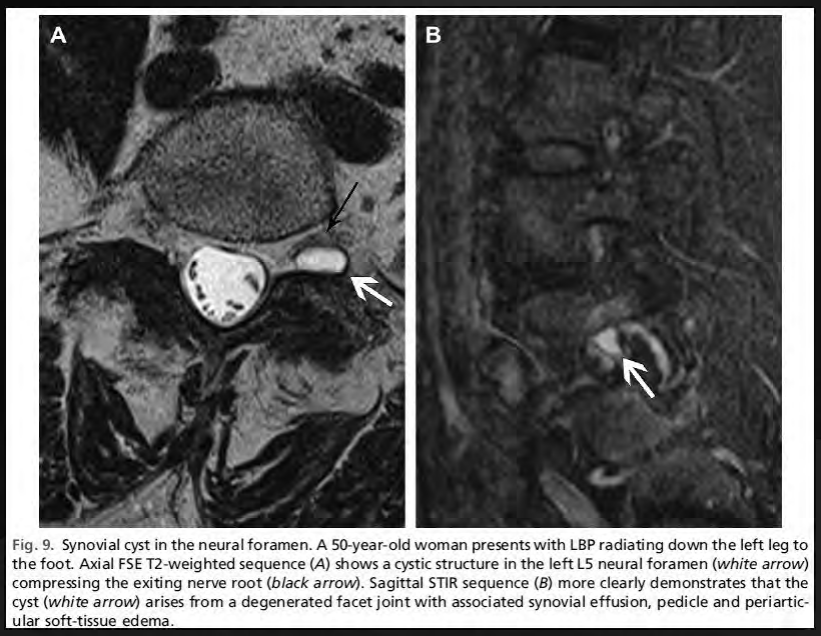

Fig. 9. Synovial cyst in the neural foramen. A 50-year-old woman presents with LBP radiating down the left leg to the foot. Axial FSE T2-weighted sequence (*A*) shows a cystic structure in the left L5 neural foramen (*white arrow*) compressing the exiting nerve root (*black arrow*). Sagittal STIR sequence (*B*) more clearly demonstrates that the cyst (*white arrow*) arises from a degenerated facet joint with associated synovial effusion, pedicle and periarticular soft-tissue edema.

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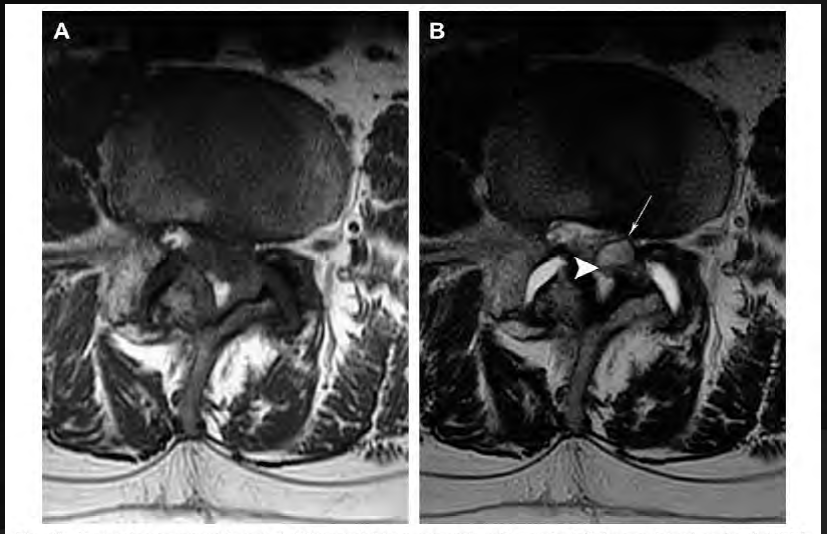

Fig. 10. Hemorrhagic synovial cyst. A 56-year-old man presents with acute left leg and back pain. Axial T1-weighted (*A*) MR image demonstrates bilateral L4-L5 facet osteoarthrosis, but the synovial cyst is difficult to identify because it is isointense to cerebrospinal fluid. Axial T2-weighted MR image (*B*) clearly shows bilateral joint effusions and a well-defined synovial cyst (*white arrow*), with a fluid-blood level (*arrowhead*) arising from the left-sided joint and low-intensity fibrotic rim.

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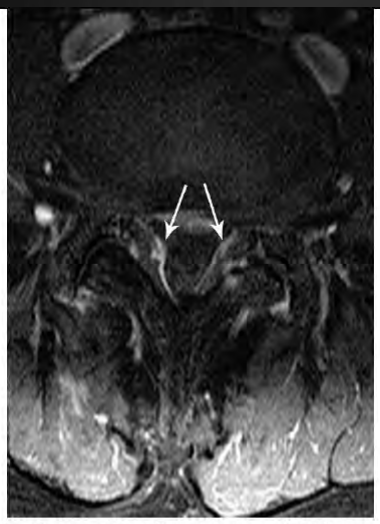

Fig. 11. Ligamentum flavum degenerative inflammation. A 84-year-old man presents with axial LBP. Axial fat-suppressed CE T1-weighted sequence demonstrates enhancement of bilateral ligamentum flavum (*white arrows*). Note bilateral facet osteoarthrosis and grade 2 facet synovitis.

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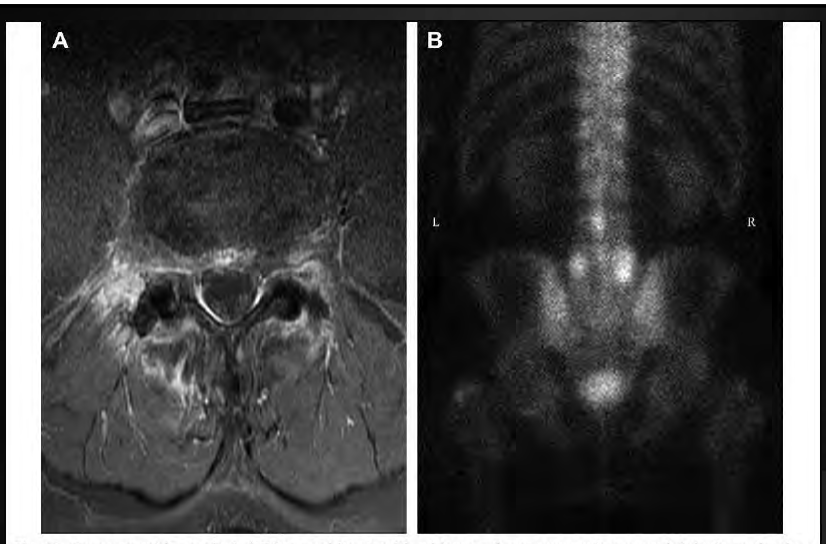

Fig. 13. Facet synovitis, grade 4. A 74-year-old man with a history of prostate carcinoma and right lower lumbar mechanical pain Axial fat-suppressed CE T1-weighted MR image (*A*) shows bilateral facet osteoarthrosis, and grade 4 synovitis on the right at the L4-L5 level, with extensive periarticular inflammatory enhancement extending into the right neural foramen. Grade 3 synovitis is present on the left. Radionuclide bone scan (*B*) in the PA projection demonstrates increased radionuclide uptake at the level of the L4-L5 facet joints, greater on the right. (*Courtesy of* Timothy Maus, MD, Mayo Clinic, Rochester, MN; with permission.)

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FDG-PET/CT facet synovitis. A 68-year-old man with a history of small cell lung carcinoma presents with right neck pain. Axial FDG-PET/CT image (A) shows increased radiotracer uptake on the right at C4-C5. Sagittal CT (B) demonstrates facet osteoarthrosis with subchondral sclerosis and cysts. Fat-suppressed CE T1-weighted MR image (C) demonstrates facet synovitis with bone marrow edema and periarticular soft-tissue inflammation (white arrows).

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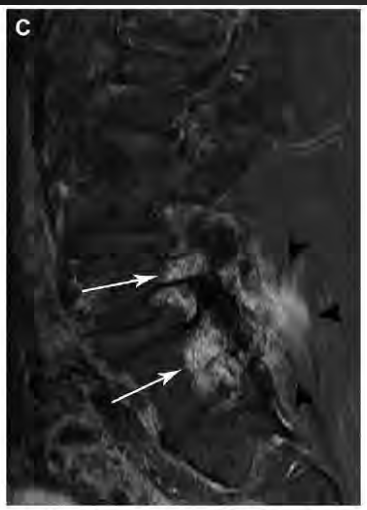

Fig. 15. Pedicle edema. A 74-year-old man (same patient as in Fig. 13) with a history of prostate carcinoma and right lower lumbar mechanical pain. Sagittal FSE T2-weighted image (*A*) demonstrates bone marrow edema in the right L4 and L5 pedicles (*white arrows*) without frank fracture line; facet synovitis is not appreciated. Sagittal fat-suppressed FSE T2-weighted (*B*) and CE T1-weighted (*C*) images also clearly demonstrate pedicle marrow edema (*white arrows*), but also clearly depict facet synovitis and extensive periarticular soft tissue inflammation and enhancement (*black arrowheads*).

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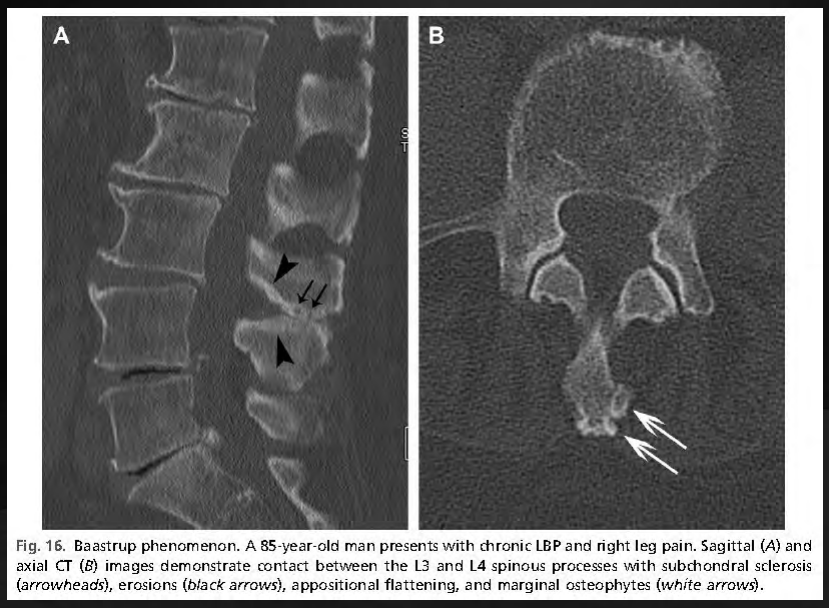

Fig. 16. Baastrup phenomenon. A 85-year-old man presents with chronic LBP and right leg pain. Sagittal (*A*) and axial CT (*B*) images demonstrate contact between the L3 and L4 spinous processes with subchondral sclerosis (*arrowheads*), erosions (*black arrows*), appositional flattening, and marginal osteophytes (*white arrows*).

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Baastrup phenomenon and interspinal bursitis. A 84-year-old man presents with LBP and neurogenic claudication. Sagittal fat-suppressed T1-weighted MR image shows multilevel interspinous (arrowheads) and supraspinous (arrows) ligament degenerative inflammation and enhancement.

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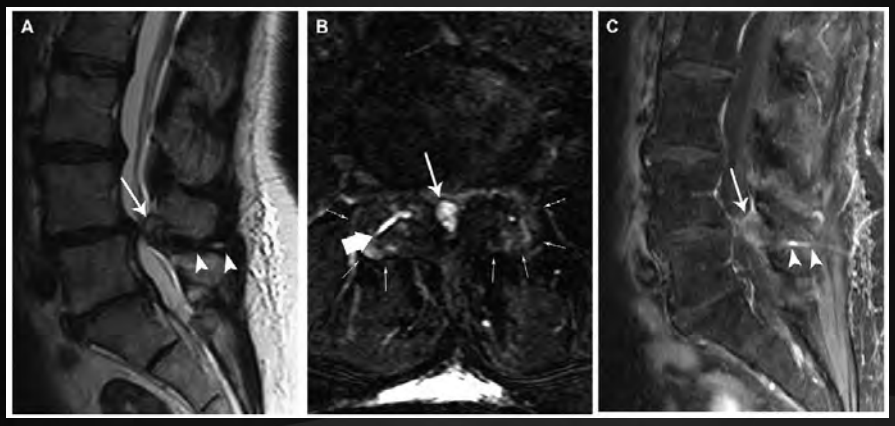

Fig. 18. Interspinal bursitis and midline epidural cyst. A 59-year-old woman with a history of breast cancer presents with back pain radiating to left buttock exacerbated in the upright position. Sagittal FSE T2-weighted image (*A*) shows fluid in the interspinous space (*arrowheads*) tracking to a poorly visualized midline posterior epidural cyst (*white arrows*). Axial fat-suppressed FSE T2-weighted image (*B*) better demonstrates the midline posterior epidural cyst (*arrow*), concurrent bilateral facet synovitis (*thick white arrow*), and right facet joint effusion (*small white arrows*). Enhancement in the interspinal space (*arrowheads*) and at the periphery of the midline epidural cyst (*arrow*) is well seen on the sagittal fat-suppressed CE T1-weighted image (*C*).

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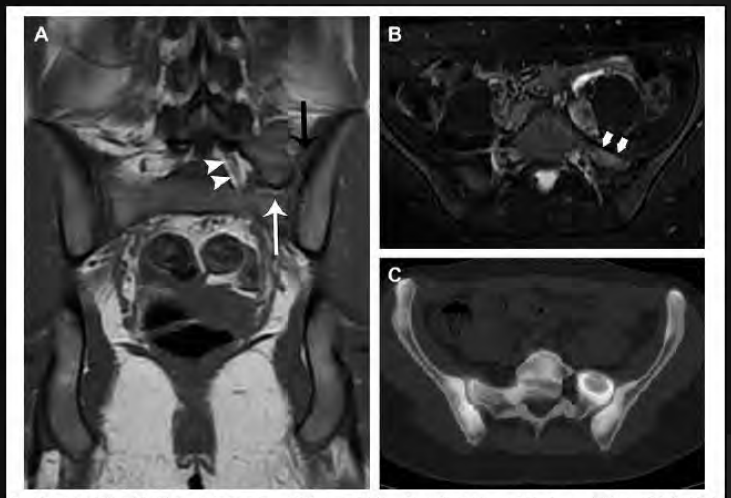

Fig. 19. Transitional lumbosacral segment. A 17-year-old female patient imaged for 1-year history of left-sided LBP. Coronal T1-weighted image (*A*) shows left-sided transitional lumbosacral segment articulating with both the sacrum (*white arrow*) and iliac wing (*black arrow*). The coronal plane clearly depicts the exiting nerve root (*white arrowheads*). Axial fat-suppressed FSE T2-weighted sequence (*B*) demonstrates marrow edema in the enlarged transverse process at the transitional level (*thick white arrows*), and there is increased radiotracer uptake in this region on radionuclide SPECT fused with CT (*C*). (*Courtesy of* Timothy Maus, MD, Mayo Clinic, Rochester, MN; with permission.)

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Box 5
Importance of clinical context

- Axial, nonradicular pain → seek out a posterior element cause
- Additional suggestive findings:
  - Morning back stiffness
  - Decreased range of motion
  - Mechanical pain with extension, flexion, or rotation maneuvers
  - Pain to palpation over facet joints and spinous processes
- Patient age
  - Young → more likely discogenic
  - Older → more likely posterior elements

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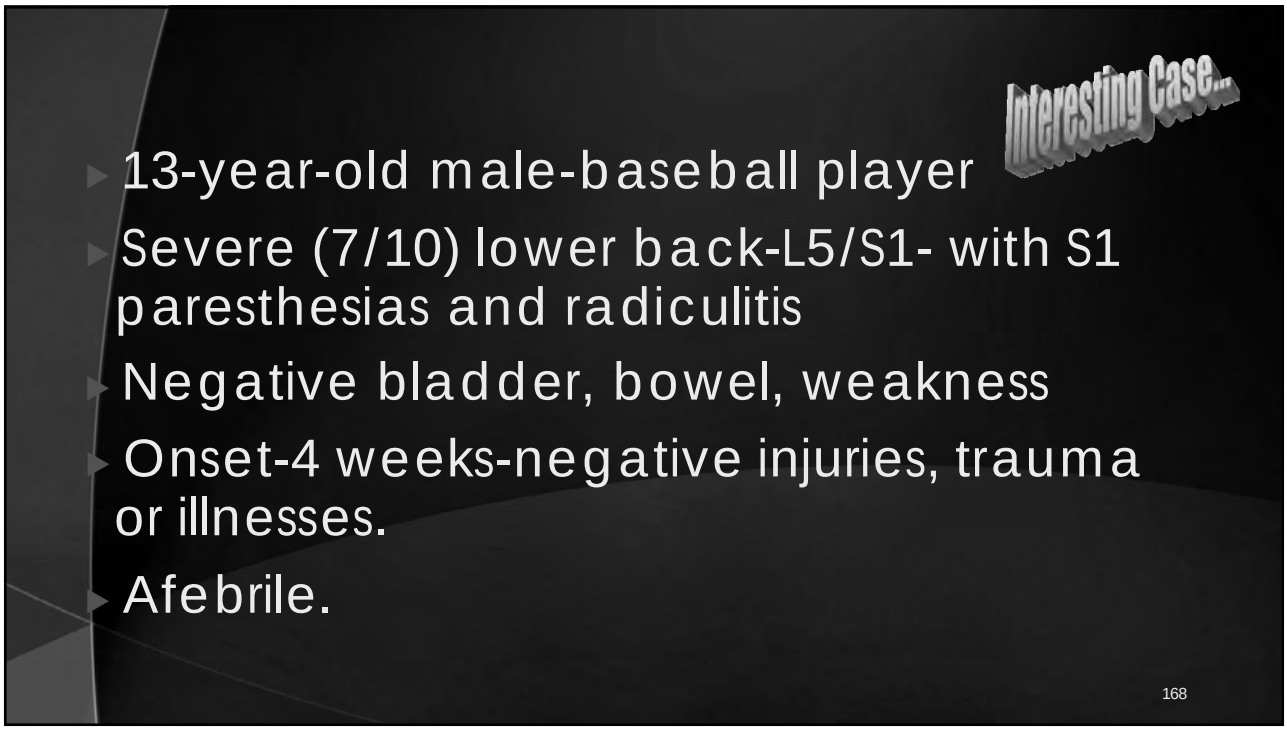

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*** (13y) - 3/2/2018 4:25:39 PM - Lumbar-spine
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*** (13y) - 3/4/2018 3:02:53 PM - SAG T1
*** (13y) - 3/4/2018 3:07:04 PM - SAG T2 FS
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A
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7/4/2004 M
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MRI LUMBOSACRAL SPINE WITH AND WITHOUT CONTRAST
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MRI LUMBOSACRAL SPINE WITH AND WITHOUT CONTRAST
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FS: 1.5
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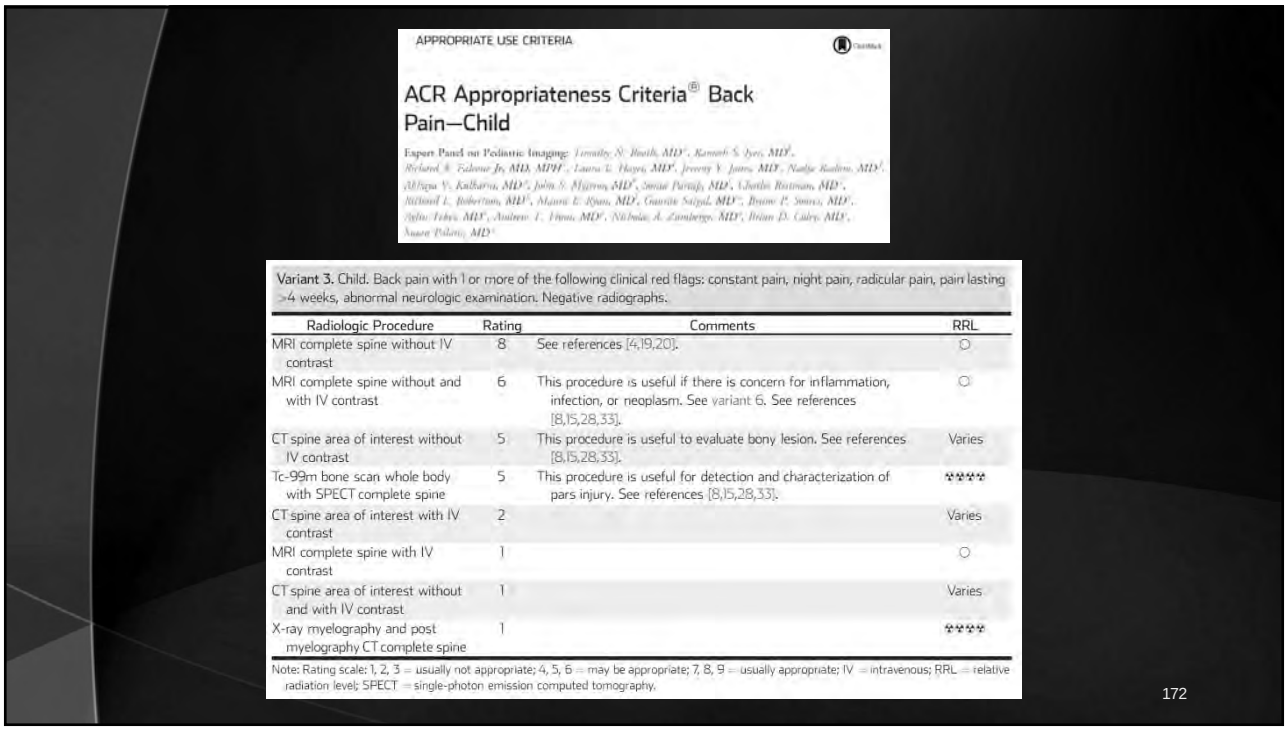
APPROPRIATE USE CRITERIA
ACR Appropriateness Criteria® Back Pain—Child
Expert Panel on Pediatric Imaging:
Variant 3. Child. Back pain with 1 or more of the following clinical red flags: constant pain, night pain, radicular pain, pain lasting >4 weeks, abnormal neurologic examination. Negative radiographs.
Radiologic Procedure | Rating | Comments | RRL
MRI complete spine without IV contrast | 8 | See references [4,19,20]. | ○
MRI complete spine without and with IV contrast | 6 | This procedure is useful if there is concern for inflammation, infection, or neoplasm. See variant 6. See references [8,15,28,33]. | ○
CT spine area of interest without IV contrast | 5 | This procedure is useful to evaluate bony lesion. See references [8,15,28,33]. | Varies
Tc-99m bone scan whole body with SPECT complete spine | 5 | This procedure is useful for detection and characterization of pars injury. See references [8,15,28,33]. | ☢☢☢☢
CT spine area of interest with IV contrast | 2 | | Varies
MRI complete spine with IV contrast | 1 | | ○
CT spine area of interest without and with IV contrast | 1 | | Varies
X-ray myelography and post myelography CT complete spine | 1 | | ☢☢☢☢
Note: Rating scale: 1, 2, 3 = usually not appropriate; 4, 5, 6 = may be appropriate; 7, 8, 9 = usually appropriate; IV = intravenous; RRL = relative radiation level; SPECT = single-photon emission computed tomography.
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Reaction of the Synovial Membrane

- Small fragments of abraded that cartilage may float in the synovial fluid as loose bodies but tend to become incorporated in the synovial membrane which, in turn, reacts by undergoing hypertrophy and producing a moderate synovial effusion.
- The synovial fluid of such an effusion has an increased mucin content and consequently exhibits increased viscosity.
- The fibrous capsule becomes greatly thickened and fibrotic thereby limiting joint motion even further.

Salter: Continuous Passive Motion

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Peripheral Proliferation

- The peripheral rim of articular cartilage of a synovial joint, is covered by a type of perichondrium which is continuous with the synovial membrane.
- In the presence of cartilage degeneration, the peripheral perichondrium proliferates and gradually produces an almost complete peripheral rim (which in any single radiographic projection resembles a lip or a spur).
- Subsequently, it's deeper part undergoes endochondral ossification (osteophyte formation).
- This explains why osteophytes associated with degenerative joint disease are always covered with cartilage.

Salter: Continuous Passive Motion

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Reactions of Synovial Membrane

- The synovial membrane, which secrete synovial fluid for both nutrition and lubrication of the articular cartilage, is capable of reacting to abnormal conditions in one or more of three ways:
  - By producing an excessive amount of fluid (effusion),
  - By becoming thicker (hypertrophy),
  - By forming intra-articular adhesions between itself and the articular cartilage.
- A joint effusion may be serous, inflammatory or hemorrhagic.

Salter: Continuous Passive Motion

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Reactions of Synovial Membrane

- A joint effusion may be serous, inflammatory or hemorrhagic.
- All but the transient effusions cause a second reaction in the synovial membrane, namely varying degrees of synovial hypertrophy.
- Synovial adhesions can also form, especially as the result of a **prolonged limitation of joint motion from any cause,** including prolonged immobilization of the abnormal.
- This explains the well-known clinical observation that prolonged immobilization of a diseased or injured joint is more likely to lead to persistent joint stiffness.

Salter: Continuous Passive Motion

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Reactions of Joint Capsular Ligaments

- The fibers capsule and ligaments allow the design range of joint motion that provide stability of the joint by preventing undesired motion.
- These structures react to abnormal conditions either by becoming stretched and elongated (joint laxity), thereby causing instability of the joint, or becoming tight and shortened (joint contracture), thereby restricting the range of joint motion.

Salter: Continuous Passive Motion

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Hayashi *et al. BMC Musculoskeletal Disorders* 2013, **14**:292
http://www.biomedcentral.com/1471-2474/14/292

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Prevalence of MRI-detected mediopatellar plica in subjects with knee pain and the association with MRI-detected patellofemoral cartilage damage and bone marrow lesions: data from the Joints On Glucosamine study

Daichi Hayashi[1,2*], Li Xu[1,3], Ali Guermazi[1], C Kent Kwoh[4,5], Michael J Hannon[4], Mohamed Jarraya[1], Stephanie M Green[4], John M Jakicic[6], Carolyn E Moore[7] and Frank W Roemer[1,8]

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Full list of author information is available at the end of the article

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- The mediopatellar plica is a synovial fold representing in embryonic remnant from the developmental process of the synovial cavity formation in the knee.
- It can be directly visualized by arthroscopy, but can also be evaluated noninvasively using conventional MRI.
- Asymptomatic synovial plicae may be found within structurally normal knee joints.
- However, direct trauma, repetitive sports activities, or other pathologic knee conditions may provoke secondary inflammation in the synovial tissues around the plica, and may result in increasing fibrotic changes, loss of elasticity, and varying degrees of synovitis.

Hayashi et al. BMC Musculoskeletal Disorders 2013, 14:292

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Figure 1 MRI classification scheme of mediopatellar plicae modified from the Sakakibara arthroscopic classification. (A) Type A lesion in the left knee consisting of a cord-like elevation in the synovial wall; **(B)** Type B lesion in the left knee, which has a shelf-like appearance but does not cover the anterior surface of the medial trochlea; **(C)** Type C lesion in the left knee, which has a large shelf-like appearance and covers the anterior surface of the medial trochlea.

Hayashi et al. BMC Musculoskeletal Disorders 2013, 14:292

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- Synovial plicae are normal anatomic structures of the knee that may become symptomatic.
- The MRI is an established technique for evaluating the anatomy of the knee, and it is a valuable tool for detecting plicae because of its high resolution resulting in increased tissue characterization.
- At MRI, knee plicae appear as low intensity structures of variable size and thickness and they are better visualized at fluid sensitive sequences with or without fat suppression.
- The combined use of clinical examination and MRI may also facilitate the diagnosis of fibrotic or inflamed plicae that may be symptomatic.

Vassiou K, et al. Postgrad Med J 2015;91:35–40.

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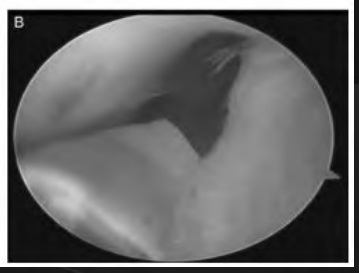

Figure 2 (A) Sagittal MR image with fat suppression shows a linear low-signal-intensity structure anterior and parallel to the anterior cruciate ligament, which represents an infrapatellar plica (arrow). (B) Arthroscopic image of an infrapatellar plica just in front of the anterior cruciate ligament which is not visible.

Vassiou K, et al. Postgrad Med J 2015;91:35–40.

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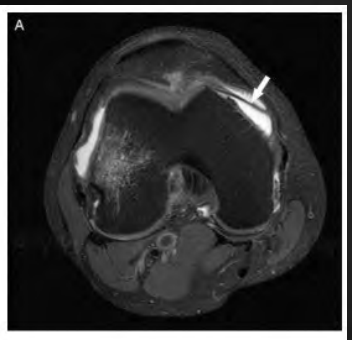

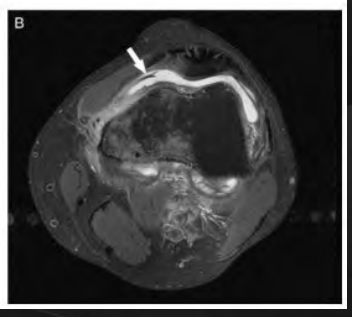

Figure 3 (A) Axial intermediate-weighted MR image with fat suppression reveals a well-demarcated medial plica (arrow) extending toward the midline of the trochlear groove and classified as Sakakibara B. (B) Axial intermediate-weighted MR image with fat suppression indicates a linear structure at the lateral aspect of the suprapatellar pouch that corresponds to a lateral plica (arrow). A medial plica coexists.

Vassiou K, et al. Postgrad Med J 2015;91:35–40.

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- Symptomatic plicae are thickened structures secondary to knee trauma, or other pathologic conditions of the knee.
- The most commonly symptomatic plica is the medial.
- Arthroscopy is considered to be the gold standard for identification of knee plicae.
- The presence of symptomatic plica has been correlated with knee impingement syndromes and early osteoarthritis.

Vassiou K, et al. Postgrad Med J 2015;91:35–40.

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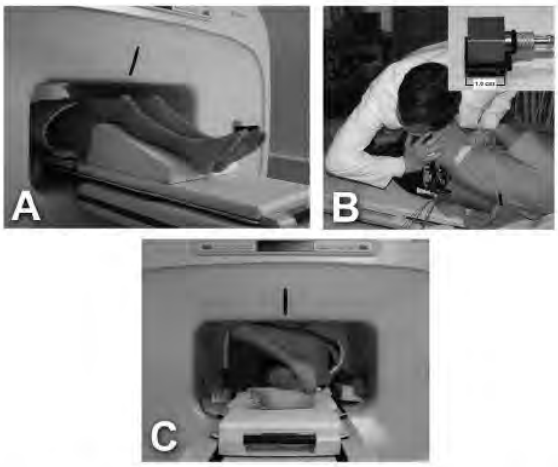

Fig 1. *Participants were first MRI scanned in the neutral supine position (A). Nine accelerometers were placed on each participant, and the output from them was collected for a period of 4 seconds during SMT (group 1) or SPP (group 2) (B; inset shows 1 of the 1.0 cm^3 accelerometers). After recordings were completed, the accelerometers were removed, and a second MRI scan was taken in the side-posture position (C).*

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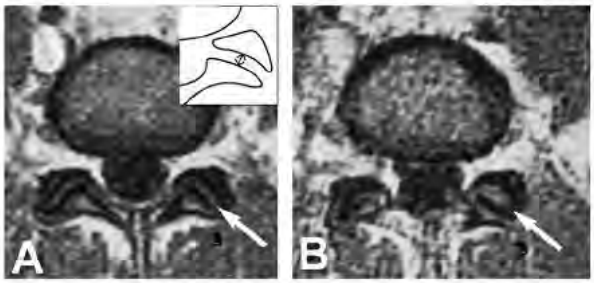

Fig 2. *Pre- (A) and post-spinal manipulation (SMT) (B) horizontal plane (axial) MRI scans of a side-posture SMT participant (group 1) demonstrating gapping of the left L5/S1 Z joint (left side = upside during SMT). Notice that the central width (thickness) of the left post-SMT Z joint space (lateral edge of joint is indicated by arrow in B) is wider than the left pre-SMT Z joint space (arrow in A). The central anterior to posterior distance between the superior and inferior articular processes of the Z joints was measured (A, inset) for the left and right L3/L4, L4/L5, and L5/S1 Z joints from each participant's first and second MRI scans. Figure (B) has been rotated counterclockwise 20° for orientation similar to (A).*

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PLOS ONE

Matrix Metalloproteases and Tissue Inhibitors of Metalloproteinases in Medial Plica and Pannus-like Tissue Contribute to Knee Osteoarthritis Progression

Chih-Chang Yang[1], Cheng-Yu Lin[1], Hwai-Shi Wang[1*], Shaw-Ruey Lyu[2,3]

1 Department of Anatomy, National Yang-Ming University, Taipei, Taiwan, R.O.C., 2 Joint Center, Tzu-Chi Dalin General Hospital, Chiayi, Taiwan, R.O.C., 3 Tzu-Chi University, Hualien, Taiwan, R.O.C.

Abstract

Osteoarthritis (OA) is characterized by degradation of the cartilage matrix, leading to pathologic changes in the joints. However, the pathogenic effects of synovial tissue inflammation on OA knees are not clear. To investigate whether the inflammation caused by the medial plica is involved in the pathogenesis of osteoarthritis, we examined the expression of matrix metalloproteinases (MMPs), tissue inhibitors of metalloproteinases (TIMPs), interleukin (IL)-1β, and tumor necrosis factor (TNF)-α in the medial plica and pannus-like tissue in the knees of patients with medial compartment OA who underwent either arthroscopic medial release (stage II; 15 knee joints from 15 patients) or total knee replacement (stage IV; 18 knee joints from 18 patients). MMP-2, MMP-3, MMP-9, IL-1β, and TNF-α mRNA and protein levels measured, respectively, by quantitative real-time PCR and Quantibody human MMP arrays, were highly expressed in extracts of medial plica and pannus-like tissue from stage IV knee joints. Immunohistochemical staining also demonstrated high expression of MMP-2, MMP-3, and MMP-9 in plica and pannus-like tissue of stage IV OA knees and not in normal cartilage. Some TIMP/MMP ratios decreased significantly in both medial plica and pannus-like tissue as disease progressed from stage II to stage IV. Furthermore, the migration of cells from the pannus-like tissue was enhanced by IL-1β, while plica cell migration was enhanced by TNF-α. The results suggest that medial plica and pannus-like tissue may be involved in the process of cartilage degradation in medial compartment OA of the knee.

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- Osteoarthritis is characterized by degradation of the cartilage matrix and gradually progresses without any repair of the damaged tissue, leading to pathologic changes in the joints.
- Previous studies on patients with OA of the knee have focused on degradation of the cartilage extracellular matrix.
- More recently, synovial tissue inflammation was also found to be a pathogenetic factor in the OA knee.

PLOS 1. November 2013 | Volume 8 | Issue 11 | e79662 189

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- There is evidence for the role of pathologic medial plica in the pathogenesis of medial compartment OA of the knee joint.
- Pannus-like tissue shows dense vascularity and contains aggressive macrophage-like cells and invasive fibroblast like cells.
- These cells, which may originate from the bone marrow or synovial membrane might contribute to cartilage erosion.
- It was recently demonstrated that matrix metalloproteinase (MMP)-3 mRNA and protein are highly expressed in the medial plica and pannus like tissue of the knees of patients with early-stage medial compartment OA.

PLOS 1. November 2013 | Volume 8 | Issue 11 | e79662 190

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TISSUE ENGINEERING: Part B
Volume 20, Number 6, 2014

DOI: 10.1089/ten.teb.2014.0014

Anti-Inflammatory Strategies in Cartilage Repair

Ying Zhang, MS,[1,2] Tyler Pizzute, BS,[1,3] and Ming Pei, MD, PhD[1–3]

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[2]Mechanical and Aerospace Engineering and [3]Exercise Physiology, West Virginia University, Morgantown, West Virginia.

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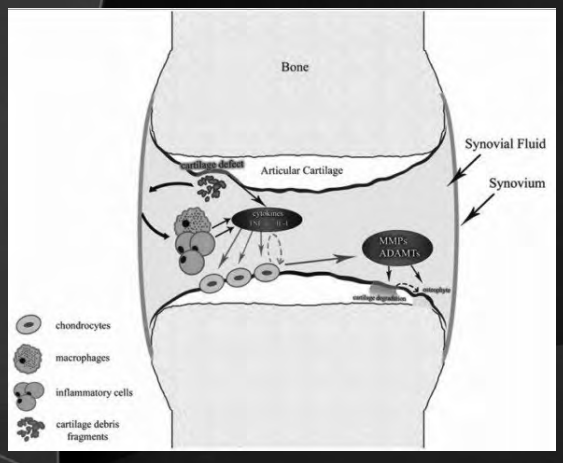
Inflammation in Cartilage Repair



- Abnormally high contact stresses such as mechanical overload transmitted to focal areas of articular cartilage result in cartilage defects and release cartilage fragments.
- This process stimulates the synovial membrane, leading to the activation of macrophages and inflamatory cells such as T cells, which produce interleukin-1b (IL-1b)and tumor necrosis factor alpha (TNFa).
- These activated inflammatory factors may stimulate chondrocytes to secrete degradative matrix metalloproteinases (MMPs) and a disintegrin and metalloprotease with thrombos-pondin motifs (ADAMTS), which are directly involved in degradation of type II collagen and aggrecans in cartilage matrix.
- In the meantime, chondrocytes can change phenotype and size in response to stimulation from inflammatory factors and undergo hypertrophy, which is an essential step in the endochondral ossification process.

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Capsulitis, Synovitis and Posterior Joints

- **T or F** FAT saturated and FAT suppressed MRI provides improved visualization of posterior articular inflammation.
- **T or F** Joint trauma can produce synovial membrane effusions, hypertrophy and intra-articular adhesions.

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Discogenic Issues/Discitis

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Rim Lesions

Acute Injuries to Cervical Joints. An Autopsy Study of Neck Sprain

Taylor JR, Twomey LT. *Spine* 1993

- 15/16 subjects who died of major trauma showed IVD endplate clefts or “Rim Lesions”
- MRI did not visualize all of these lesions.
- Suggested a source of pain.

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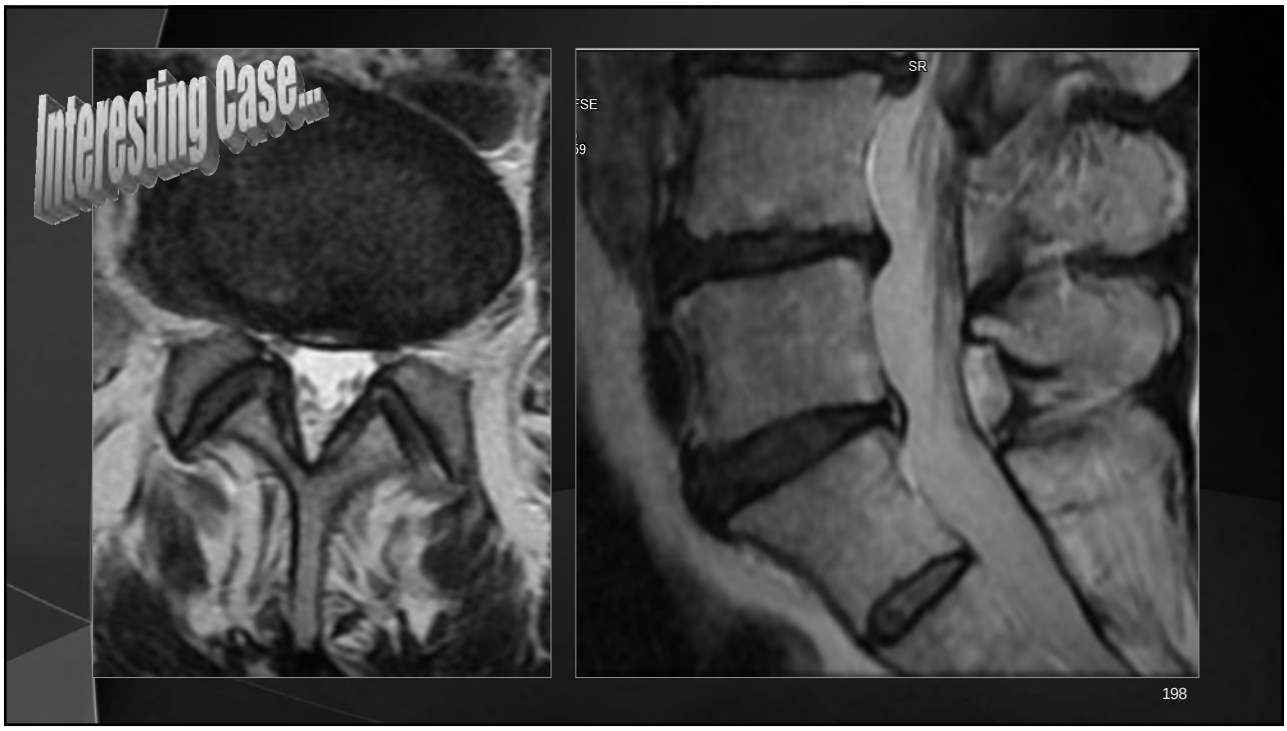

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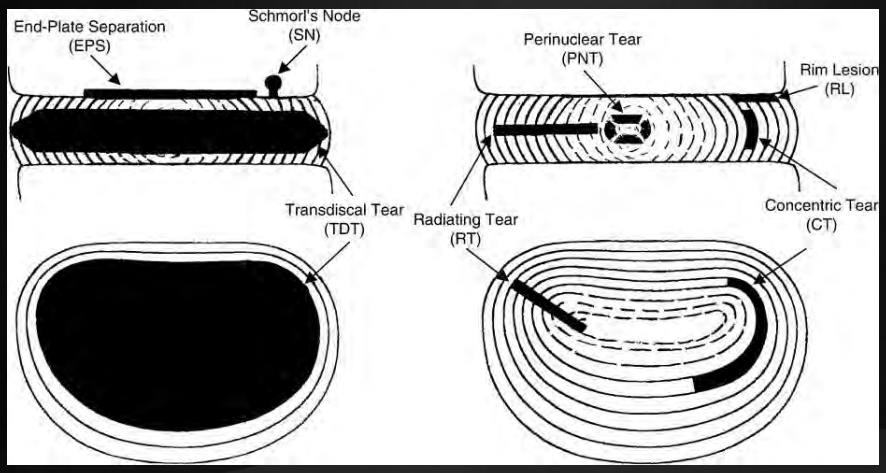

Perinuclear tears (PNT) and a radiating tear (RT).
Vernon Roberts: Spine, Volume 32(25).December 1, 2007.2797-2804

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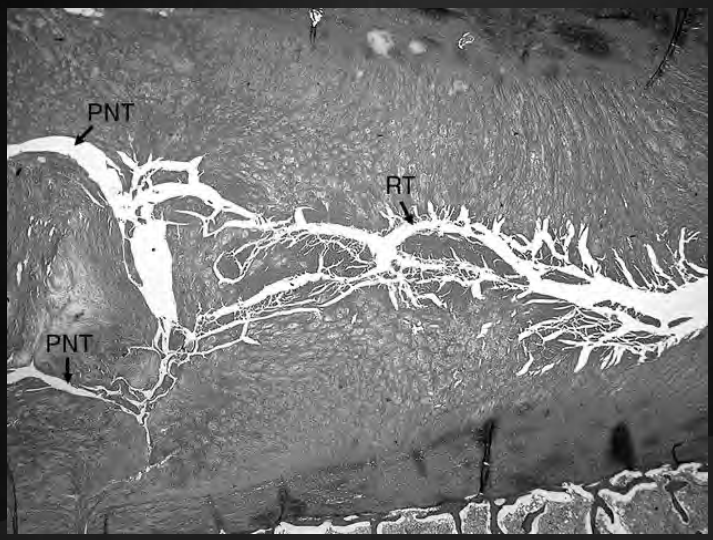

Vernon Roberts: Spine, Volume 32(25).December 1, 2007.2797-2804

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L4–L5 disc from a 72-year-old man, showing a transdiscal tear with characteristic destructive cavitation of the disc center containing free fragments and the radiating “bottle-brush” pattern of minor clefts.
Vernon Roberts: Spine, Volume 32(25).December 1, 2007.2797-2804

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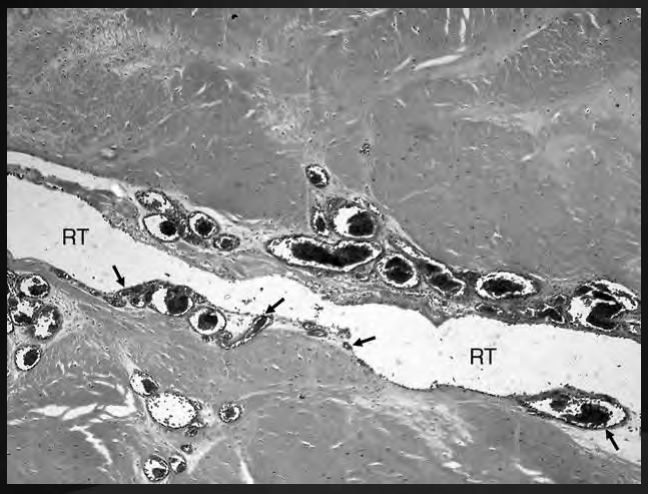

Neovascularization of a radiating tear (RT) in the L4–L5 disc showing that some vessels attached to the inner surface have walls composed only of a single layer of endothelial cells (arrows).
Vernon Roberts: Spine, Volume 32(25).December 1, 2007.2797-2804

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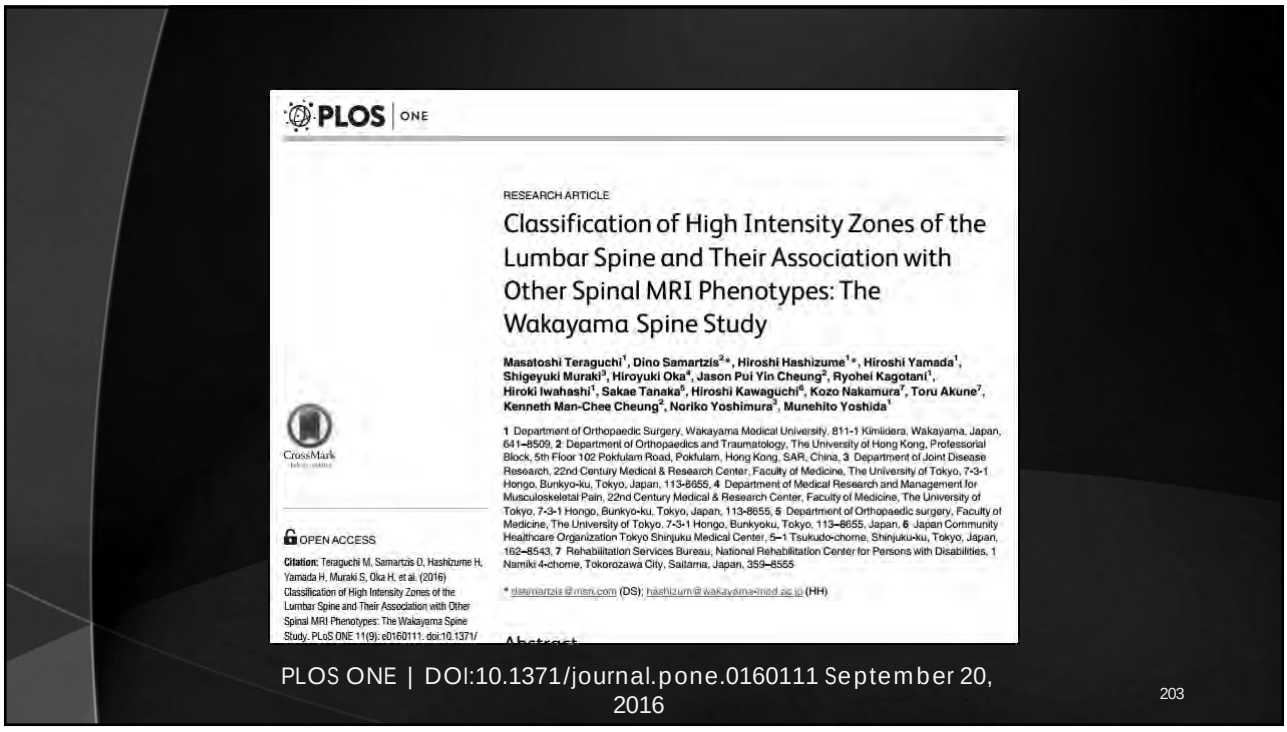

PLOS ONE

RESEARCH ARTICLE

Classification of High Intensity Zones of the Lumbar Spine and Their Association with Other Spinal MRI Phenotypes: The Wakayama Spine Study

Masatoshi Teraguchi[1], Dino Samartzis[2]*, Hiroshi Hashizume[1]*, Hiroshi Yamada[1], Shigeyuki Muraki[3], Hiroyuki Oka[4], Jason Pui Yin Cheung[2], Ryohei Kagotani[1], Hiroki Iwahashi[1], Sakae Tanaka[5], Hiroshi Kawaguchi[6], Kozo Nakamura[7], Toru Akune[7], Kenneth Man-Chee Cheung[2], Noriko Yoshimura[3], Munehito Yoshida[1]

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* dasmartzis@msn.com (DS); hashizum@wakayama-med.ac.jp (HH)

OPEN ACCESS

Citation: Teraguchi M, Samartzis D, Hashizume H, Yamada H, Muraki S, Oka H, et al. (2016) Classification of High Intensity Zones of the Lumbar Spine and Their Association with Other Spinal MRI Phenotypes: The Wakayama Spine Study. PLoS ONE 11(9): e0160111. doi:10.1371/

Abstract

Table 1. Assessment of lumbar High Intensity Zones on MRI.

Variables	Definition
Shape	
Round	Concentric or oval cavity
Fissure	Parallel and transverse layer to the adjacent endplate
Vertical	Vertical layer to the adjacent endplate
Rim	Oblique radiating layer from the adajacent endplate
Enlarged	Greater concentric area than typical round HIZ
Horizontal location within disc	
Posterior	HIZ located in the posterior annulus fibrosus
Anteriror	HIZ located in the anterior annulus fibrosus
Signal type on T1W and T2W HIZ image	
T1W low-intensity type of HIZ	Decreased signal than the bone marrow on T1W sagittal MRI
T1W high-intensity type of HIZ	Increased signal than the bone marrow on T1W sagittal MRI
T1W iso-intensity type of HIZ	Same signal than the bone marrow on T1W sagittal MRI

HIZ: high intensity zones, MRI: magnetic resonance imaging, T1W: T1-weighted, T2W: T2-weighted, MRI: magnetic resonance imaging

doi:10.1371/journal.pone.0160111.t001

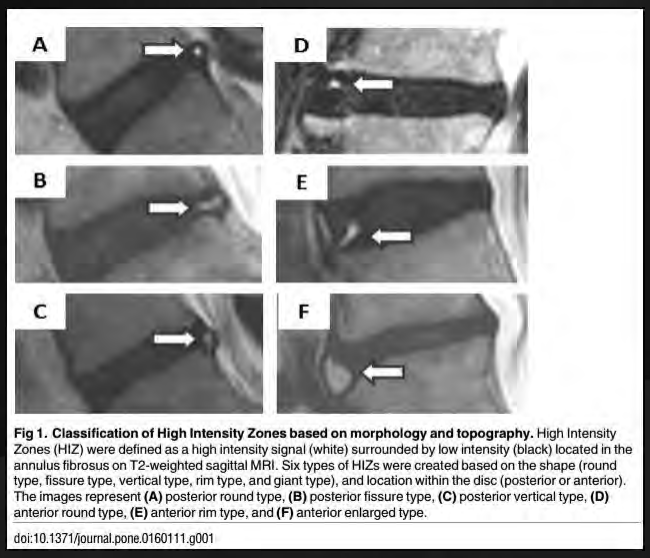

Fig 1. Classification of High Intensity Zones based on morphology and topography. High Intensity Zones (HIZ) were defined as a high intensity signal (white) surrounded by low intensity (black) located in the annulus fibrosus on T2-weighted sagittal MRI. Six types of HIZs were created based on the shape (round type, fissure type, vertical type, rim type, and giant type), and location within the disc (posterior or anterior). The images represent **(A)** posterior round type, **(B)** posterior fissure type, **(C)** posterior vertical type, **(D)** anterior round type, **(E)** anterior rim type, and **(F)** anterior enlarged type.

doi:10.1371/journal.pone.0160111.g001

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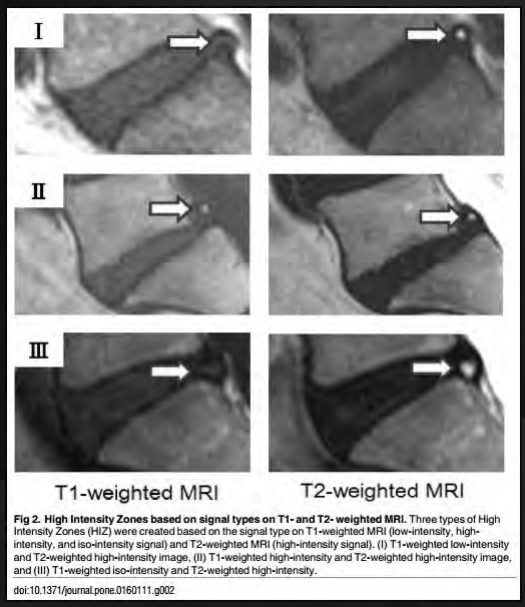

Fig 2. High Intensity Zones based on signal types on T1- and T2- weighted MRI. Three types of High Intensity Zones (HIZ) were created based on the signal type on T1-weighted MRI (low-intensity, high-intensity, and iso-intensity signal) and T2-weighted MRI (high-intensity signal). (I) T1-weighted low-intensity and T2-weighted high-intensity image, (II) T1-weighted high-intensity and T2-weighted high-intensity image, and (III) T1-weighted iso-intensity and T2-weighted high-intensity.

doi:10.1371/journal.pone.0160111.g002

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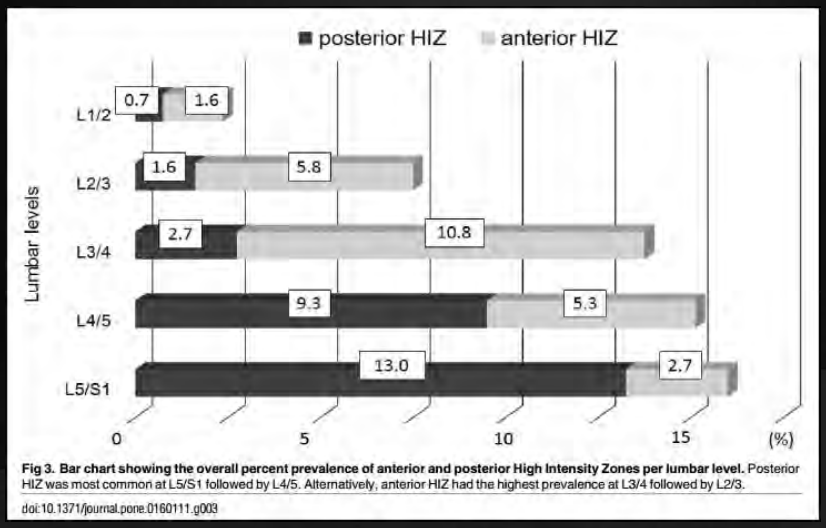

Fig 3. Bar chart showing the overall percent prevalence of anterior and posterior High Intensity Zones per lumbar level. Posterior HIZ was most common at L5/S1 followed by L4/5. Alternatively, anterior HIZ had the highest prevalence at L3/4 followed by L2/3.

doi:10.1371/journal.pone.0160111.g003

PLOS ONE | DOI:10.1371/journal.pone.0160111 September 20, 2016

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Possible Pathogenesis of Painful Intervertebral Disc Degeneration

Peng, Baogan MD, PhD et al. *Spine*, Volume 31(5), 1 March 2006, pp 560-56

To study the pathogenesis of disc degeneration, meanwhile discriminating between common disc degeneration and painful disc degeneration .

Results. The distinct histologic characteristic of the disc from the patient with discogenic low back pain was the ingrowth of vascularized granulation tissue along torn fissures, extending from the external layer of the anulus fibrosus into the nucleus pulposus.

Conclusions. The findings indicated that degeneration of the painful disc might originate from the injury and subsequent repair of anulus fibrosus. Growth factors, such as bFGF and TGF-[beta]1, macrophages and mast cells might play a key role in the repair of the injured anulus fibrosus and subsequent disc degeneration.

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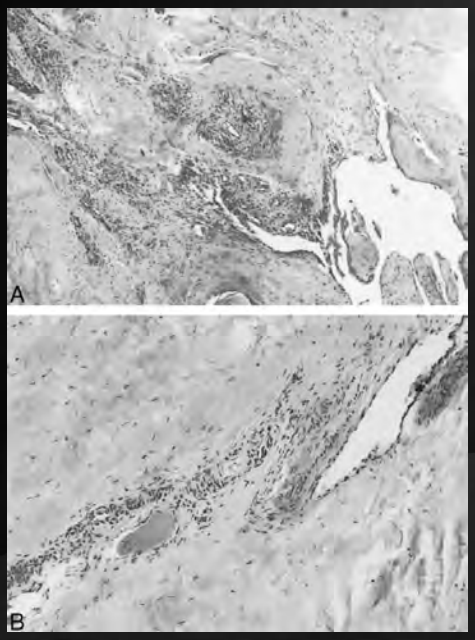

A, The ingrowth of vascularized granulation tissue into anulus along tear in painful disc.

B, A strip of granulation tissue and surrounding tissue in anulus showing fibrosis in surrounding tissue.

From: Peng: Spine, Volume 31(5).March 1, 2006.560-566

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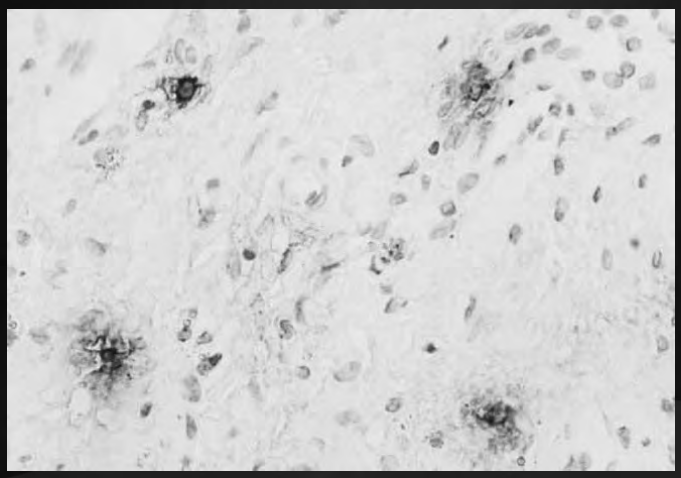

Mast cells in granulation tissue in painful disc.
From: Peng: Spine, Volume 31(5).March 1, 2006.560-566

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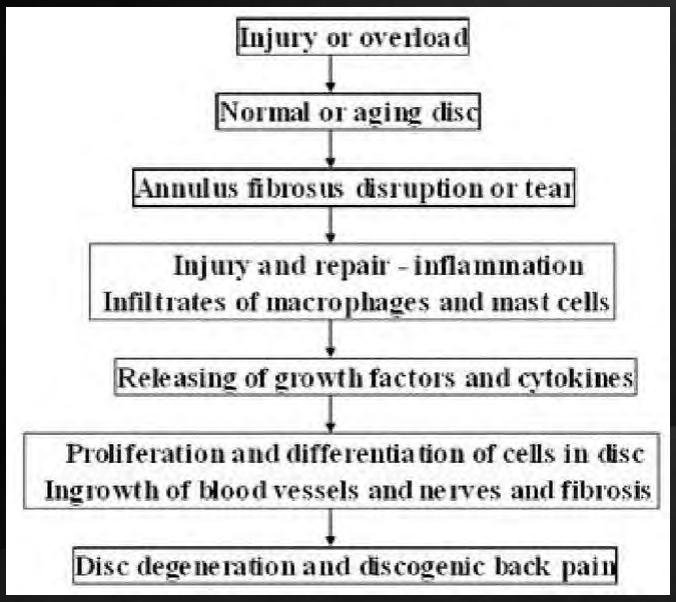

From: Peng: Spine, Volume 31(5).March 1, 2006.560-566

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IVD Nutrition

Very Important!!!

Nutrition of the Intervertebral Disc.
Spine. 29(23):2700-2709, December 1, 2004.
Urban, Jill P.G. PhD et al.

Objectives. To summarize the information on disc nutrition in relation to disc degeneration.

Summary of the Background Data. The disc is avascular, and the disc cells depend on diffusion from blood vessels at the disc's margins to supply the nutrients essential for cellular activity and viability and to remove metabolic wastes such as lactic acid. The nutrient supply can fail due to changes in blood supply, sclerosis of the subchondral bone or endplate calcification, all of which can block transport from blood supply to the disc or due to changes in cellular demand.

Methods. A review of the studies on disc blood supply, solute transport, studies of solute transport in animal and human disc in vitro, and of theoretical modeling studies that have examined factors affecting disc nutrition.

Results. Small nutrients such as oxygen and glucose are supplied to the disc's cells virtually entirely by diffusion; convective transport, arising from load-induced fluid movement in and out of the disc, has virtually no direct influence on transport of these nutrients. Consequently, there are steep concentration gradients of oxygen, glucose, and lactic acid across the disc; oxygen and glucose concentrations are lowest in the center of the nucleus where lactic acid concentrations are greatest. The actual levels of concentration depend on the balance between diffusive transport and cellular demand and can fall to critical levels if the endplate calcifies or nutritional demand increases.

Conclusions. Loss of nutrient supply can lead to cell death, loss of matrix production, and increase in matrix degradation and hence to disc degeneration.

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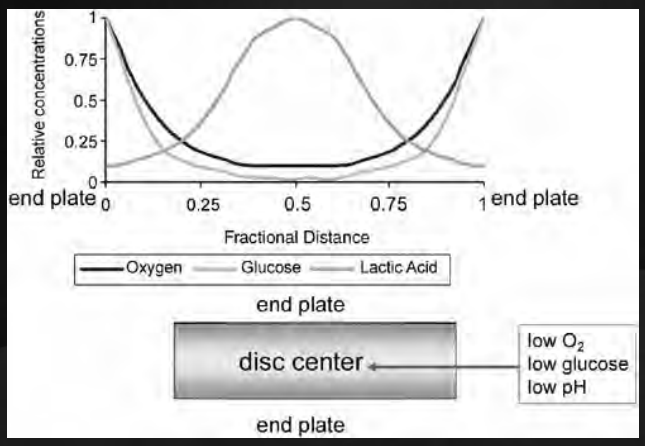
NUTRIENT SUPPLY AND INTERVERTEBRAL DISC METABOLISM

Grunhagen et al. JBJS. Volume 88 Supplement 2, April 2006, p 30–35.



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Spine
SPINE Volume 41, Number 7, pp 568–576

BASIC SCIENCE

Influences of Nutrition Supply and Pathways on the Degenerative Patterns in Human Intervertebral Disc

Qiaoqiao Zhu, BS,* Xin Gao, BS,† Howard B. Levene, MD, PhD,‡ Mark D. Brown, MD, PhD,§ and Weiyong Gu, PhD*,†

"Impairment of different nutrition pathways results in different degenerative patterns."

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J Orthop Res. 2013 February ; 31(2): 210–217. doi:10.1002/jor.22216.

Intervertebral Disc Degeneration and Ectopic Bone Formation in Apolipoprotein E Knockout Mice

Dawei Zhang[a], **Li Jin**[a], **Davis L. Reames**[b], **Francis H. Shen**[a], **Adam L. Shimer**[a], and **Xudong Li**[a]

[a]Department of Orthopedic Surgery University of Virginia Health System, Charlottesville, Virginia, United States of America

[b]Department of Neurological Surgery, University of Virginia Health System, Charlottesville, Virginia, United States of America

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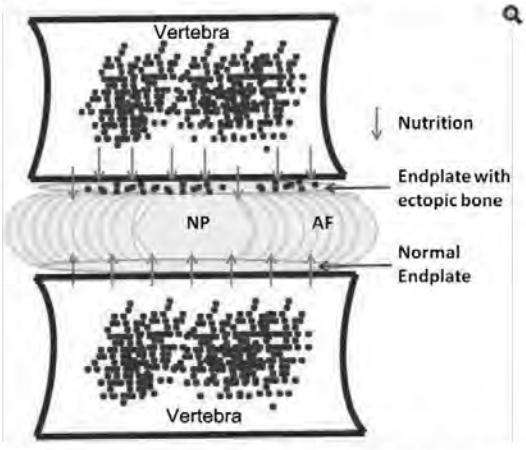
Fig.8



Scheme illustrating pathogenesis of intervertebral disc degeneration in ApoE KO mice: Ectopic bone formation in the endplates defers the nutrition supplies to intervertebral disc.

J Orthop Res. 2013 February ; 31(2): 210–217.

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Spine
SPINE Volume 40, Number 15, pp 1158-1164

BASIC SCIENCE

ISSLS Prize Winner: Dynamic Loading–Induced Convective Transport Enhances Intervertebral Disc Nutrition

Sarah E. Gullbrand, PhD,* Joshua Peterson, BS,* Jenna Ahlborn, BS,* Rosemarie Mastropolo, BS,* Arun Fricker, BS,* Timothy T. Roberts, MD,† Mostafa Abousayed, MD,† James P. Lawrence, MD, MBA,† Joseph C. Glennon, VMD‡ and Eric H. Ledet, PhD*

Conclusion. These results illustrate that trans-endplate diffusion can be enhanced by forced convection in both healthy and degenerative discs in vivo. Mechanical loading–induced convection could offer therapeutic benefi t for degenerated discs by enhancing uptake of nutrients and clearance of by-products.

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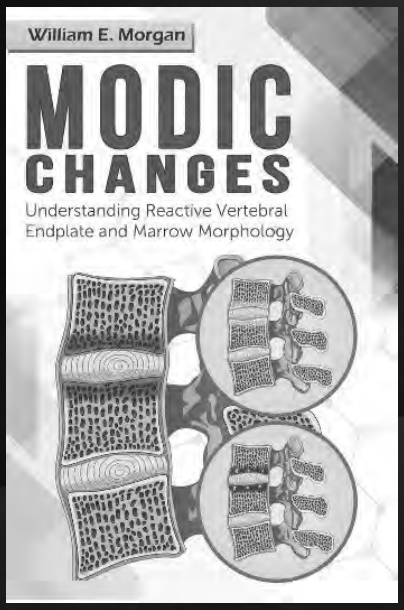

Morgan WE. Modic Changes: Understanding Reactive Vertebral Endplate and Marrow Morphology. Copyright 2015. Bethesda Spine Institute

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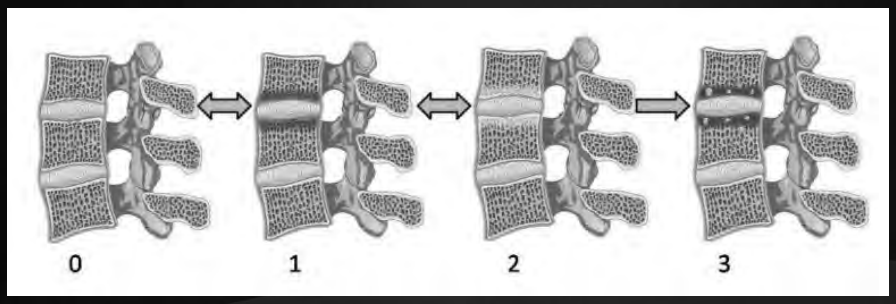

Morgan WE. Modic Changes: Understanding Reactive Vertebral Endplate and Marrow Morphology. Copyright 2015. Bethesda Spine Institute

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Normal bone is spongy and uniform in appearance. The vertebral endplates are a thin dense margin of bone.	 Normal
Bony edema has been connected with acute endplate or disc disruption. This edema is visible on MRI and is classified as Type 1 Modic change. It has been associated with pain and inflammation.	 Type 1 Modic Changes
Type 2 Modic changes are indicative of yellow fatty infiltration into cortical bone following bony ischemia. Type 2 Modic changes may progress from type I Modic changes.	 Type 2 Modic Changes
Type 3 changes are categorized by sclerotic changes of subchondral bone and thickening of the endplates. In time, thickened endplates will reduce nutrient and fluid movement into adjoining discs. This will contribute to reduced fluid content within the adjoining disc and subsequent degenerative disc disease.	 Type 3 Modic Changes

Morgan WE. Modic Changes: Understanding Reactive Vertebral Endplate and Marrow Morphology. Copyright 2015. Bethesda Spine Institute7

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Fatty infiltration into bone can have a heterogeneous mottled appearance which may appear like metastases, and conversely, metastases may remind the clinician of fatty infiltration. On MRI, comparing T1, T2, and fat-suppressed images will help to distinguish fatty infiltration from neoplasms. It is important to always defer to a trained radiologist for the identification of pathology.

Differentiating Fat from Bony Metastases			
	T1	T2	T2 with fat suppression
Fat	Bright	Bright	Dark
Metastases	Dark	Bright	Bright

Morgan WE. Modic Changes: Understanding Reactive Vertebral Endplate and Marrow Morphology. Copyright 2015. Bethesda Spine Institute

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Differentiating Hemangiomas from Metastasis

Any discussion about the differentiation between benign and cancerous lesions on MRI should occur over the safety net provided by radiologists. Hemangiomas are a common benign finding on lumbar MRI and are usually incidental and asymptomatic. Upon first viewing a large hemangioma on MR, a clinician may be taken back by the appearance of this impressive looking lesion. Having confidence in differentiating these two findings will expedite appropriate progression of care.

Lesion Type	T1	T2	T2 with Fat suppression
Hemangioma	Bright	Bright	Dark
Metastasis	Dark	Bright	Bright

Morgan WE. Modic Changes: Understanding Reactive Vertebral Endplate and Marrow Morphology. Copyright 2015. Bethesda Spine Institute

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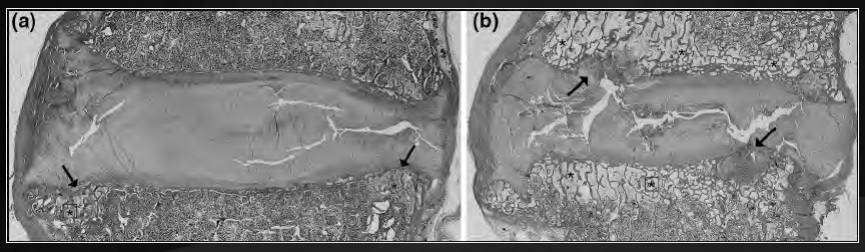
Modic Changes

Reactive vertebral body modifications associated with disc inflammation and degenerative disc disease, as seen on MR images.



Modic change type 1 characterized by fibrovascular tissue (asterisks) and trabecular thickening.

Modic change type 2. Fatty marrow replacement (asterisks) and fibrotic tissue occurs along the entire endplates.

Dudli et al. Eur Spine J. Feb 25. **Pathobiology of Modic changes.**

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Prevalence of Modic Degenerative Marrow Changes in the Cervical Spine

Cynthia K. Peterson, RN, DC, M Med Ed,[a] B. Kim Humphreys, DC, PhD,[b] and Tania C. Pringle, DC[c]

ABSTRACT

Objective: The prevalence and distribution of Modic degenerative marrow changes as seen on magnetic resonance imaging scans have been reported for the lumbar spine, and research suggests that type 1 Modic changes are linked to low back pain. The purpose of this study was to report on the prevalence, types, and distribution of the changes found for the cervical spine.

Methods: One hundred thirty-three cervical spine T_1-weighted and T_2-weighted sagittal magnetic resonance imaging scans were viewed retrospectively by two radiologists. Data were recorded for patient age, patient sex, and the presence or absence of Modic changes. If Modic changes were present, then the precise vertebral levels of these changes and the specific Modic type were recorded. Descriptive statistics were calculated for the prevalence of Modic changes overall, the prevalence of types 1, 2, and 3 changes, and the prevalence in male vs female patients. The frequency of these changes by spinal level was also determined.

Results: One hundred eighteen patients met the inclusion criteria. Modic changes were seen in 19 patients (16%), with 4 showing changes in more than one segmental level. The most common Modic change observed was type 1. Type 3 marrow changes were the second most common category to be noted. Only 3 patients had Modic type 2 marrow changes. The most common cervical spinal level to show Modic changes was C5-6.

Conclusions: Modic degenerative bone marrow changes are observed in the cervical spine, with the C5-6 level being the most commonly involved. Unlike in the lumbar spine in which Modic type 2 changes predominate, type 1 marrow changes were far more common in the cervical spine. Further studies should focus on the clinical relevance of these findings. (J Manipulative Physiol Ther 2007;30:5-10)

Key Indexing Terms: *Magnetic Resonance Imaging; Intervertebral Disk; Cervical Vertebrae; Bone Marrow*

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Prevalence of Modic Degenerative Marrow
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Practical Applications

- Modic degenerative marrow changes are common in the cervical spine.
- Type 1 changes appear to be more common in the neck, whereas type 2 changes predominate in the lumbar spine.
- The C5-6 level is most commonly involved.
- There is no sex difference in the prevalence of Modic changes in the cervical spine.

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Prevalence of Modic Degenerative Marrow

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Relationship of Modic Changes, Disk Herniation Morphology, and Axial Location to Outcomes in Symptomatic Cervical Disk Herniation Patients Treated With High-Velocity, Low-Amplitude Spinal Manipulation: A Prospective Study

Michel Kressig, MChiroMed,[a,b] Cynthia K. Peterson, RN, DC, MMedEd,[b] Kyle McChurch, DC,[a] Christof Schmid, DC,[c] Serafin Leemann, DC,[c] Bernard Anklin, DC,[c] and B. Kim Humphreys, DC, PhD[b]

ABSTRACT

Objective: The purpose of this study was to evaluate whether cervical disk herniation (CDH) location, morphology, or Modic changes (MCs) are related to treatment outcomes.

Methods: Magnetic resonance imaging (MRI) and outcome data from 44 patients with CDH treated with spinal manipulative therapy were evaluated. MRI scans were assessed for CDH axial location, morphology, and MCs. Pain (0-10 for neck and arm) and Neck Disability Index (NDI) data were collected at baseline; 2 weeks; 1, 3, and 6 months; and 1 year. The Patient's Global Impression of Change data were collected at all time points and dichotomized into "improved," yes or no. Fischer's exact test compared the proportion improved with MRI abnormalities. Numerical rating scale and NDI scores were compared with MRI abnormalities at baseline and change scores at all time points using the *t* test or Mann-Whitney *U* test.

Results: Patients who were Modic positive had higher baseline NDI scores ($P = .02$); 77.8% of patients who were Modic positive and 53.3% of patients who were Modic negative reported improvement at 2 weeks ($P = .21$). Fifty percent of Modic I and 83.3% of Modic II patients were improved at 2 weeks ($P = .07$). At 3 months and 1 year, all patients with MCs were improved. Patients who were Modic positive had higher NRS and NDI change scores. Patients with central herniations were more likely to improve only at the 2-week time point ($P = .022$).

Conclusions: Although patients who were Modic positive had higher baseline NDI scores, the proportion of these patients improved was higher for all time points up to 6 months. Patients with Modic I changes did worse than patients with Modic II changes at only 2 weeks. (J Manipulative Physiol Ther 2016;39:565-575)

Key Indexing Terms: *Cervical Spine; Disk Herniation; Chiropractic Manipulation; MRI; Outcomes; Modic Changes*

J Manipulative Physiol Ther 2016;39:565-575.

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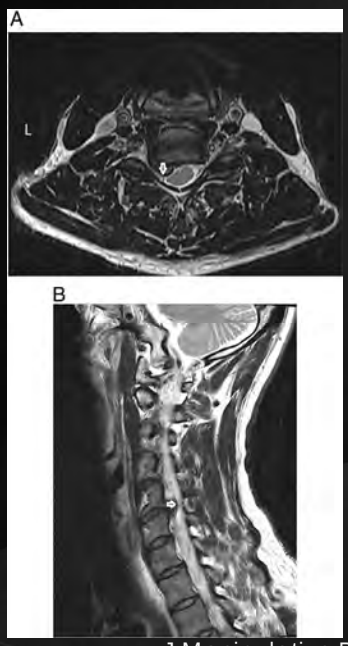

J Manipulative Physiol Ther 2016;39:565-575.

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Practical Applications

- A higher proportion of patients who were Modic positive and had CDH reported improvement after cervical manipulation compared with patients who were Modic negative at 2 weeks, 1 month, and 3 months.
- Patients with CDH who were Modic positive had significantly higher baseline disability scores, but at all follow-up time points other than 6 months, there were no differences compared with patients who were Modic negative.
- Patients with central herniations were more likely to improve at the 2-week time point compared with patients with paracentral or foraminal herniations.

J Manipulative Physiol Ther 2016;39:565-575.

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Symptomatic, Magnetic Resonance Imaging–Confirmed Cervical Disk Herniation Patients: A Comparative-Effectiveness Prospective Observational Study of 2 Age- and Sex-Matched Cohorts Treated With Either Imaging-Guided Indirect Cervical Nerve Root Injections or Spinal Manipulative Therapy

Cynthia K. Peterson, RN, DC, MMedEd,[a,b] Christian W.A. Pfirrmann, MD, MBA,[c] Jürg Hodler, MD, MBA,[d] Serafin Leemann, DC,[e] Christof Schmid, DC,[e] Bernard Anklin, DC,[e] and B. Kim Humphreys, DC, PhD[f]

J Manipulative Physiol Ther 2016;39:210-217.

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Fig 2. *Image of the injection.*

- Most acute patients with MRI-confirmed symptomatic cervical disk herniations treated with either CNRI or SMT reported clinically relevant improvement at 3 months with no significant difference in outcomes between the 2 treatment methods.
- However, when comparing the 3-month outcomes for the subacute/chronic patients, more than 78% of patients treated with SMT reported clinically relevant improvement compared with 37.5% of patients receiving a single CNRI.
- The treatment costs between the 2 groups were very similar. There were no adverse events for either cohort.

J Manipulative Physiol Ther 2016;39:210-217.

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Comparison of Outcomes in MRI Confirmed Lumbar Disc Herniation Patients With and Without Modic Changes Treated With High Velocity, Low Amplitude Spinal Manipulation

Michelé Annen, B.Med.,[a] Cynthia Peterson, DC, M.Med.Ed.,[b] Serafin Leemann, DC,[c] Christof Schmid, DC,[c] Bernard Anklin, DC,[c] and B. Kim Humphreys, DC, PhD[d]

ABSTRACT

Objective: The purpose of this study was to determine if there is a difference in outcomes between Modic positive and negative lumbar disc herniation (LDH) patients treated with spinal manipulative therapy (SMT).

Methods: This prospective outcomes study includes 72 MRI confirmed symptomatic LDH patients treated with SMT. Numerical rating scale (NRS) pain and Oswestry disability data were collected at baseline. NRS, patient global impression of change to assess overall improvement, and Oswestry data were collected at 2 weeks, 1, 3, 6 months and 1 year. MRI scans were analyzed for Modic change present/absent and classified as Modic I or II when present. Chi-squared test compared the proportion of patients reporting relevant "improvement" between patients with and without Modic changes and those with Modic I vs. II. NRS and Oswestry scores were compared at baseline and change scores at all follow-up time points using the unpaired Student *t* test.

Results: 76.5% of Modic positive patients reported "improvement" compared to 53.3% of Modic negative patients ($P = .09$) at 2 weeks. Modic positive patients had larger decreases in leg pain ($P = .02$) and disability scores ($P = .012$) at 2 weeks. Modic positive patients had larger reductions in disability levels at 3 ($P = .049$) and 6 months ($P = .001$). A significant difference ($P = .001$) between patients with Modic I vs. Modic II was found at 1 year, where Modic II patients did significantly better.

Conclusion: Modic positive patients reported higher levels of clinically relevant improvement 2 weeks, 3 and 6 months compared to Modic negative patients. However, at 1 year Modic I patients were significantly less likely to report "improvement", suggesting they may be prone to relapse. (J Manipulative Physiol Ther 2016;39:200-209)

Key Indexing Terms: *Modic Changes; Disc Herniation; Lumbar Spine; Outcomes Assessment; Manipulation, Spinal*

J Manipulative Physiol Ther 2016;39:200-209.

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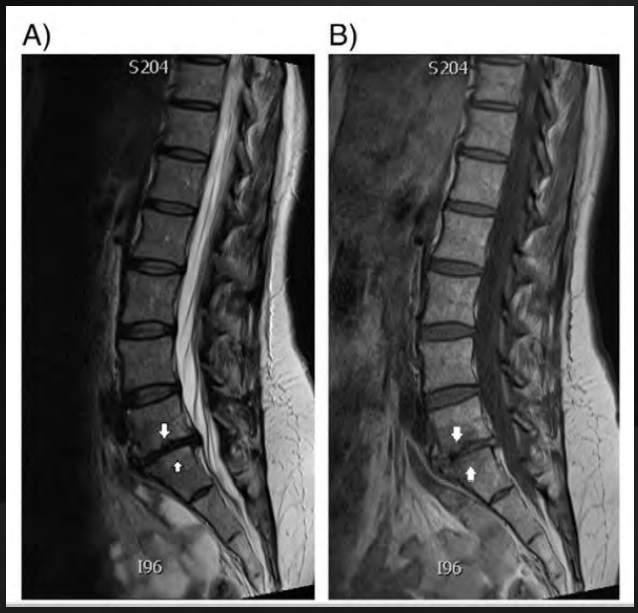

J Manipulative Physiol Ther 2016;39:200-209.

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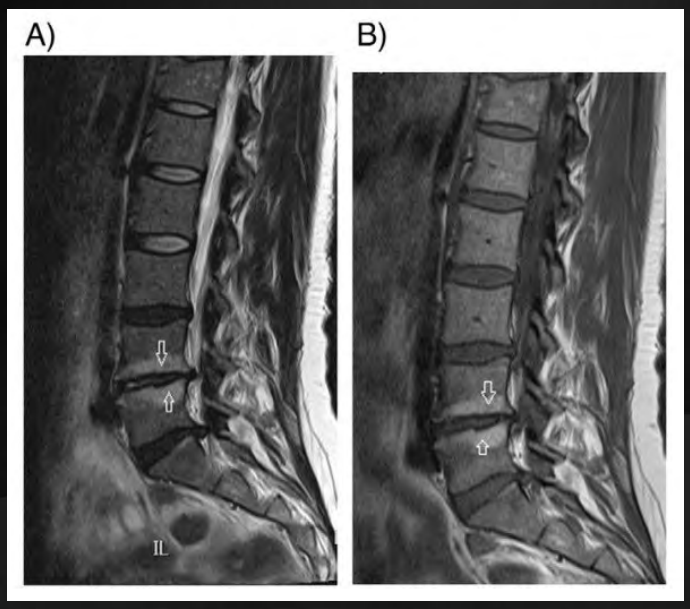

J Manipulative Physiol Ther 2016;39:200-209.

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Practical Applications

- Lumbar disc herniation patients with Modic changes report better outcomes after spinal manipulation treatment at 2 weeks and 3 and 6 months compared to patients without Modic changes.
- Only at the 1 year time point did patients with Modic I changes have significantly worse outcomes with a similar trend at 1 month.
- Modic I patients appear to be more prone to recurrences compared to Modic II patients and those without Modic changes.

J Manipulative Physiol Ther 2016;39:200-209.

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Symptomatic, MRI Confirmed, Lumbar Disc Herniations: A Comparison of Outcomes Depending on the Type and Anatomical Axial Location of the Hernia in Patients Treated With High-Velocity, Low-Amplitude Spinal Manipulation

Marco Ehrler, B. Med.,[a] Cynthia Peterson, DC, M.Med.Ed.,[b] Serafin Leemann, DC,[c] Christof Schmid, DC,[c] Bernard Anklin, DC,[c] and B. Kim Humphreys, DC, PhD[d]

- Patients with sequestered herniations treated with SMT to the level of herniation reported significantly higher levels of leg pain reduction at 1 month and a higher proportion reported improvement at all data collection time points compared to patients with extruded disc herniations but this did not reach statistical significance.
- Further investigation is needed to determine mechanisms for this finding. This also calls into question the seriousness of disc sequestration in determining appropriate treatment.

J Manipulative Physiol Ther 2016;39:192-199

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Fig 1. *Axial T2-weighted lumbar MRI slice showing the anatomic zones for classifying the location of disc herniation according to the combined task forces of the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology. This patient has a paracentral herniation (b). a = central; b = paracentral; c = foraminal; d = extraforaminal.*

J Manipulative Physiol Ther 2016;39:192-199

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J Manipulative Physiol Ther 2016;39:192-199

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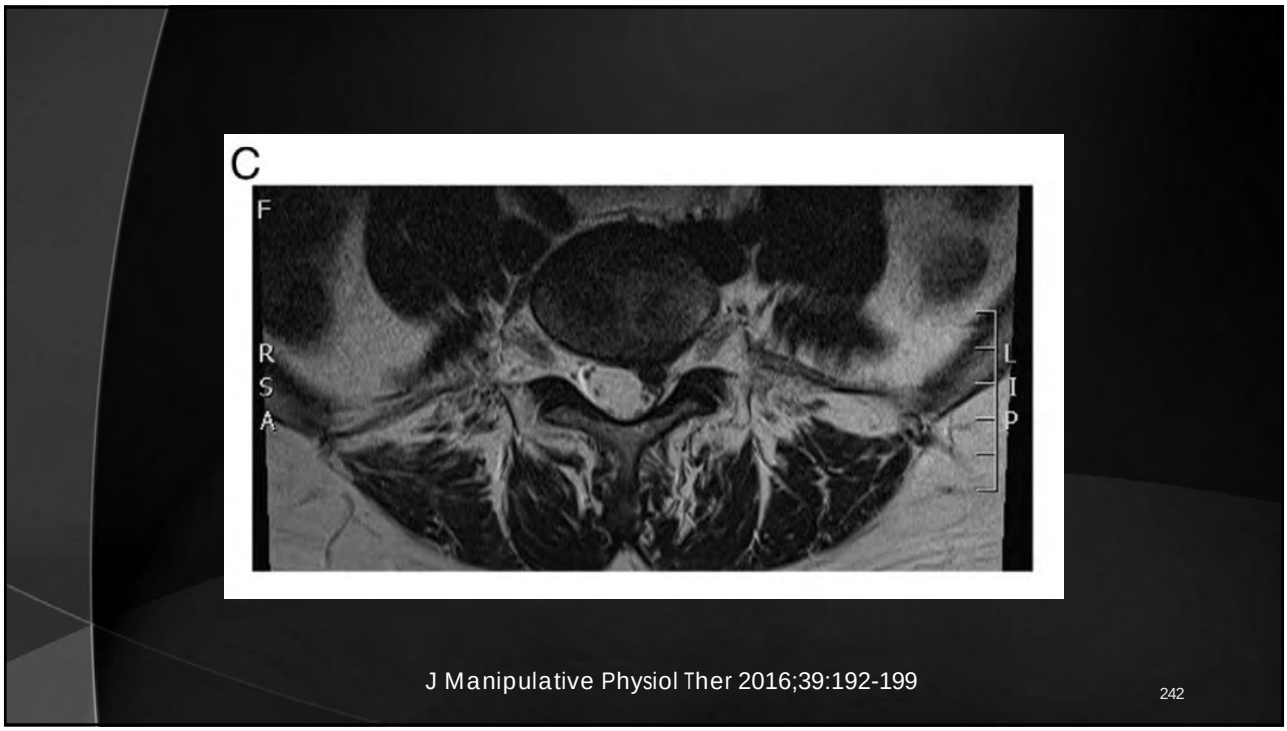

J Manipulative Physiol Ther 2016;39:192-199

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Fig 3. *Sagittal and axial T2-weighted slices showing a large disc sequestration at the L5-S1 level. The fragment extends inferiorly behind the S1 vertebral body. Modic changes are also present at the inferior end plate of L5. This patient was included in this study.*

J Manipulative Physiol Ther 2016;39:192-199

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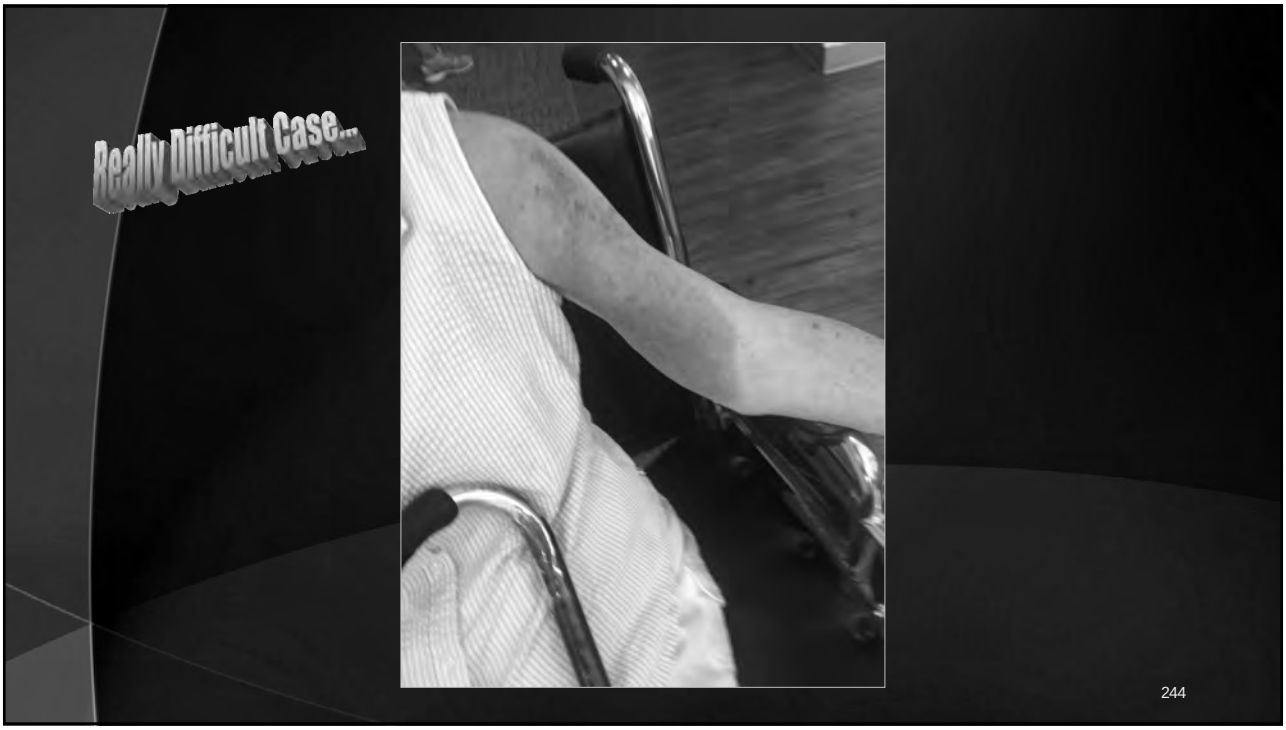

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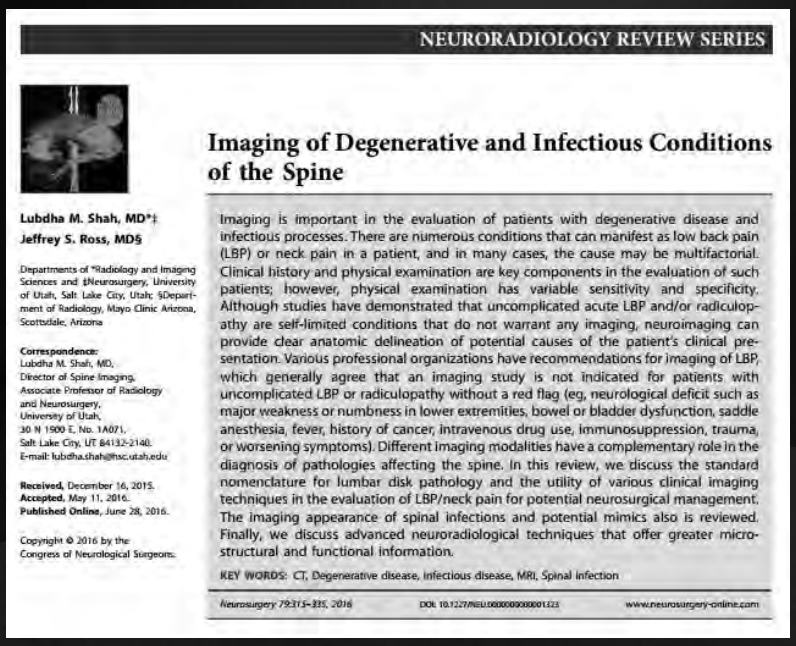

NEURORADIOLOGY REVIEW SERIES

Imaging of Degenerative and Infectious Conditions of the Spine

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Published Online, June 28, 2016.

Imaging is important in the evaluation of patients with degenerative disease and infectious processes. There are numerous conditions that can manifest as low back pain (LBP) or neck pain in a patient, and in many cases, the cause may be multifactorial. Clinical history and physical examination are key components in the evaluation of such patients; however, physical examination has variable sensitivity and specificity. Although studies have demonstrated that uncomplicated acute LBP and/or radiculopathy are self-limited conditions that do not warrant any imaging, neuroimaging can provide clear anatomic delineation of potential causes of the patient's clinical presentation. Various professional organizations have recommendations for imaging of LBP, which generally agree that an imaging study is not indicated for patients with uncomplicated LBP or radiculopathy without a red flag (eg, neurological deficit such as major weakness or numbness in lower extremities, bowel or bladder dysfunction, saddle anesthesia, fever, history of cancer, intravenous drug use, immunosuppression, trauma, or worsening symptoms). Different imaging modalities have a complementary role in the diagnosis of pathologies affecting the spine. In this review, we discuss the standard nomenclature for lumbar disk pathology and the utility of various clinical imaging techniques in the evaluation of LBP/neck pain for potential neurosurgical management. The imaging appearance of spinal infections and potential mimics also is reviewed. Finally, we discuss advanced neuroradiological techniques that offer greater microstructural and functional information.

KEY WORDS: CT, Degenerative disease, Infectious disease, MRI, Spinal infection

Neurosurgery 79:315–335, 2016 DOI: 10.1227/NEU.0000000000001123 www.neurosurgery-online.com

Neurosurgery 79:315–335, 2016.

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Spinal Infections

- Spinal infections may involve the intramedullary (eg, viral myelitis, abscess), intradural extramedullary (eg, meningitis), and extradural spaces.
- The latter includes epidural abscess, paraspinal abscess, and diskitis-osteomyelitis (DOM).
- Spinal infection is the most common form of hematogenous osteomyelitis in patients 50 years of age and represents 3% to 5% of all cases of osteomyelitis.
- The increasing incidence has been attributed to an increase in susceptible patients such as intravenous drug users, individuals undergoing hemodialysis, and immunocompromised hosts.

Neurosurgery 79:315–335, 2016.

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Spinal Infections

- The diagnosis of osteomyelitis may be difficult and requires the combination of information obtained from many different modalities, including serological, radiographic, and microbiological diagnostic tests.
- Because the clinical diagnosis of spinal infection can be challenging owing to vague symptoms of LBP or neck stiffness, radiological evaluations have gained importance in the diagnosis, treatment planning, and treatment monitoring of the spinal infections.

Neurosurgery 79:315–335, 2016.

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Osteomyelitis

FIGURE 16. *This patient had an L4-L5 microdiskectomy a1 2 weeks previously and complains of increasing LBP.* **Left,** *posterior-anterior and* (**right**) *lateral radiographs demonstrate loss of disk height with irregular endplate erosions and obscuration of the cortical margins* (**white arrows**).

Neurosurgery 79:315–335, 2016.

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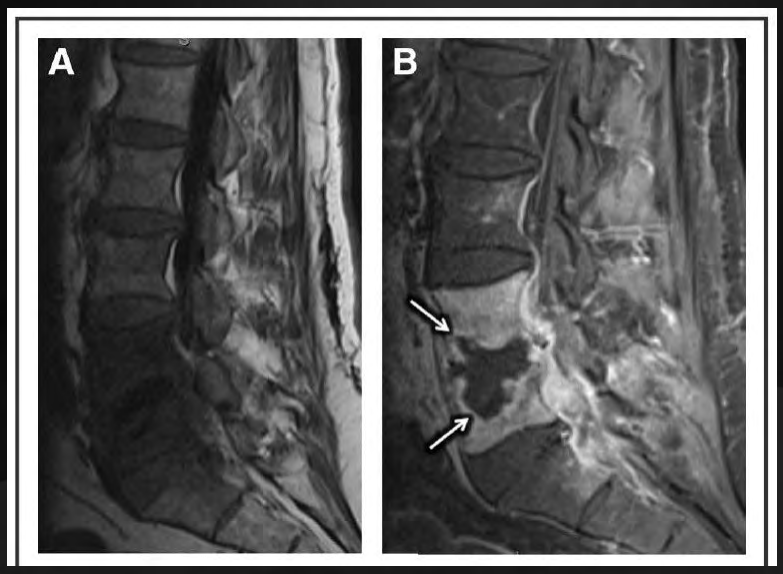
Osteomyelitis



Neurosurgery 79:315–335, 2016.

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FIGURE 22. Left, sagittal STIR and (right) postcontrast T1-weighted, fat-saturated images demonstrate vertebral osteitis with high STIR signal intensity with contrast enhancement at the anterosuperior and anteroinferior vertebral body corners. These are examples of Romanus lesions in a patient with ankylosing spondylitis.

Ankylosing Spondylitis

Neurosurgery 79:315–335, 2016.

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Charcot Joints

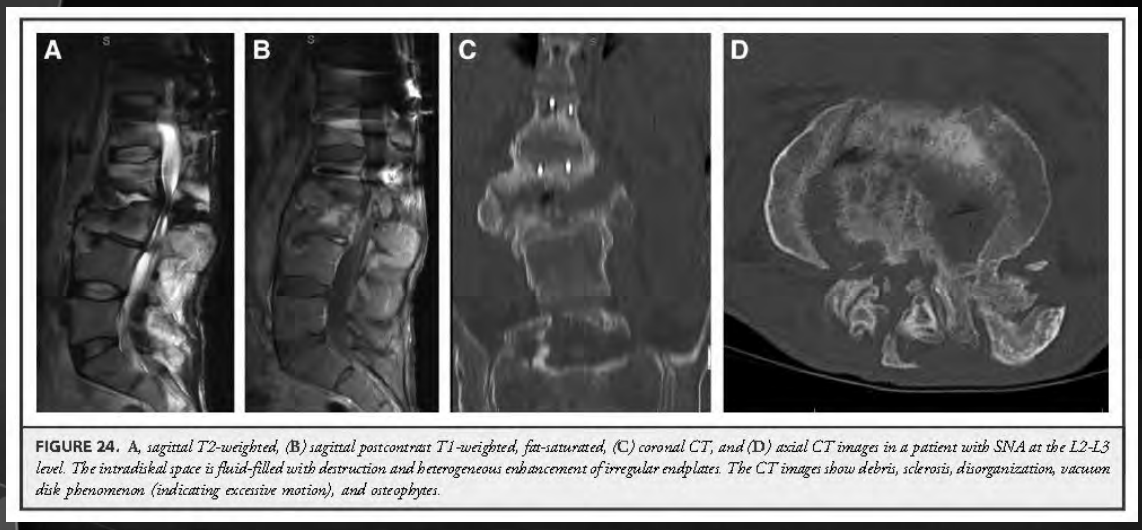

FIGURE 24. A, sagittal T2-weighted, (B) sagittal postcontrast T1-weighted, fat-saturated, (C) coronal CT, and (D) axial CT images in a patient with SNA at the L2-L3 level. The intradiskal space is fluid-filled with destruction and heterogeneous enhancement of irregular endplates. The CT images show debris, sclerosis, disorganization, vacuum disk phenomenon (indicating excessive motion), and osteophytes.

Neurosurgery 79:315–335, 2016.

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Morphologic Changes in the Cervical Neural Foramen due to Flexion and Extension: In Vivo Imaging Study.

Kitagawa et.al. Spine. 29(24):2821-2825, December 15, 2004.

Conclusions. The present results are consistent with those of previous in vitro studies and may explain the clinical observation that cervical extension aggravates symptoms in patients with cervical radiculopathy and that flexion often relieves them.

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Upright MRI

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Upright MRI

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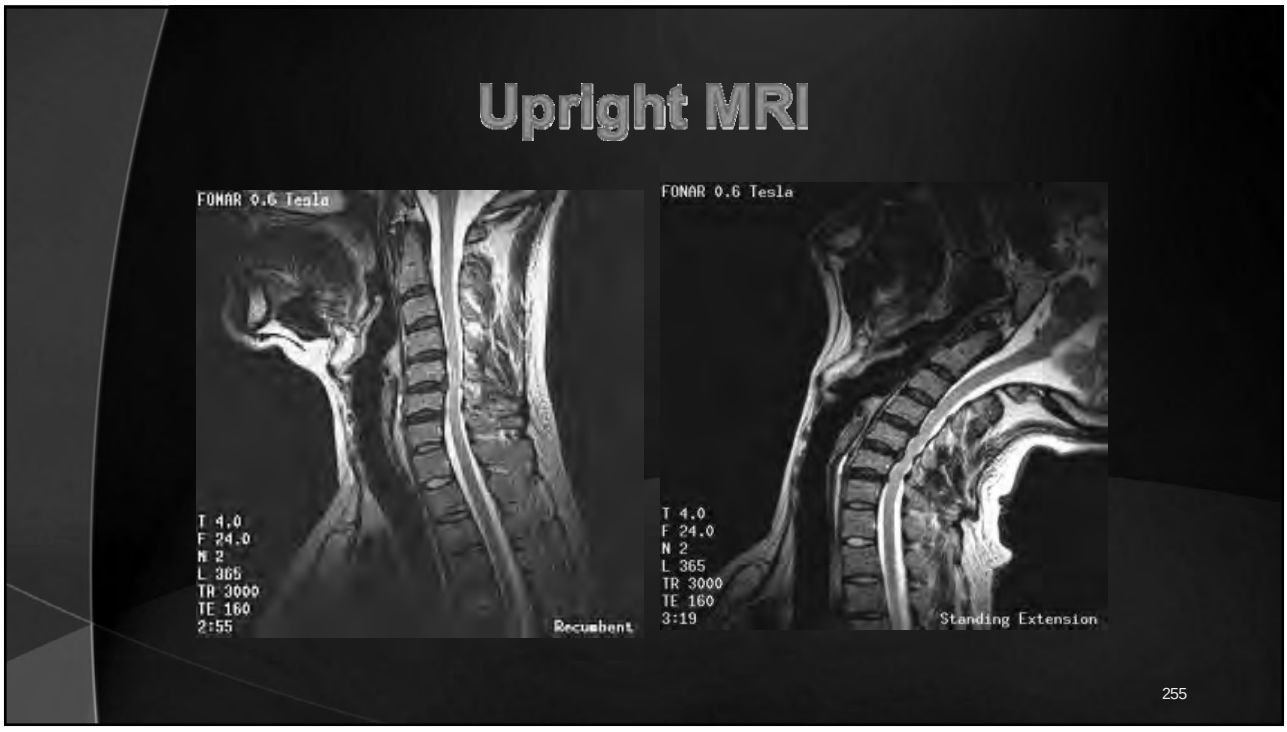
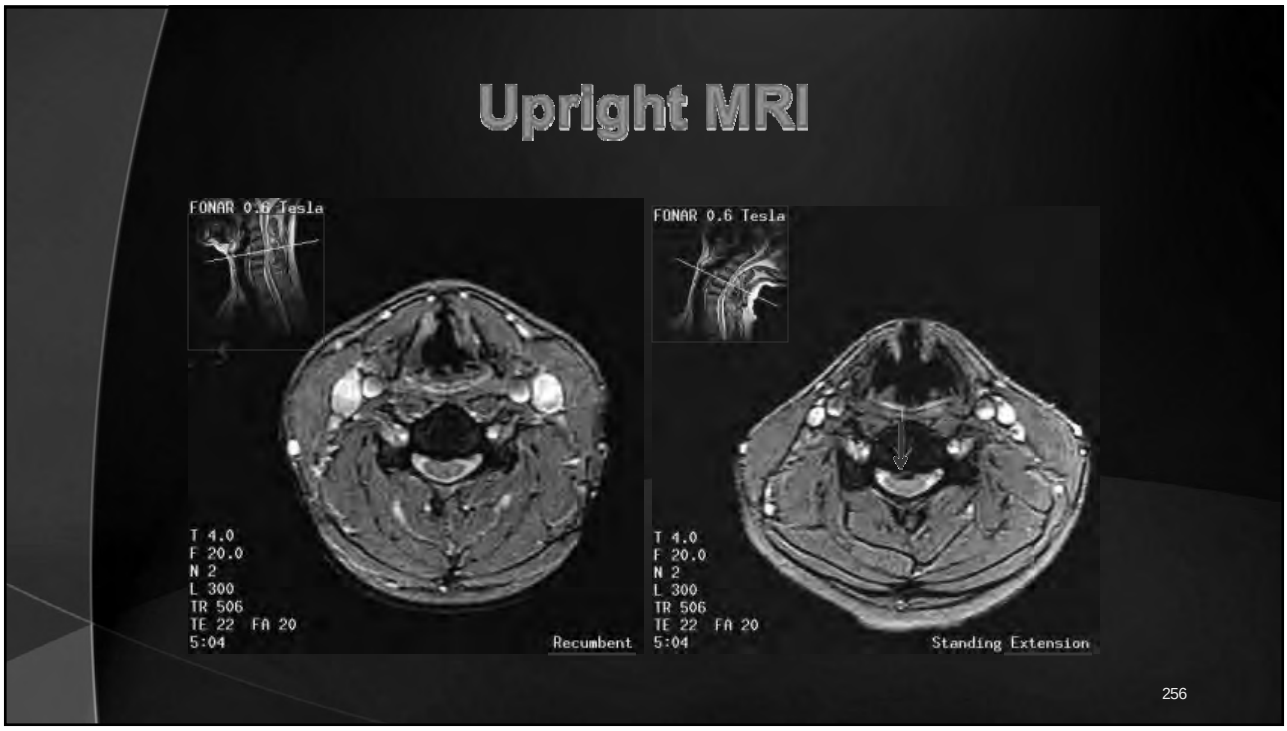

Upright MRI
FONAR 0.6 Tesla
T 4.0
F 24.0
N 2
L 365
TR 3000
TE 160
2:55
Recumbent
FONAR 0.6 Tesla
T 4.0
F 24.0
N 2
L 365
TR 3000
TE 160
3:19
Standing Extension
255

255


Upright MRI
FONAR 0.6 Tesla
T 4.0
F 20.0
N 2
L 300
TR 506
TE 22 FA 20
5:04
Recumbent
FONAR 0.6 Tesla
T 4.0
F 20.0
N 2
L 300
TR 506
TE 22 FA 20
5:04
Standing Extension
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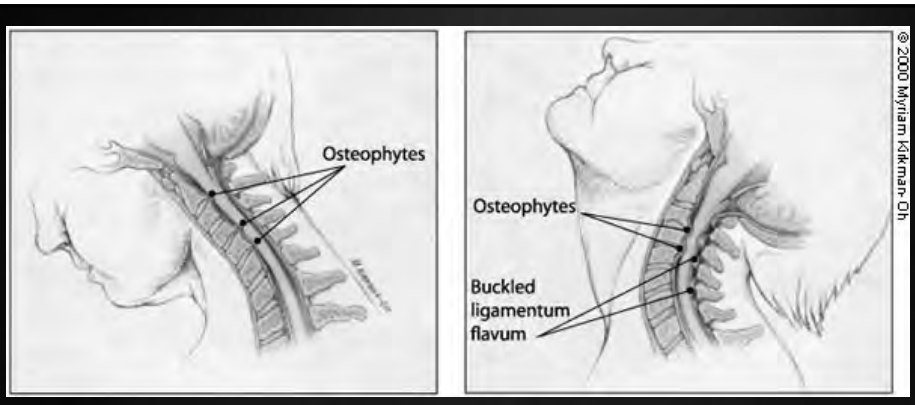

Common signs of Central Canal Stenosis

- Atrophy of the hand musculature
- Hyperreflexia
- Lhermitte's sign (electric shock-like sensation down the center of the back following flexion of the neck)
- Sensory loss

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Discogenic Issues/Discitis

- **T or F** At the center of the intervertebral disc, we find high oxygen levels, blood glucose levels and pH.
- **T or F** Modic Type 1 changes are indicative of bone marrow edema associated with acute or sub-acute inflammatory changes.

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CNS/Radiculitis/Neuritis/Myelitis

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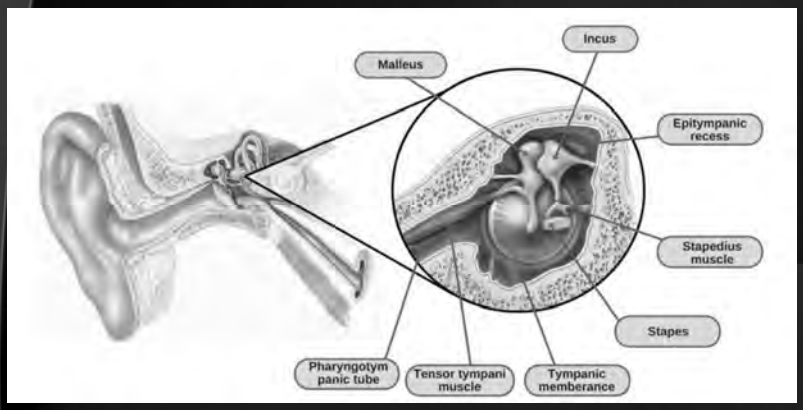
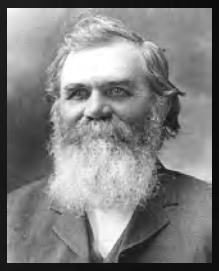
Harvey Liilard / D.D. Moment?





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IS THERE A DOUBLE INNERVATION OF THE TENSOR TYMPANI MUSCLE IN HUMANS?

ANTONIUS C. KIERNER, MD
VIENNA, AUSTRIA

REGINA MAYER, MTA
VIENNA, AUSTRIA

OLIVER ADUNKA, MD
FRANKFURT, GERMANY

The middle ear muscles and their function have not yet been fully explored. The statement of Lawrence, for example, that the tensor tympani muscle of humans might have a dual innervation has never been proven or disproven. The question is of great interest; in our opinion, it represents one of the key questions in the putative afferent feedback loop of the middle ear muscles in humans. A light microscopic study was performed on 16 tensor tympani muscles taken from 11 cadavers. Six muscles were taken out in toto and stained according to the modified method of Sihler. The remaining 10 muscles were dehydrated and embedded in paraffin. In 5 of these muscles, complete transverse serial sections were made on a microtome at 7 µm and alternately stained by silver impregnation, S-100 protein immunohistochemistry, and ferric oxide. In the remaining 5 muscles, complete longitudinal serial sections were made at 10 µm. These sections were alternately stained by the methods of Cason and Maskar. Neither the surgical microscopic investigation nor the light microscopic investigation revealed any innervation to the human tensor tympani muscle other than the one arising from the mandibular branch of the trigeminal nerve. Our findings, apart from the fact that they clearly refute an unproven hypothesis, might represent another small step toward understanding the innervation of the tensor tympani muscle.

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Noise & Health
A Bimonthly Inter-disciplinary International Journal

ARTICLE
Year : 2013 | Volume : 15 | Issue : 63 | Page : 117--128

Tonic tensor tympani syndrome in tinnitus and hyperacusis patients: A multi-clinic prevalence study

Myriam Westcott[1], Tanit Ganz Sanchez[2], Isabel Diges[3], Clarice Saba[4], Ross Dineen[1], Celene McNeill[5], Alison Chiam[6], Mary O'Keefe[7], Tricia Sharples[8],
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[2] Instituto Ganz Sanchez de Otorrinolaringologia, Tinnitus and Hyperacusis, Sao Paulo, Brazil
[3] Clinica de Acufenos e Hiperacusa, Fundacion Dr. Carlos Herraiz, Madrid, Spain
[4] CEOB - Centro de Otorrinolaringologia de Bahia, Salvador, Bahia, Brazil
[5] Healthy Hearing and Balance Care, Sydney, Australia
[6] Jervis Bay Hearing Centre, Vincentia, N.S.W, Australia
[7] The University of Auckland Hearing and Tinnitus Clinic, Auckland, NewZealand
[8] Eastern Audiology Services, Auckland, NewZealand

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Australia

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American Pain Society
RESEARCH
EDUCATION
TREATMENT
ADVOCACY

PUBLISHED BY ELSEVIER

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Available online at www.jpain.org and www.sciencedirect.com

Brain Mechanisms of Anticipated Painful Movements and Their Modulation by Manual Therapy in Chronic Low Back Pain

Dan-Mikael Ellingsen,* Vitaly Napadow,* Ekaterina Protsenko,*,† Ishtiaq Mawla,*,‡ Matthew H. Kowalski,§ David Swensen,¶ Deanna O'Dwyer-Swensen,¶ Robert R. Edwards,|| Norman Kettner,** and Marco L. Loggia*

*A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts, †School of Medicine, University of California, San Francisco, California, ‡Neuroscience Graduate Program, University of Michigan Medical School, Ann Arbor Michigan, §Osher Integrative Care Center, Brigham and Women's Hospital, Boston, MA, Massachusetts, ¶Melrose Family Chiropractic & Sports Injury Centre, Melrose, Massachusetts, ||Department of Anesthesiology, Harvard Medical School, Brigham & Women's Hospital, Boston, Massachusetts, **Department of Radiology, Logan University, Chesterfield, Missouri

In cLBP patients, SMT reduced both clinical pain and aversiveness (fear and expected pain).

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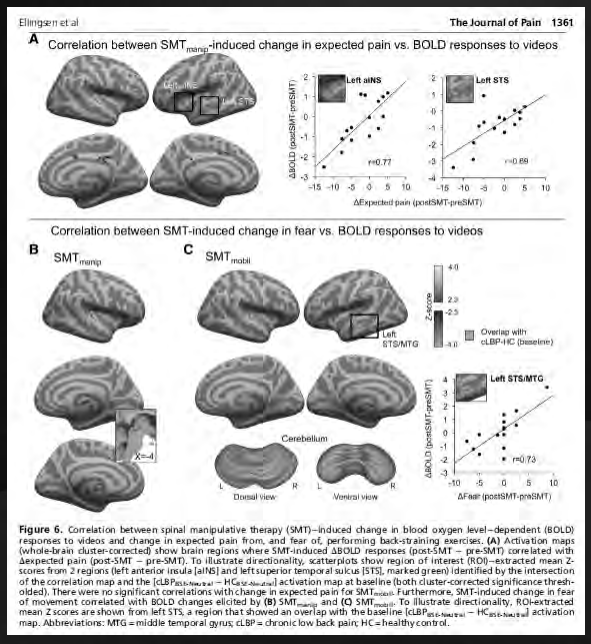

Figure 6. Correlation between spinal manipulative therapy (SMT)–induced change in blood oxygen level–dependent (BOLD) responses to videos and change in expected pain from, and fear of, performing back-straining exercises. **(A)** Activation maps (whole-brain cluster-corrected) show brain regions where SMT-induced ΔBOLD responses (post-SMT – pre-SMT) correlated with Δexpected pain (post-SMT – pre-SMT). To illustrate directionality, scatterplots show region of interest (ROI)–extracted mean Z-scores from 2 regions (left anterior insula [aINS] and left superior temporal sulcus [STS], marked green) identified by the intersection of the correlation map and the [$cLBP_{pre-SMT/post-SMT}$ – $HC_{pre-SMT/post-SMT}$] activation map at baseline (both cluster-corrected significance thresholded). There were no significant correlations with change in expected pain for SMT_{mobil}. Furthermore, SMT-induced change in fear of movement correlated with BOLD changes elicited by **(B)** SMT_{manip} and **(C)** SMT_{mobil}. To illustrate directionality, ROI-extracted mean Z scores are shown from left STS, a region that showed an overlap with the baseline [$cLBP_{pre-SMT/post-SMT}$ – $HC_{pre-SMT/post-SMT}$] activation map. Abbreviations: MTG = middle temporal gyrus; cLBP = chronic low back pain; HC = healthy control.

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Page: 1 of 2

James Demetrious, DC, FACO
4837 Carolina Beach Road, Suite 205
Wilmington, NC 28412
Telephone: (910) 790-8020

Marvin Weingarten
Patient ID: 33098706 **DOB:** 10/20/1972 **Sex:** M **Account No.:** 3070
Encounter ID: 138795167 **Encounter Date:** 06/13/2016
Encounter Type: Office Visit

SUBJECTIVE:

Chief Complaint: Mr. Weingarten presents today with acute concerns about symptoms that began yesterday upon assisting his daughter. He reported alteration of sensation of the left face, a sensation of weakness of facial musculature and difficulty articulating words. He reported that it felt as though he received a Novocain injection at the dentist. He reports a recurrence of neck discomfort extending into the left scapula and upper extremity that was quite severe causing h...n to see care in our office today. No chiropractic treatment was provided today.

While facial symptoms have improved since yesterday, persistent discomfort in the neck, shoulder and upper extremity persist. He denies any recent traumas or injuries. No apparent changes in his medical history.

The patient suffered a similar incident one year ago during which he underwent medical assessment and MRI evaluations of the head and neck. Results are in the patient's file.

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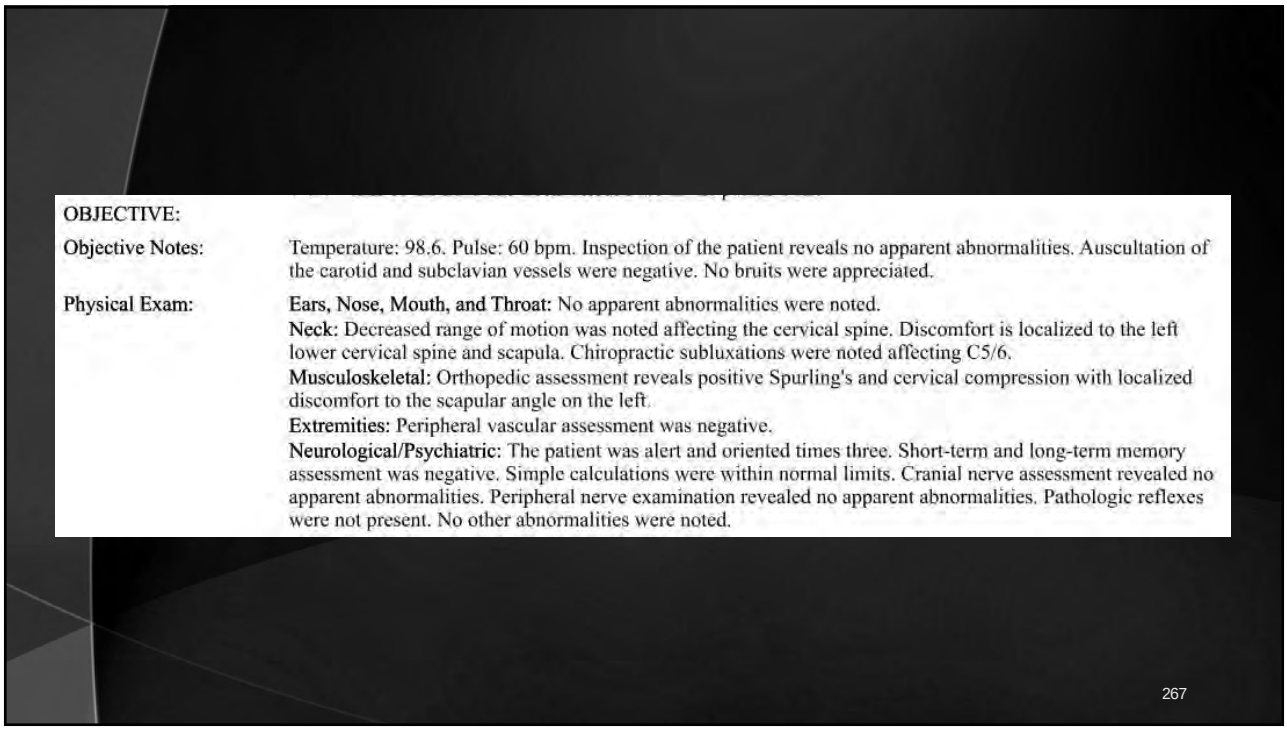

OBJECTIVE:

Objective Notes: Temperature: 98.6. Pulse: 60 bpm. Inspection of the patient reveals no apparent abnormalities. Auscultation of the carotid and subclavian vessels were negative. No bruits were appreciated.

Physical Exam:

Ears, Nose, Mouth, and Throat: No apparent abnormalities were noted.

Neck: Decreased range of motion was noted affecting the cervical spine. Discomfort is localized to the left lower cervical spine and scapula. Chiropractic subluxations were noted affecting C5/6.

Musculoskeletal: Orthopedic assessment reveals positive Spurling's and cervical compression with localized discomfort to the scapular angle on the left.

Extremities: Peripheral vascular assessment was negative.

Neurological/Psychiatric: The patient was alert and oriented times three. Short-term and long-term memory assessment was negative. Simple calculations were within normal limits. Cranial nerve assessment revealed no apparent abnormalities. Peripheral nerve examination revealed no apparent abnormalities. Pathologic reflexes were not present. No other abnormalities were noted.

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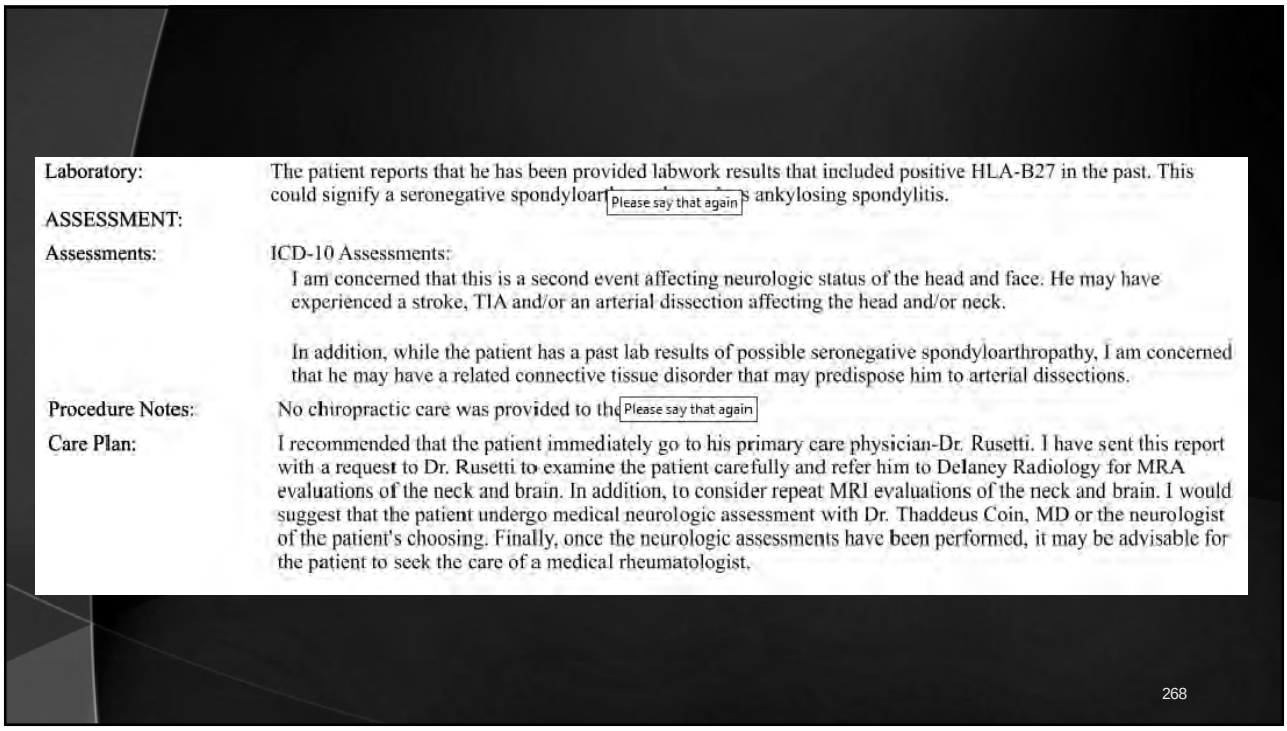

Laboratory: The patient reports that he has been provided labwork results that included positive HLA-B27 in the past. This could signify a seronegative spondyloart[Please say that again]s ankylosing spondylitis.

ASSESSMENT:

Assessments: ICD-10 Assessments:

I am concerned that this is a second event affecting neurologic status of the head and face. He may have experienced a stroke, TIA and/or an arterial dissection affecting the head and/or neck.

In addition, while the patient has a past lab results of possible seronegative spondyloarthropathy, I am concerned that he may have a related connective tissue disorder that may predispose him to arterial dissections.

Procedure Notes: No chiropractic care was provided to th[Please say that again]

Care Plan: I recommended that the patient immediately go to his primary care physician-Dr. Rusetti. I have sent this report with a request to Dr. Rusetti to examine the patient carefully and refer him to Delaney Radiology for MRA evaluations of the neck and brain. In addition, to consider repeat MRI evaluations of the neck and brain. I would suggest that the patient undergo medical neurologic assessment with Dr. Thaddeus Coin, MD or the neurologist of the patient's choosing. Finally, once the neurologic assessments have been performed, it may be advisable for the patient to seek the care of a medical rheumatologist.

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- **6/23/16:**
  - **MRI Brain with and without contrast:** solitary small, 4 mm cortical abnormality involving the right precentral gyrus of uncertain etiology and significance. No acute ischemia on diffusion imaging. Absence of edema would weigh against a small metastatic lesion. Likely represents and enhancing small subacute cortical ischemic lesion.
  - **MRA of the intracranial arteries:** negative intracranial MRA.
  - **MRA of the carotid and vertebral arteries with contrast:** negative cervical MRA.
- **8/19/16:**
  - **MRI Brain with and without contrast:** previous area of abnormal enhancement in the right lateral posterior frontal will has resolved with mild residual underlying T2 signal change, compatible with a chronic infarct. No new infarct or new enhancing intracranial lesion is observed, nor hematoma or mass effect.

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- Unknown etiology until approved discussion with the patient's mother:
  - Discussion with his mother revealed that she was had a recessive Factor V history.
  - Factor V Leiden is a variant (mutated form) of human Factor V (one of several substances that helps blood clot), which causes an increase in blood clotting (hypercoagulability). With this mutation, the anticoagulant protein secreted (which normally inhibits the pro-clotting activity of factor V) is not able to bind normally to Factor V, leading to a hypercoagulable state, i.e., an increased tendency for the patient to form abnormal and potentially harmful blood clots.
  - The patient was placed on a daily aspirin regimen.

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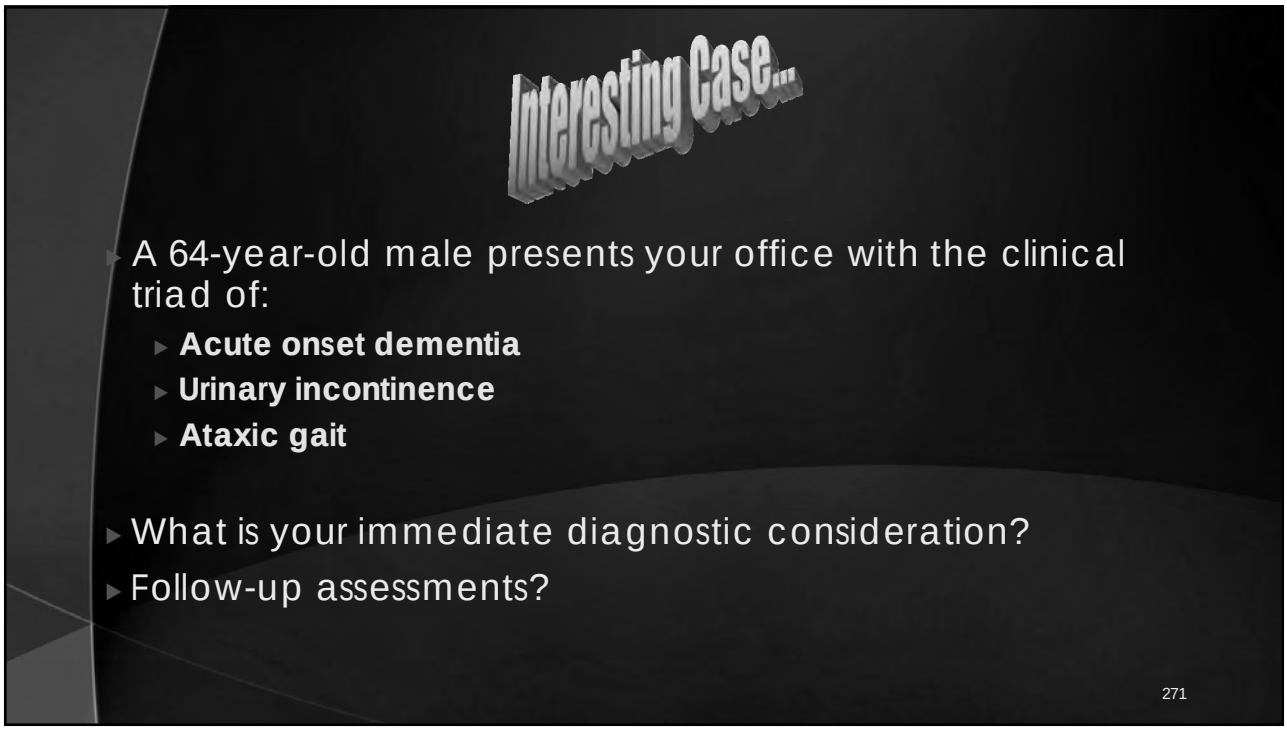
Interesting Case...
A 64-year-old male presents your office with the clinical triad of:
Acute onset dementia
Urinary incontinence
Ataxic gait
What is your immediate diagnostic consideration?
Follow-up assessments?
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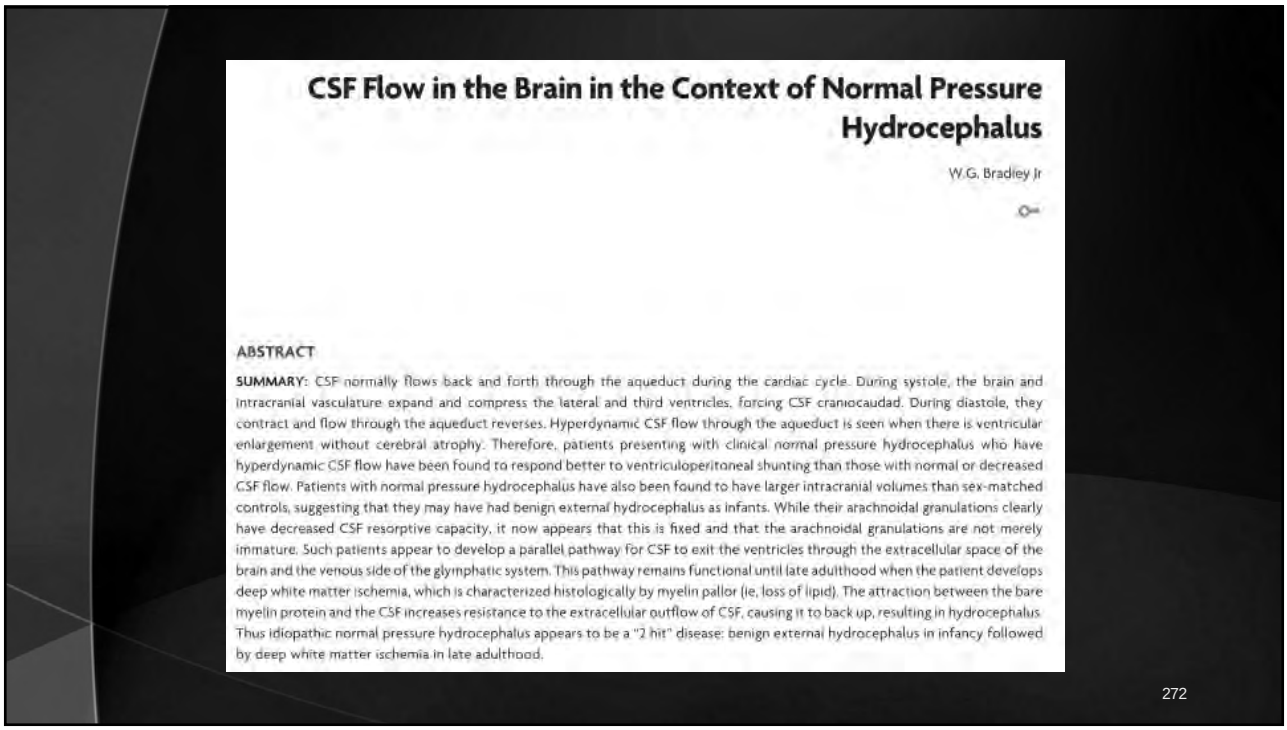
CSF Flow in the Brain in the Context of Normal Pressure Hydrocephalus
W.G. Bradley Jr
ABSTRACT
SUMMARY: CSF normally flows back and forth through the aqueduct during the cardiac cycle. During systole, the brain and intracranial vasculature expand and compress the lateral and third ventricles, forcing CSF craniocaudad. During diastole, they contract and flow through the aqueduct reverses. Hyperdynamic CSF flow through the aqueduct is seen when there is ventricular enlargement without cerebral atrophy. Therefore, patients presenting with clinical normal pressure hydrocephalus who have hyperdynamic CSF flow have been found to respond better to ventriculoperitoneal shunting than those with normal or decreased CSF flow. Patients with normal pressure hydrocephalus have also been found to have larger intracranial volumes than sex-matched controls, suggesting that they may have had benign external hydrocephalus as infants. While their arachnoidal granulations clearly have decreased CSF resorptive capacity, it now appears that this is fixed and that the arachnoidal granulations are not merely immature. Such patients appear to develop a parallel pathway for CSF to exit the ventricles through the extracellular space of the brain and the venous side of the glymphatic system. This pathway remains functional until late adulthood when the patient develops deep white matter ischemia, which is characterized histologically by myelin pallor (ie, loss of lipid). The attraction between the bare myelin protein and the CSF increases resistance to the extracellular outflow of CSF, causing it to back up, resulting in hydrocephalus. Thus idiopathic normal pressure hydrocephalus appears to be a "2 hit" disease: benign external hydrocephalus in infancy followed by deep white matter ischemia in late adulthood.
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Review Article

The Role of the Craniocervical Junction in Craniospinal Hydrodynamics and Neurodegenerative Conditions

Michael F. Flanagan[1,2]

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Received 4 May 2015; Revised 7 September 2015; Accepted 17 September 2015

Academic Editor: Mamede de Carvalho

The craniocervical junction (CCJ) is a potential choke point for craniospinal hydrodynamics and may play a causative or contributory role in the pathogenesis and progression of neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, MS, and ALS, as well as many other neurological conditions including hydrocephalus, idiopathic intracranial hypertension, migraines, seizures, silent-strokes, affective disorders, schizophrenia, and psychosis. The purpose of this paper is to provide an overview of the critical role of the CCJ in craniospinal hydrodynamics and to stimulate further research that may lead to new approaches for the prevention and treatment of the above neurodegenerative and neurological conditions.

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Biography of NASA's Chief Health and Medical Officer

Dr. JD Polk, DO, MS, MMM, CPE, FACOEP, FAsMA, is the agency *Chief Health and Medical Officer* of the National Aeronautics and Space Administration (NASA) located at NASA Headquarters in Washington D.C. He began serving in this position in November of 2016.

Dr. Polk is the former *Dean of Medicine* for Des Moines University's College of Osteopathic Medicine. Prior to his work at Des Moines University, Dr. Polk was the *Assistant Secretary (Acting) for Health Affairs and Chief Medical Officer* of the U.S. Department of Homeland Security (DHS), assuming this post after serving as the *Principal Deputy Assistant Secretary for Health Affairs and Deputy Chief Medical Officer*. Before coming to DHS, Dr. Polk was the *Chief of Space Medicine* for NASA's Johnson Space Center in Houston, Texas. He is the former *State Emergency Medical Services Medical Director* for the State of Ohio, and former *Chief of Metro Life Flight* in Cleveland, Ohio. Dr. Polk is a *Fellow* of the American College of Osteopathic Emergency Physicians, and a *Fellow* of the Aerospace Medicine Association.

Dr. Polk received his degree in Osteopathic Medicine from the A.T. Still University in Kirksville, Missouri. He completed his residency in emergency medicine with the Mt. Sinai hospitals via Ohio University and completed his training in aerospace medicine at the University of Texas Medical Branch. He is board certified in both emergency medicine and aerospace medicine. Dr. Polk holds a Master in Science in Space Studies from the American Military University, a Master in Medical Management from the University of Southern California's Marshall School of Business, and a Masters Certificate in Public Health from the University of New England.

Dr. Polk is well published in the fields of emergency medicine, disaster medicine, space medicine, and medical management. He is a *Clinical Associate Professor of Emergency Medicine* at the Edward Via College of Osteopathic Medicine. He has received numerous awards and commendations including citations from the Federal Bureau of Investigations, White House Medical Unit, Association of Air Medical Services, U.S. Air Force, and has received the NASA Center Director's Commendation, the NASA Exceptional Service Medal, the National Security and International Affairs Medal and the NASA Exceptional Achievement Medal.

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Radiology

Orbital and Intracranial Effects of Microgravity: Findings at 3-T MR Imaging[1]

Larry A. Kramer, MD
Ashot E. Sargsyan, MD
Khader M. Hasan, PhD
James D. Polk, DO
Douglas R. Hamilton, MD, PhD[2]

Purpose: To identify intraorbital and intracranial abnormalities in astronauts previously exposed to microgravity by using quantitative and qualitative magnetic resonance (MR) techniques.

Exposure to microgravity can result in a spectrum of intraorbital and intracranial findings similar to those in idiopathic intracranial hypertension.

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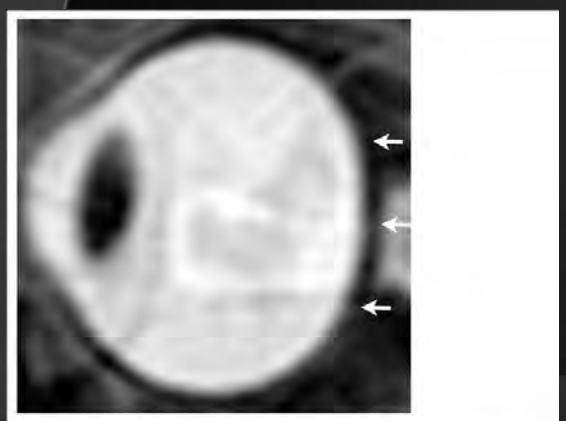

Figure 3a: Sagittal oblique T2-weighted MR images. **(a)** Image of left eye before long-term exposure to microgravity. Note convexity of posterior globe (arrows). **(b)** Image of left eye after long-term exposure to microgravity. Note loss of convexity of the posterior scleral margin (arrows). **(c)** Image of right eye of different astronaut. Note two abruptly angulated foci (long arrows) in optic nerve sheath and posterior globe flattening (short arrows).

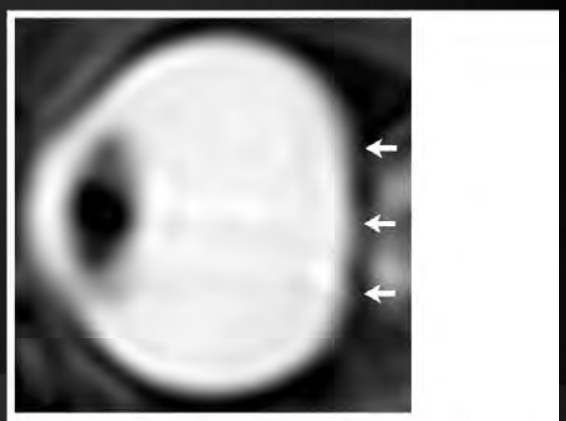

Figure 3b: Sagittal oblique T2-weighted MR images. **(a)** Image of left eye before long-term exposure to microgravity. Note convexity of posterior globe (arrows). **(b)** Image of left eye after long-term exposure to microgravity. Note loss of convexity of the posterior scleral margin (arrows). **(c)** Image of right eye of different astronaut. Note two abruptly angulated foci (long arrows) in optic nerve sheath and posterior globe flattening (short arrows).

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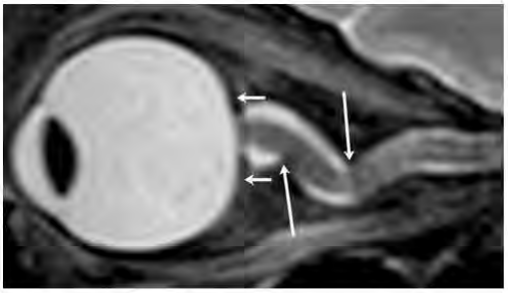

Figure 3c: Sagittal oblique T2-weighted MR images. **(a)** Image of left eye before long-term exposure to microgravity. Note convexity of posterior globe (arrows). **(b)** Image of left eye after long-term exposure to microgravity. Note loss of convexity of the posterior scleral margin (arrows). **(c)** Image of right eye of different astronaut. Note two abruptly angulated foci (long arrows) in optic nerve sheath and posterior globe flattening (short arrows).

Radiology: Volume 263: Number 3—June 2012 n radiology.rsna.org

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Interesting Case...

Chiropractic & Osteopathy

BioMed Central

Case report

Open Access

Post-traumatic upper cervical subluxation visualized by MRI: a case report

James Demetrious[1,2]

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Case report
Open Access
Post-traumatic upper cervical subluxation visualized by MRI: a case report
James Demetrious[1,2]
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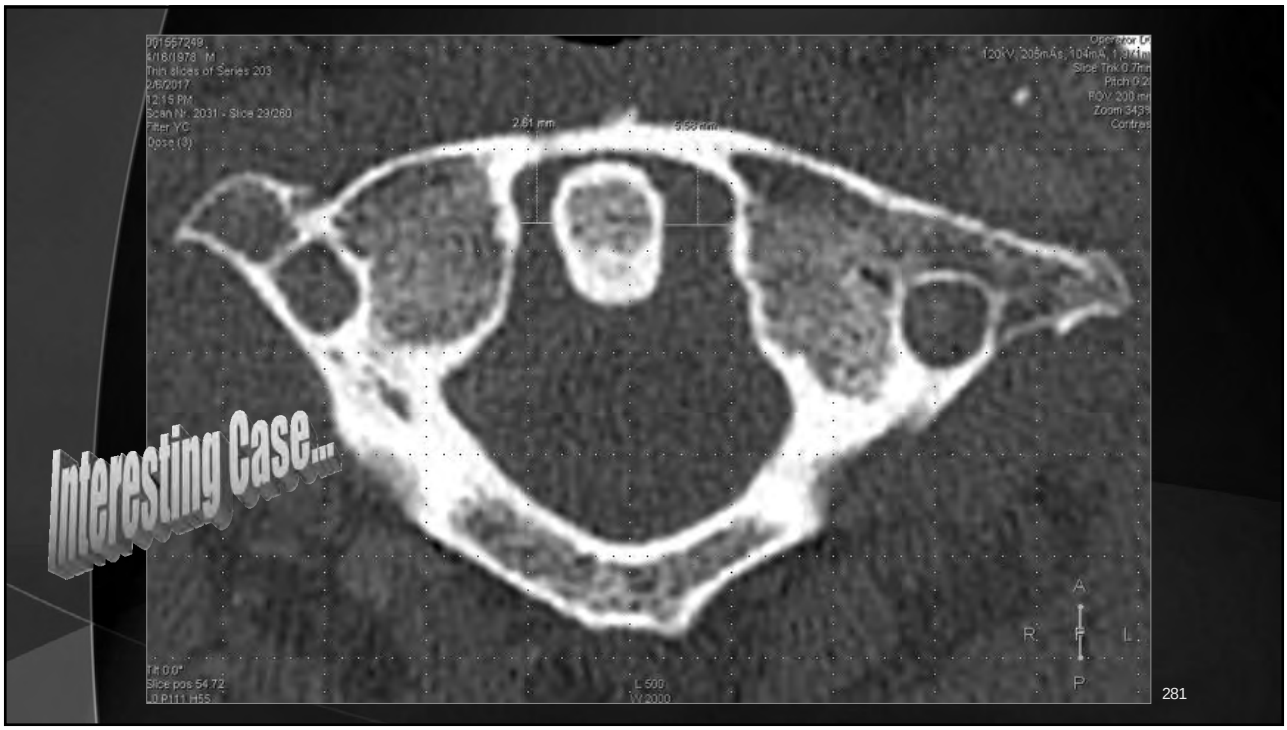

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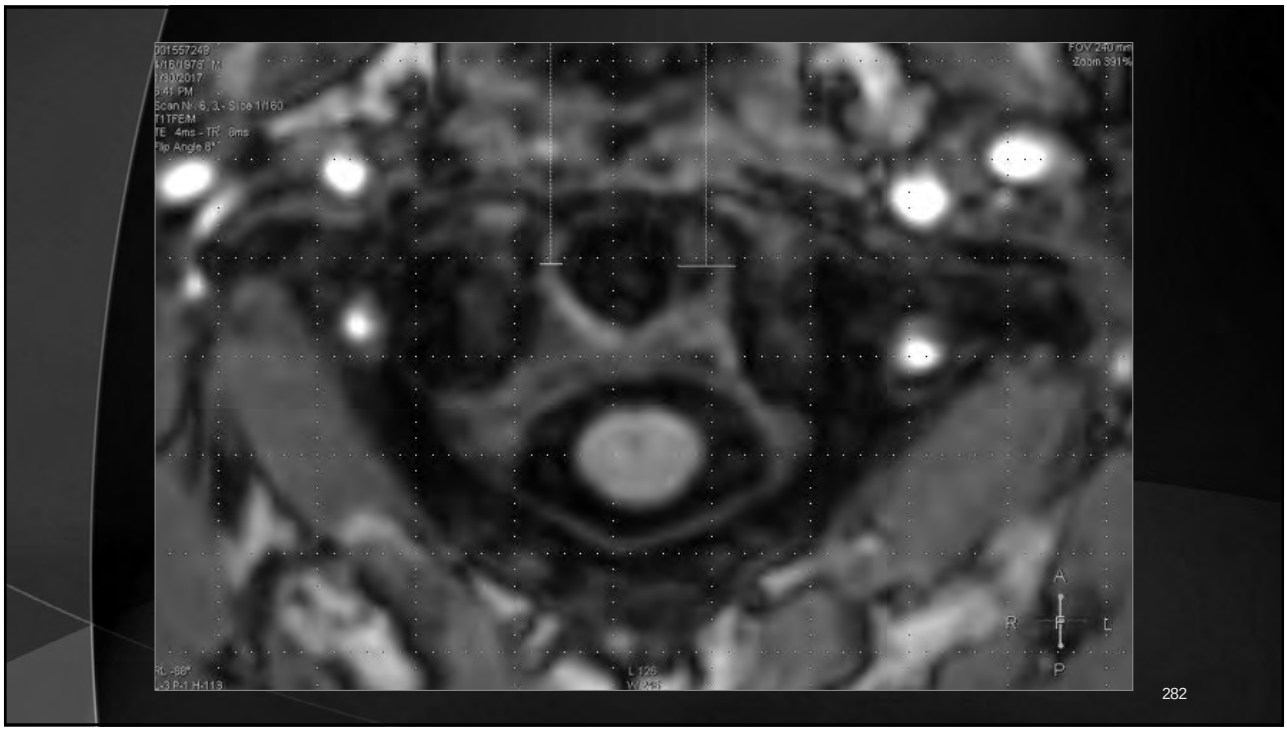

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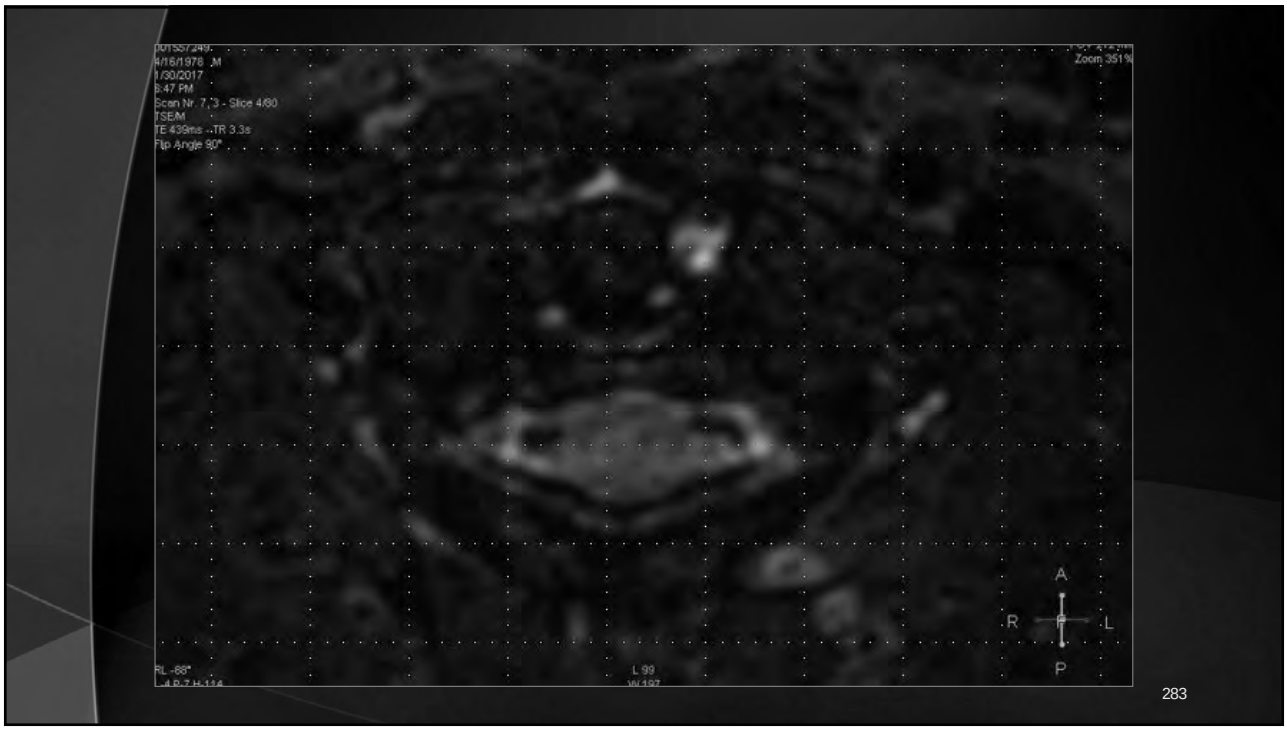

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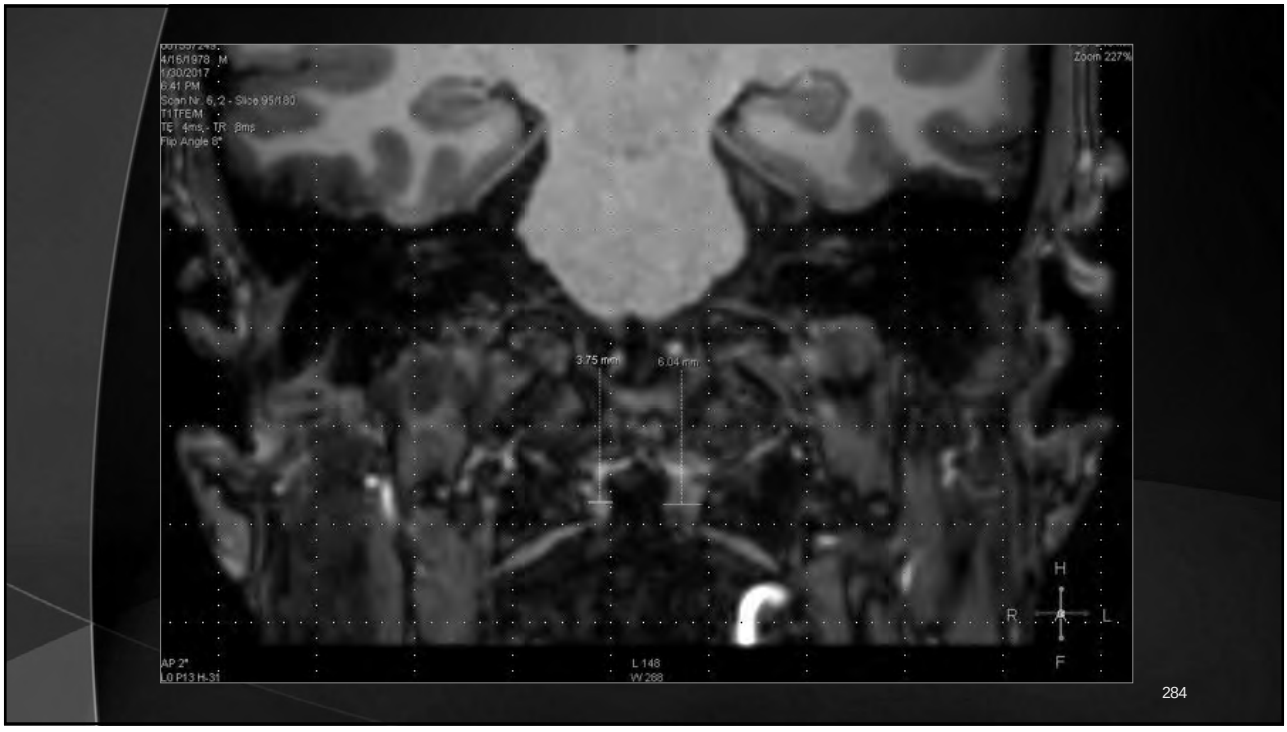

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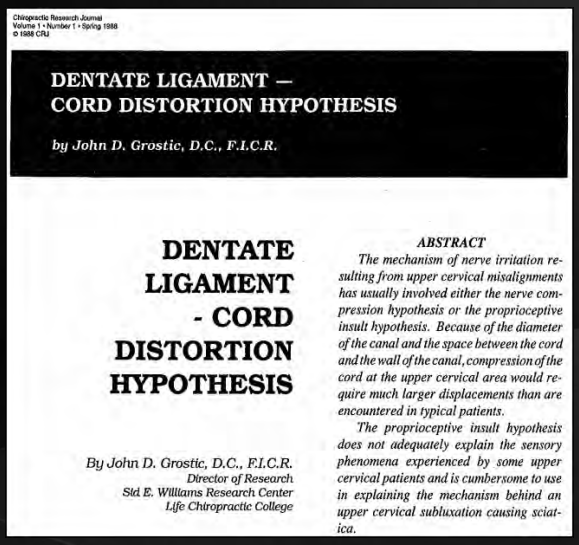
John Grostic, DC, FICR



Chiropractic Research Journal
Volume 1 • Number 1 • Spring 1988
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**DENTATE LIGAMENT —
CORD DISTORTION HYPOTHESIS**

by John D. Grostic, D.C., F.I.C.R.

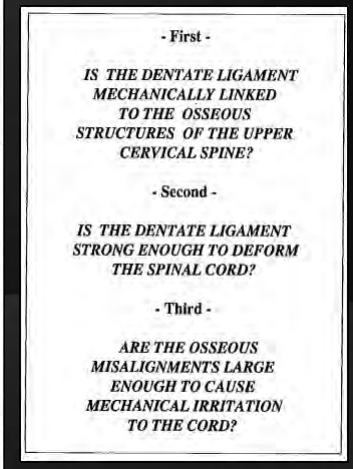
DENTATE LIGAMENT - CORD DISTORTION HYPOTHESIS

By John D. Grostic, D.C., F.I.C.R.
Director of Research
Sid E. Williams Research Center
Life Chiropractic College

ABSTRACT

The mechanism of nerve irritation resulting from upper cervical misalignments has usually involved either the nerve compression hypothesis or the proprioceptive insult hypothesis. Because of the diameter of the canal and the space between the cord and the wall of the canal, compression of the cord at the upper cervical area would require much larger displacements than are encountered in typical patients.

The proprioceptive insult hypothesis does not adequately explain the sensory phenomena experienced by some upper cervical patients and is cumbersome to use in explaining the mechanism behind an upper cervical subluxation causing sciatica.



- First -

IS THE DENTATE LIGAMENT MECHANICALLY LINKED TO THE OSSEOUS STRUCTURES OF THE UPPER CERVICAL SPINE?

- Second -

IS THE DENTATE LIGAMENT STRONG ENOUGH TO DEFORM THE SPINAL CORD?

- Third -

ARE THE OSSEOUS MISALIGNMENTS LARGE ENOUGH TO CAUSE MECHANICAL IRRITATION TO THE CORD?

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Grostic

- Grostic proposed the hypothesis that the Atlas Subluxation Complex could embarrass function in tracts of the lateral and ventrolateral columns by virtue of the dentate ligaments.

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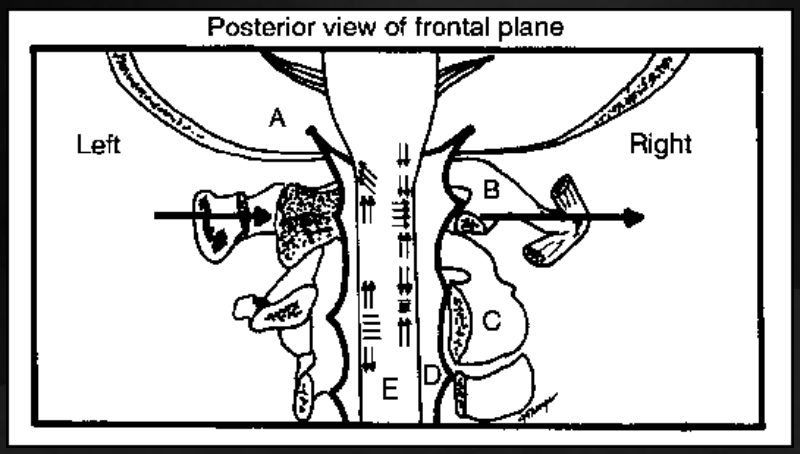
Grostic



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Grostic

- The significance of Grostic's finding is that any subluxation of the atlas, by virtue of dural attachment, could transfer the forces of eccentric motion into the cord via the stronger cervical denticulate ligaments.

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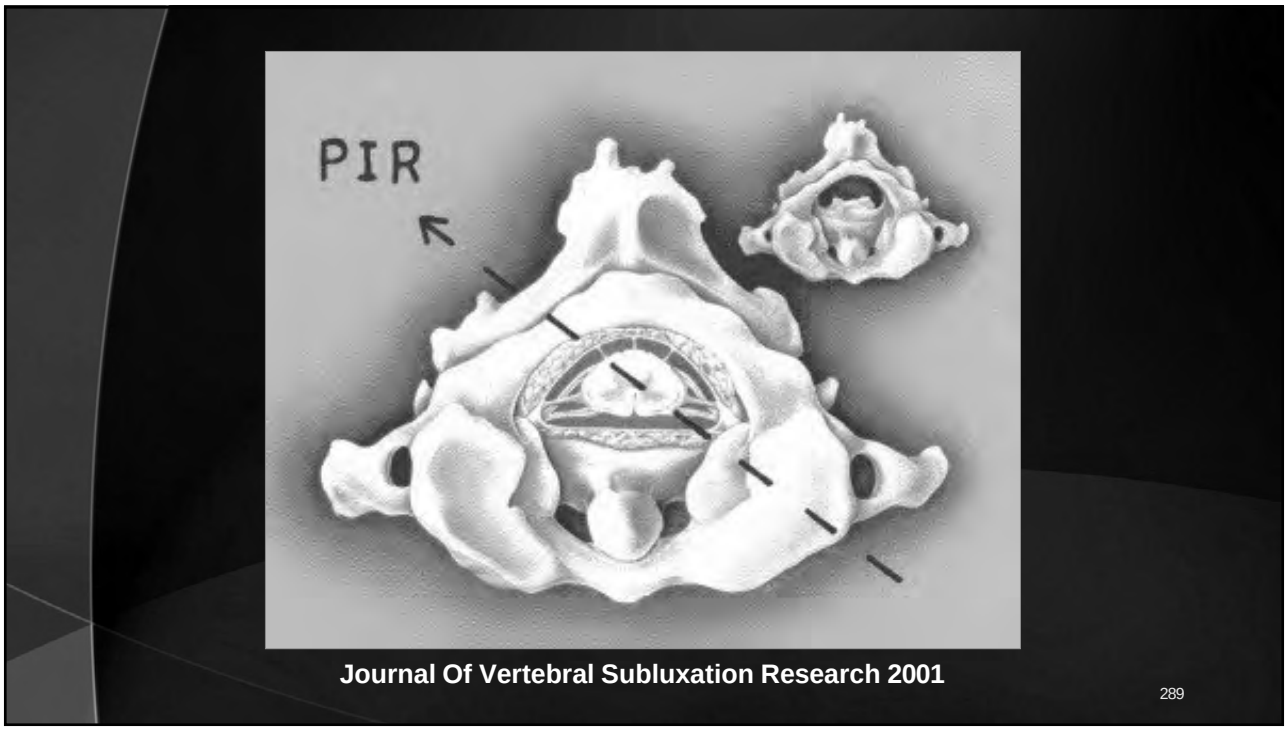
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Journal Of Vertebral Subluxation Research 2001
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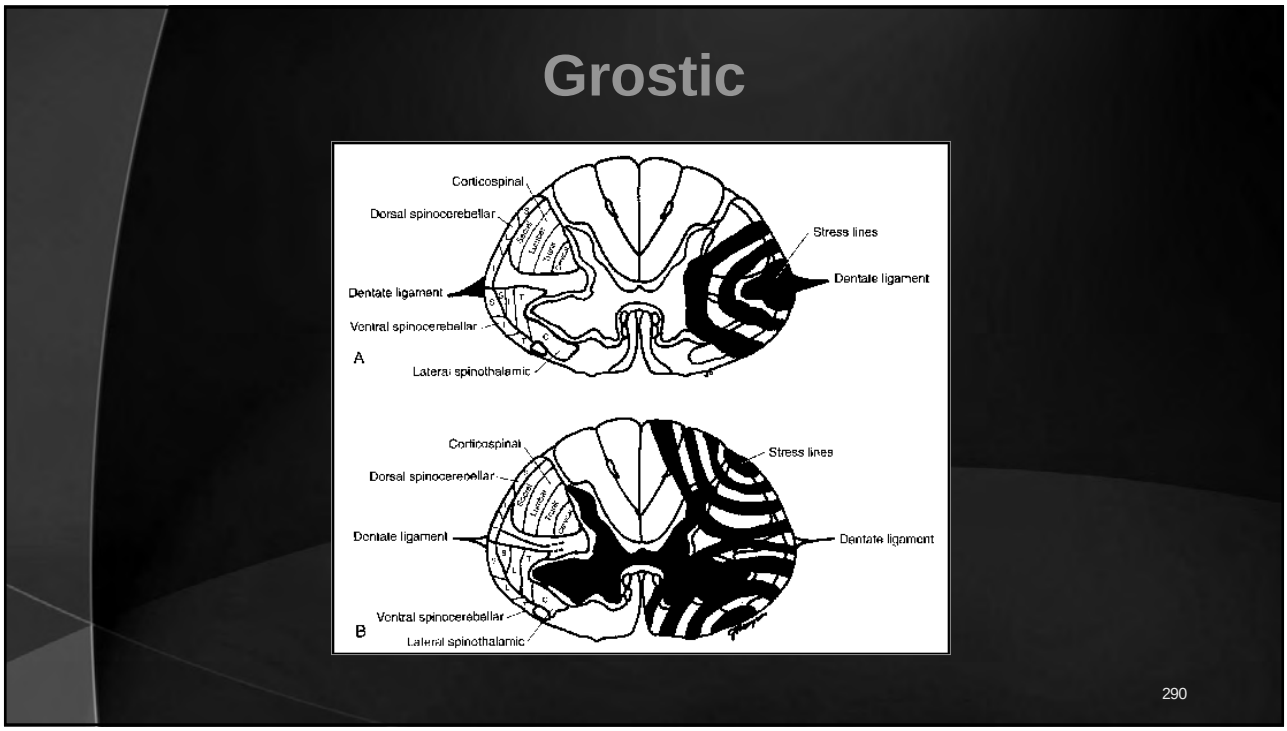
Grostic
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Dorsal spinocerebellar
Dentate ligament
Ventral spinocerebellar
Lateral spinothalamic
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Dentate ligament
Corticospinal
Dorsal spinocerebellar
Dentate ligament
Ventral spinocerebellar
Lateral spinothalamic
B
Stress lines
Dentate ligament
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Journal of Neurology, Neurosurgery, and Psychiatry 1997;62:334–340

Pathogenesis of cervical spondylotic myelopathy

David N Levine

Conclusions

- The results strongly favour the theory that CSM is caused by tensile stresses transmitted to the spinal cord from the dura via the dentate ligaments.
- A spondylotic bar can increase dentate tension by displacing the spinal cord dorsally, while the dural attachments of the dentate, anchored by the dural root sleeves and dural ligaments, are displaced less.
- The spondylotic bar may also increase dentate tension by interfering locally with dural stretch during neck flexion, the resultant increase in dural stress being transmitted to the spinal cord via the dentate ligaments.
- Flexion of the neck increases dural tension and should be avoided in the conservative treatment of CSM.

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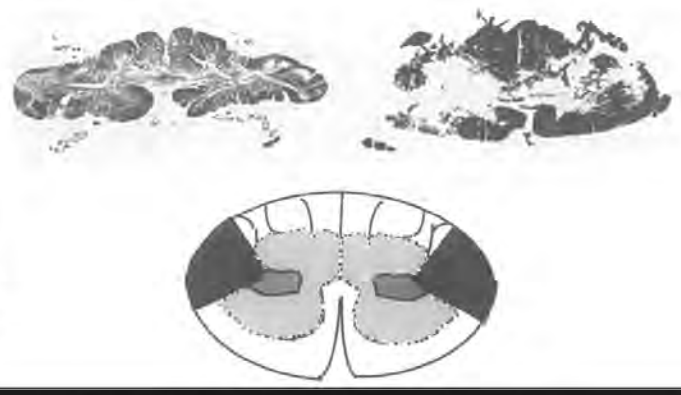
Journal of Neurology, Neurosurgery, and Psychiatry 1997;62:334–340

Pathogenesis of cervical spondylotic myelopathy

David N Levine

Figure 1 Topography of neuropathology of CSM. The top row shows myelin stained cross sections of the spinal cord at the level of a spondylotic bar from two representative cases studied at postmortem. On the left is case 4 of Brain et al[9] and on the right is case 3 of Mair and Druckman.[7] On the bottom is a schematic diagram adapted from Ogino et al[13] with permission. The dark shading indicates the most vulnerable areas, affected in even mild cases, the intermediate shading designates moderately vulnerable regions, and the light shading indicates areas damaged only in severe cases. The unshaded areas are spared.



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Physiol. Chem. Phys. & Med. NMR (2011) *41*: 1–17

The Possible Role of Cranio-Cervical Trauma and Abnormal CSF Hydrodynamics in the Genesis of Multiple Sclerosis

Raymond V. Damadian and David Chu

FONAR Corporation
110 Marcus Drive, Melville, NY 11747
E-mail: rvdamadian@fonar.com

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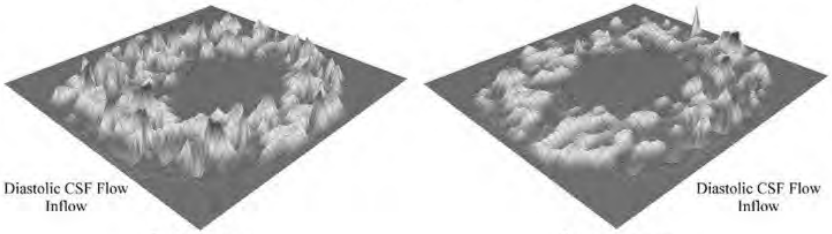
CSF Pixel Velocities at mid C-2 in Upright MS Patient #8 Before and After Successful Treatment
Provided by the FONAR UPRIGHT® Multi-Position™ MRI



Pre-treatment
Figure 16a

Post-treatment
Figure 16b

- Figure 16a shows the velocity maps of the flow of cerebrospinal fluid (CSF) in the upright patient before treatment.
- The maps are visualized in 3D pixels, known as voxels. Figure 16b shows the pixel velocity maps of the same upright patient immediately following treatment.
- Figure 16b reveals an overall reduction in CSF velocity and, most significantly, the distinct reduction in the number of CSF flow jets (red), which are velocity spikes in CSF flow.

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- In addition, average CSF velocity was reduced in the patient following treatment, as indicated in the maps by a reduction in average peak height.
- The overall flow of CSF was also more homogeneous after treatment, as indicated by fewer peak height variations. The CSF pixel velocities of Figure 16 were computed and mapped by FONAR scientists-engineers Michael Boitano and Bob Wolf.
- The CSF flow measurements obtained immediately following successful AO treatment of the patient also exhibited a 28.6% reduction of the patient's CSF pressure.

FONAR The Inventor of MR Scanning™

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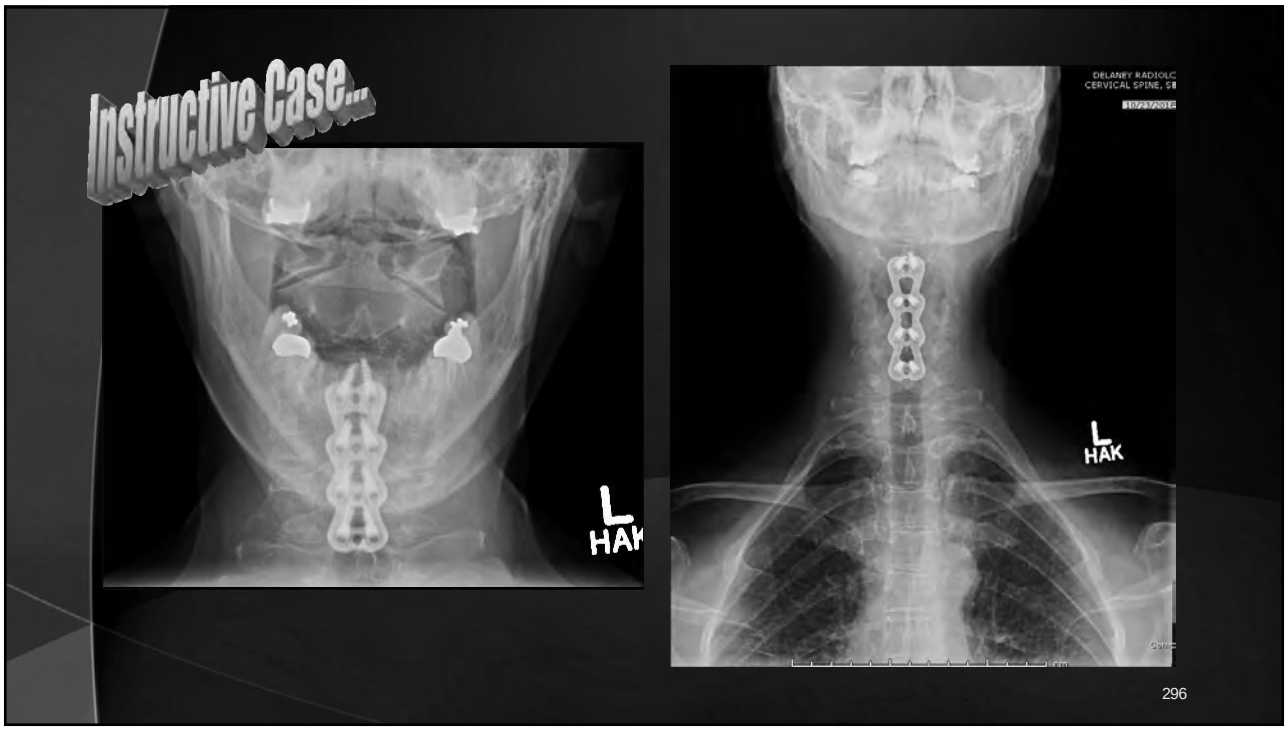

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FLEXION
EXTENSION
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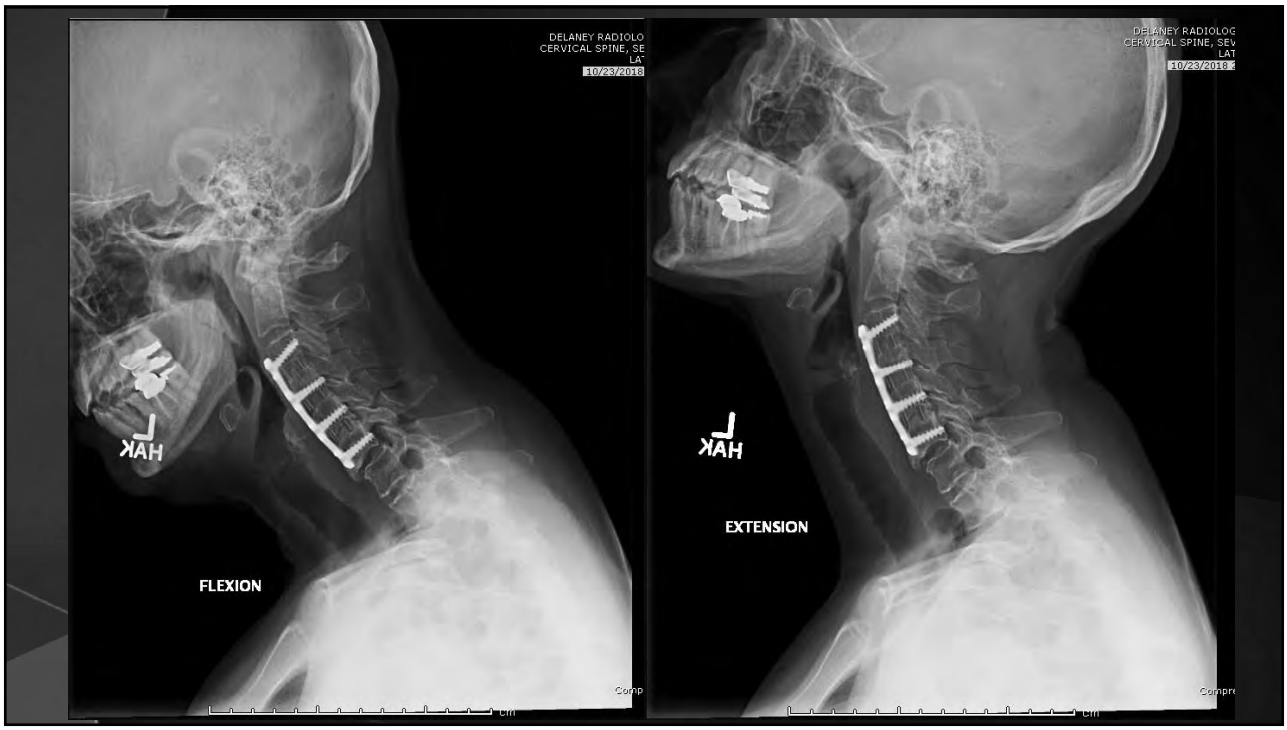
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EXTENSION

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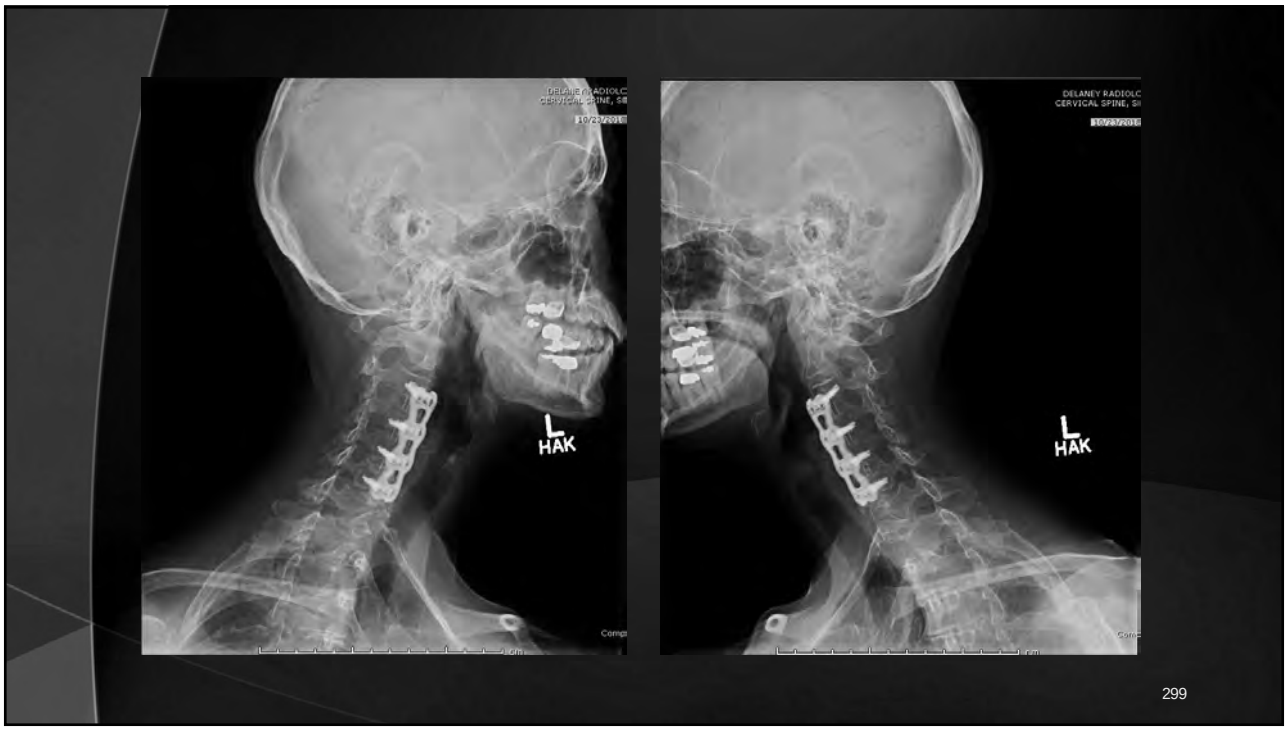

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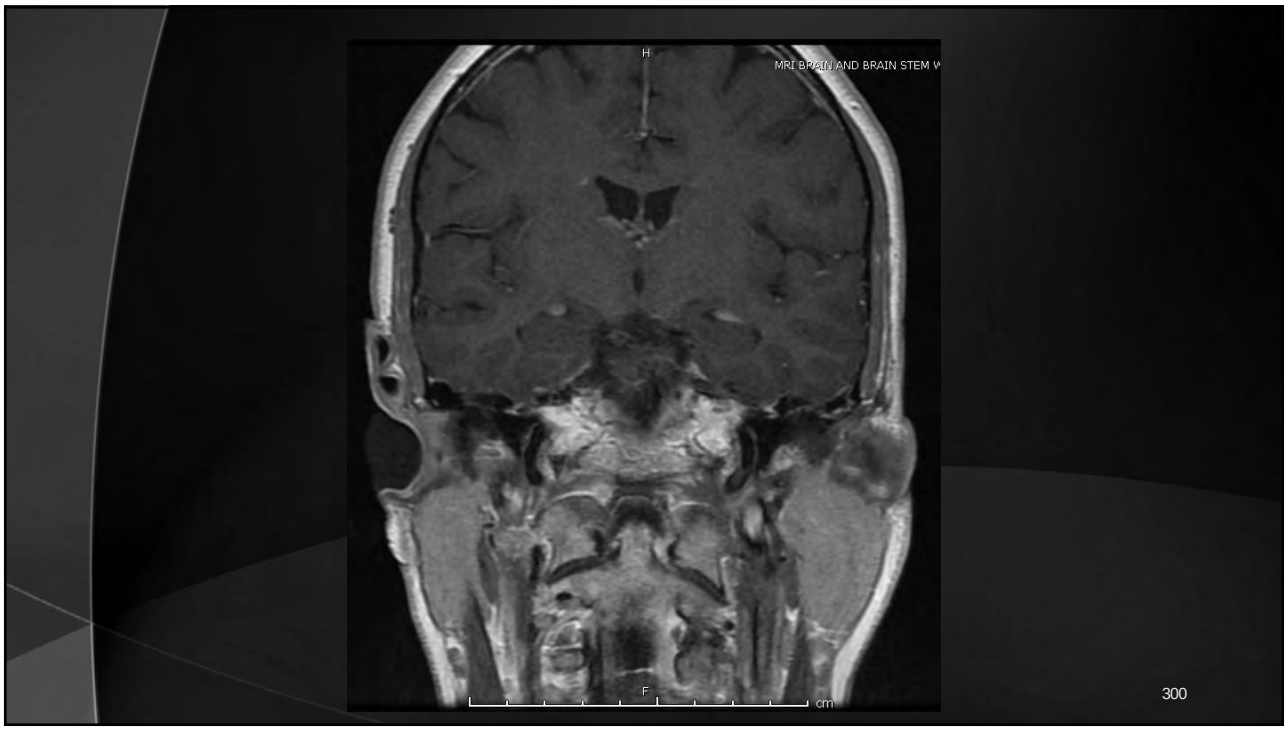

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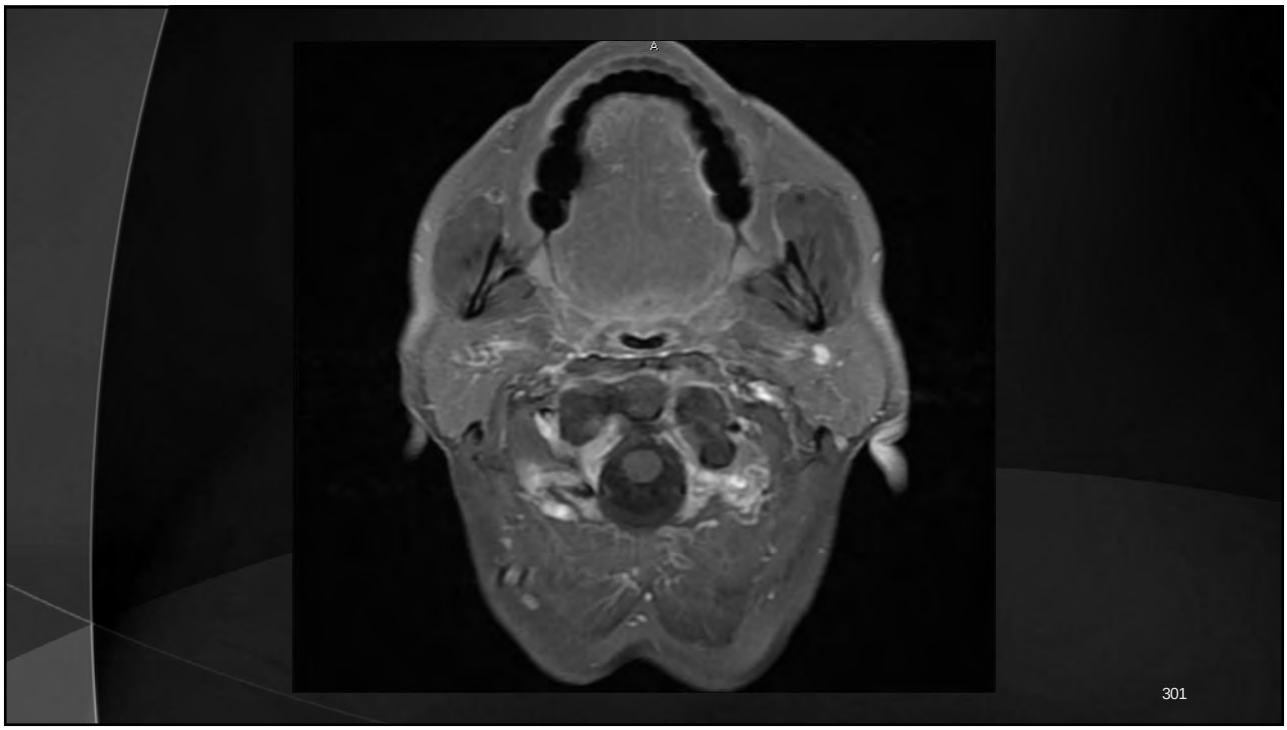

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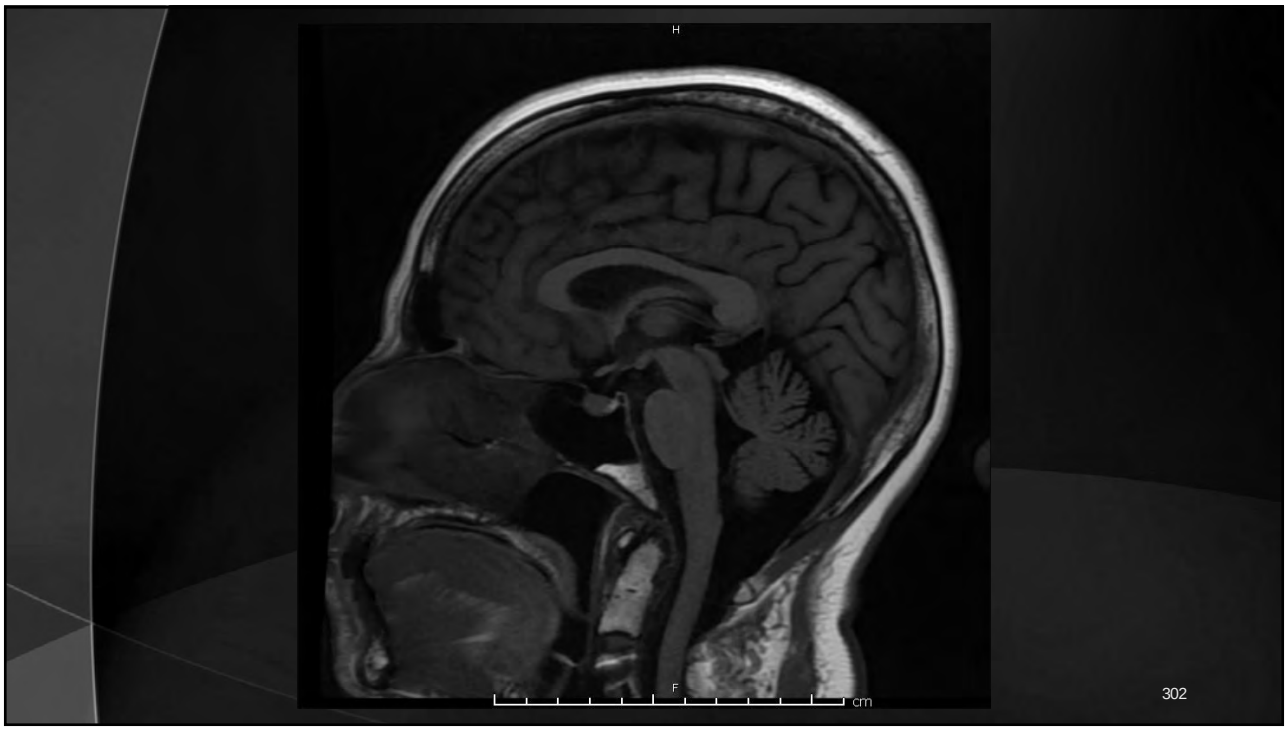

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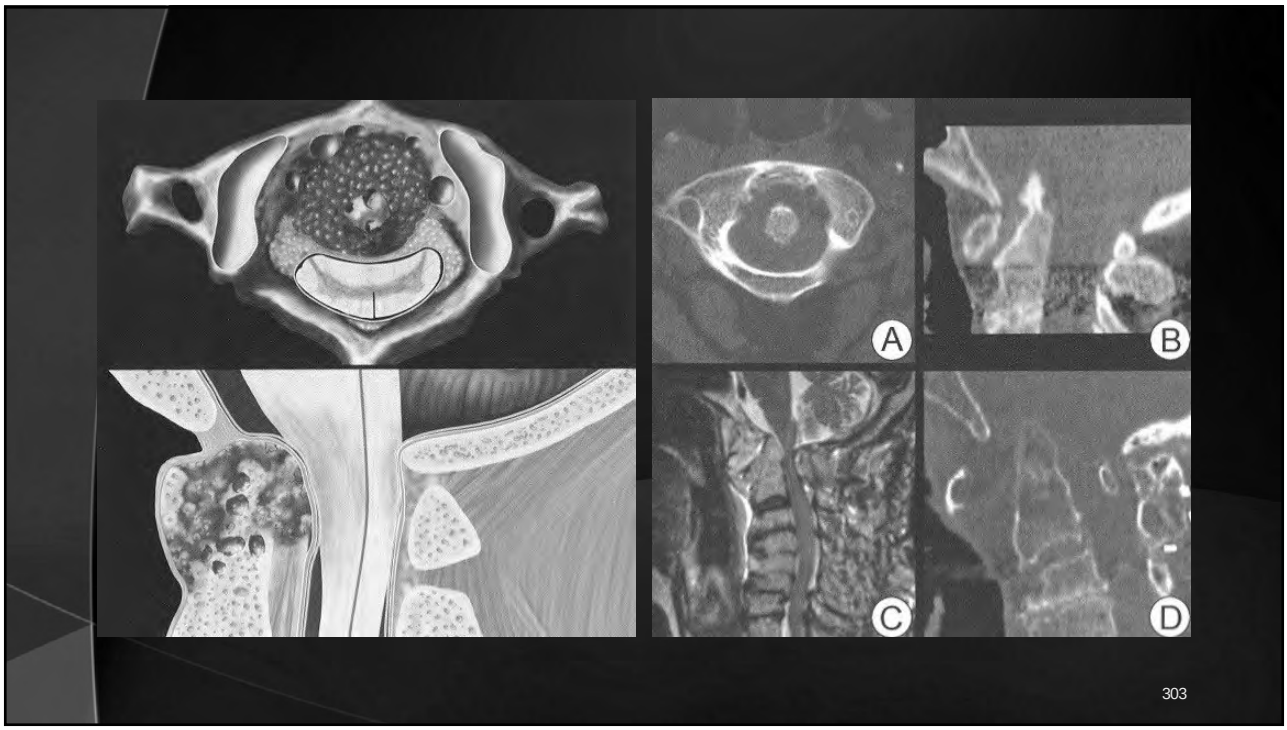

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ESR and CRP:

- Not specific enough to diagnose a particular type of arthritis or disease.

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Classification…Polyarthritis

Autoimmune:	Rheumatic, Rheumatoid, Ankylosing spondylitis, Reiter syndrome etc.
Degenerative:	Osteroarthritis
Crystal Deposition:	Gout – Monosodium urate
	CPPD - Pseudo Gout
Infective –	Septic, TB, Lyme etc. rare.

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Anti-cyclic Citrullinated Peptide Antibody (Anti-CCP):

- These antibodies help diagnose RA. It is particularly useful in the early stages of RA or in borderline cases as it is a more specific test than the RF test.
- According to the American College of Rheumatology, approximately 95% of patients with a positive CCP will go on to develop RA.
- However, only about 6 of 10 people with early RA will test positive to CCP.

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Rheumatoid Factor (RF):

- The test for rheumatoid factor is commonly used to help diagnose rheumatoid arthritis.
- Rheumatoid factor is an antibody (a protein made by the body's immune system).
- It is found in about 8 of 10 people who have rheumatoid arthritis (RA), but about two out of 10 people with RA will never test positive for rheumatoid factor. Rheumatoid factor levels can also vary and the test results may be negative in the early stages or during inactive periods (remission) of RA.
- If you have symptoms of RA but your first rheumatoid factor test is negative, your doctor may order the test to be repeated.
- However a positive rheumatoid factor test does not always mean you have RA as there are several other conditions that can also give positive rheumatoid factor results.
- Healthy people without RA can also test positive for rheumatoid factor, particularly older people. This does not mean you will develop the condition.

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Serologic Factors in RA: Anti-CCP and RF

	Sensitivity (%)	Specificity (%)
Anti-CCP*	41	98
RF	62	84
Anti-CCP + RF	33	99.6

* anti-cyclic citrullinated peptide

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HLA Typing:

- This test looks for HLA-B27. Present in 8% of the general population including healthy people without spondyloarthritis.
- Commonly found in people with ankylosing spondylitis, reactive arthritis or psoriatic arthritis.
- HLA – DR4 is associated with an increased risk of rheumatoid arthritis.

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Antinuclear Antibody (ANA):

- The ANA test is used to screen for autoimmune disorders.
- 95% of people with systemic lupus erythematosus (SLE or lupus) have a positive ANA test.
- The ANA test may also be positive in other conditions, such as Sjogrens syndrome, scleroderma, Raynaud's disease, mixed connective tissue disease and rheumatoid arthritis.
- ANA test results can also be positive in up to 1 in 10 healthy people without any known autoimmune disease.

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Multi-Biomarker Disease Activity (MBDA) score:

- The MBDA score is a novel blood-test based disease activity score of single integer ranging 1-100.
- Score derived from 12 serum biomarkers (VCAM-1, EGF, VEGF-A, IL-6, TNF-RI, YKL-40, MMP-1, MMP-3, leptin, resistin, SAA, CRP).
- The MBDA reflects disease activity in RA.
- Is predictive for radiographic progression and risk of flare after drug reduction.

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Lyme Disease:

- Lyme disease (LD) is caused by infection with a member of the Borrelia burgdorferi sensu lato complex.
- Transmission of LD-associated Borrelia requires at least 36 hours of tick attachment.
  - Approximately 80% of infected individuals will develop a unique expanding skin lesion with a central zone of clearing, referred to as erythema migrans (EM; stage 1).
  - In the absence of treatment, patients may progress to early disseminated disease (stage 2), which is characterized by neurologic manifestations (eg, meningitis, cranial neuropathy, radiculoneuropathy) and is often associated with B garinii infection.
- Patients with late LD often present with intermittent or persistent arthralgia, most often associated with B burgdorferi infection, or with acrodermatitis chronica atrophicans (ACA), typically due to infection with B afzelii.
- Importantly, while serologic assessment for LD may be negative in the early weeks following infection, over 90% of patients with later stages of infection are seropositive by serology, which remains the diagnostic method of choice for this disease.
- Diagnosis of LD is currently based on a 2-tiered serologic testing algorithm, as recommended by the Centers for Disease Control and Prevention (CDC), and involves an initial screening assay for detection of antibodies to LD-causing Borrelia species.

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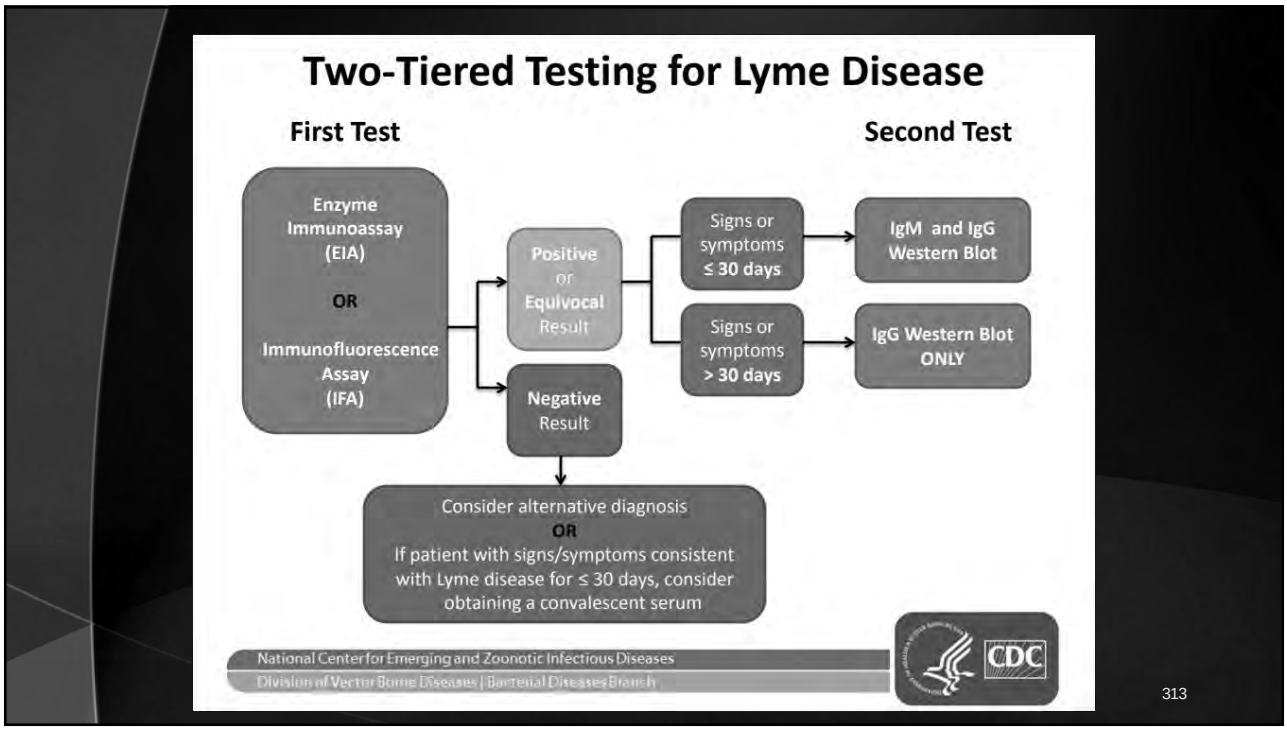

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Serum Uric Acid:

- Gout
- Monitor elevations due to cellular turnover during chemo- and radiation therapies

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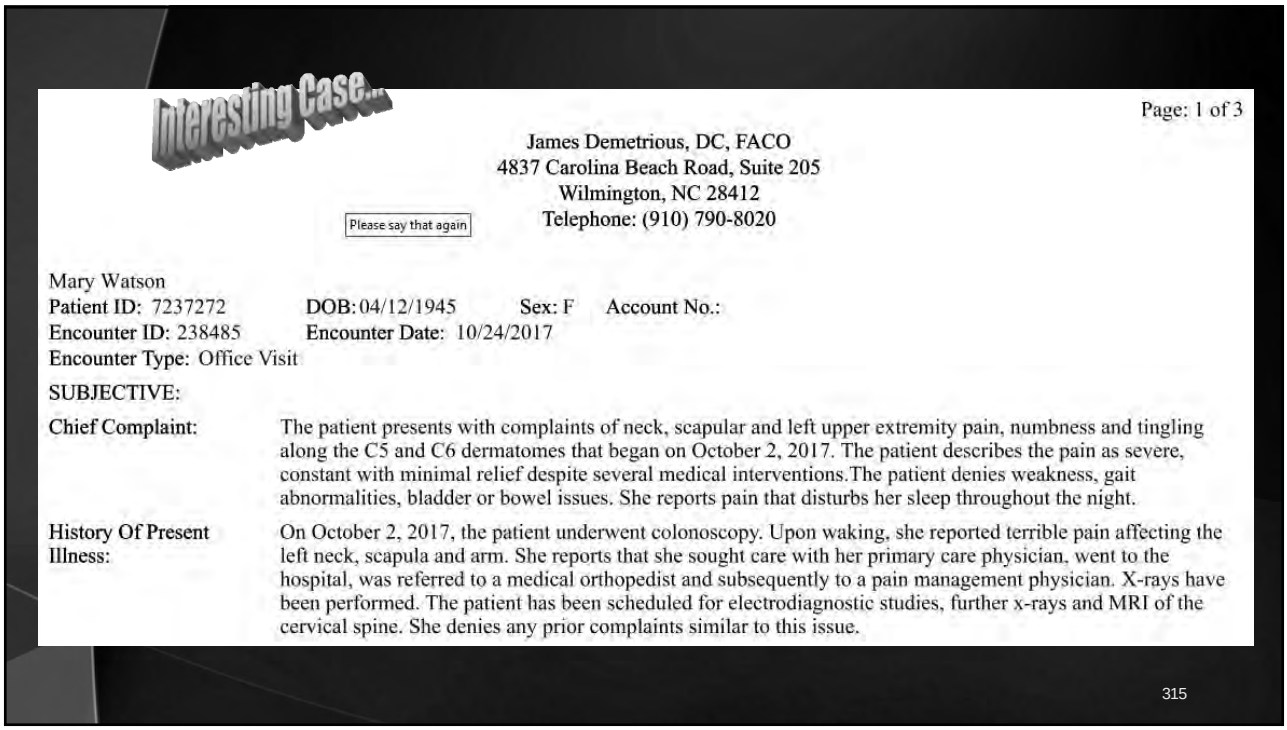
Interesting Case...
Page: 1 of 3
James Demetrious, DC, FACO
4837 Carolina Beach Road, Suite 205
Wilmington, NC 28412
Telephone: (910) 790-8020
Please say that again
Mary Watson
Patient ID: 7237272 DOB: 04/12/1945 Sex: F Account No.:
Encounter ID: 238485 Encounter Date: 10/24/2017
Encounter Type: Office Visit
SUBJECTIVE:
Chief Complaint: The patient presents with complaints of neck, scapular and left upper extremity pain, numbness and tingling along the C5 and C6 dermatomes that began on October 2, 2017. The patient describes the pain as severe, constant with minimal relief despite several medical interventions.The patient denies weakness, gait abnormalities, bladder or bowel issues. She reports pain that disturbs her sleep throughout the night.
History Of Present Illness: On October 2, 2017, the patient underwent colonoscopy. Upon waking, she reported terrible pain affecting the left neck, scapula and arm. She reports that she sought care with her primary care physician, went to the hospital, was referred to a medical orthopedist and subsequently to a pain management physician. X-rays have been performed. The patient has been scheduled for electrodiagnostic studies, further x-rays and MRI of the cervical spine. She denies any prior complaints similar to this issue.
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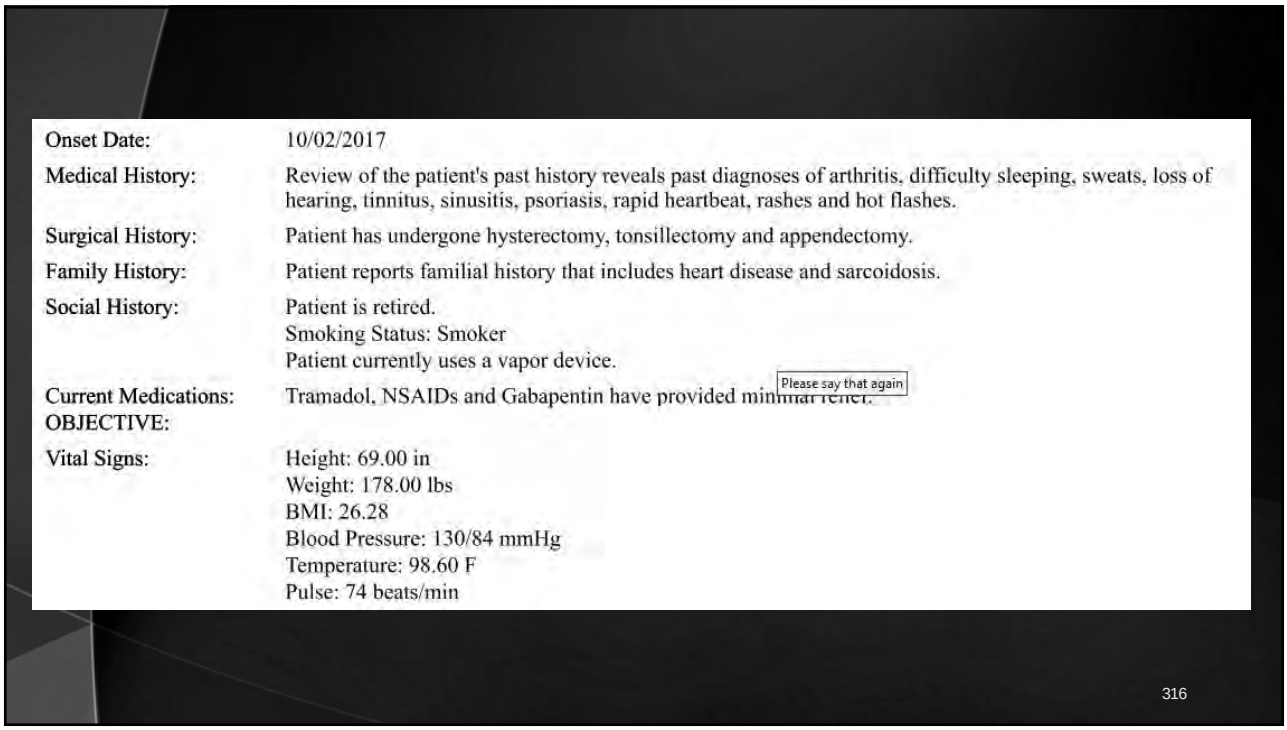
Onset Date: 10/02/2017
Medical History: Review of the patient's past history reveals past diagnoses of arthritis, difficulty sleeping, sweats, loss of hearing, tinnitus, sinusitis, psoriasis, rapid heartbeat, rashes and hot flashes.
Surgical History: Patient has undergone hysterectomy, tonsillectomy and appendectomy.
Family History: Patient reports familial history that includes heart disease and sarcoidosis.
Social History: Patient is retired.
Smoking Status: Smoker
Patient currently uses a vapor device.
Current Medications: Tramadol, NSAIDs and Gabapentin have provided min
Please say that again
OBJECTIVE:
Vital Signs: Height: 69.00 in
Weight: 178.00 lbs
BMI: 26.28
Blood Pressure: 130/84 mmHg
Temperature: 98.60 F
Pulse: 74 beats/min
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Objective Notes:	Inspection of the patient revealed a pleasant 72-year-old female with guarded head and neck motion. She was alert and oriented x4. Chiropractic subluxations were noted affecting C5 and T2 as evidenced by decreased intersegmental motion and increased muscle tone affecting the paraspinal musculature upon palpation. Global ranges of motion of the cervical spine produced left upper extremity pain on extension, left lateral flexion and left rotation. Orthopedic assessment revealed signs that suggest cervical radiculopathy. Cervical compression, Spurling's test and Valsalva maneuver produced neck, scapular and upper extremity symptomatology. Bakody sign was positive indicating radicular symptomatology. Neurologic assessment was performed. Cranial nerve assessment was negative. Alteration of sensation to pinprick was noted along the C6 dermatome. 0/5 brachioradialis DTR on the left. Motor evaluation revealed 4/5 strength of wrist extension. Patient had a negative Hoffman sign. Babinski was not present. Cardiovascular and peripheral vascular assessments were negative. Examination of the shoulders revealed full range of motion without restriction, weakness or pain. No other abnormalities were noted.
Imaging:	Patient reports that she has undergone several x-rays of the neck and shoulder. Shoulder x-ray results were available to me through the Delaney record system revealing no acute abnormalities affecting the left shoulder. In addition, their system revealed that the patient has been scheduled for MRI and x-rays of the cervical spine on Thursday, October 19, 2017. I requested that the patient obtain images and reports for my assessment.

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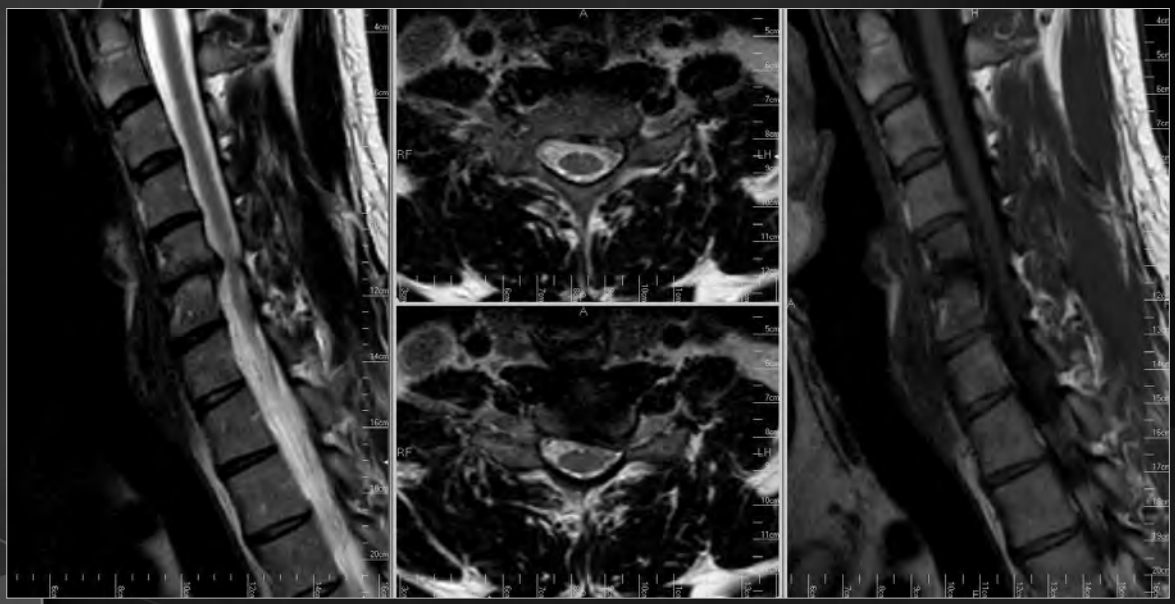

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ASSESSMENT:

Assessments:

ICD-10 Assessments:

Patient was provided a primary Medicare diagnosis of chiropractic subluxations, cervical radiculopathy and likely advanced degenerative joint disease producing central or foraminal stenosis. It is likely that the position during which her colonoscopy was performed provoked and inflamed this condition.

Imaging and MRI assessments should clarify any spinal contribution to her current symptomatology and rule out other space occupying lesions.

Patient reports that she was provided a diagnosis of Parsonage Turner syndrome by the pain management physician. I disagree with this assessment. The patient's symptoms and signs are not reflective of brachial neuritis and her symptomatic/clinical picture does not reflect this disorder. Rather, she shows very strong signs that suggest discrete C6 nerve root compromise.

Please say that again

We will monitor the patient's response to care utilizing weekly visual analog scales, pain drawings and the Neck Disability Index.

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Functional Status:

The patient is an acute distress. She needs relief as soon as possible.

PLAN:

Procedure Notes:

With the patient's consent, axial traction was performed utilizing computerized intermittent traction techniques. The patient reported relief during treatment and immediately subsequent to treatment.

Care Plan:

I have recommended chiropractic care at a frequency of three visits per week for the next 2-4 weeks. It is my hope that she will progressively improve during that time frame. Chiropractic care will be provided utilizing traction techniques that alleviate radicular symptomatology.

I have advised the patient to undergo prescribed imagin Please say that again to motor deficits and the severity of her symptomatology, this is reasonable and appropriate based upon the ACR criteria.

The patient has reported that she has a scheduled electrodiagnostic study this week. I would recommend that she undergo a trial of chiropractic care prior to undergoing this test.

I would recommend that she seek the care of her medical doctor. Medications prescribed thus far have been ineffective. I would defer to her medical doctors pertaining to her medications as she may benefit from anti-inflammatory measures to resolve nerve root inflammation, but due to inherent side effects, her medical doctors should make this decision. I will discuss with the patient supplemental and nutritional means to alleviate inflammation.

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Patient Instructions:	I discussed with the patient issues related to provocative postures that increase radicular symptomatology. I strongly recommended that she avoid and modify any activity of daily living that provokes radicular symptoms. I have discussed with her the utilization of pillows at ni[Please say that again]ay support her neck and head better and alleviate discomfort.
Informed Consent::	The patient provided consent for examination and treatment. Careful discussion was made pertaining to informed consent issues, related care, side effects and likelihoods. This report was dictated utilizing transcription software. Any errors in this report or subsequent reports are unintended.

James Demetrious, DC, FACO Date: 10/24/2017

[Provider]: James Demetrious, DC

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Journal of Manipulative and Physiological Therapeutics 525
Volume 15 • Number 8 • October, 1992
0161-4754/92/1508-0525 $03.00/0 © 1992 JMPT

Case Reports

Metastatic Testicular Seminoma of the Cervicothoracic Spine

JAMES DEMETRIOUS, D.C.*

ABSTRACT

A case of metastatic testicular seminoma affecting the cervico-thoracic spine is reported along with its clinical and radiographic findings. Case progression is discussed. (J Manipulative Physiol Ther 1992; 15:525–528).

Key Indexing Terms: Metastasis, Seminoma, Cervical Vertebrae, Spine, Chiropractic.

Figure 1. The sagittal image reveals areas of abnormal signal intensity in the C3 and T1 vertebral bodies.

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Cervical Spondylotic Myelopathy

Patient: 67 year old female

History: This 67 yr. old female presented with history of numbness/tingling in left upper extremity, several weeks duration. Recent investigations for this complaint included an EKG and NCV studies. More recent onset of urinary urgency, bilateral aching pain in the lower extremities and "loss of control" of the right leg prompted consultation with another physician who ordered MRI examination, images of which are shown here.

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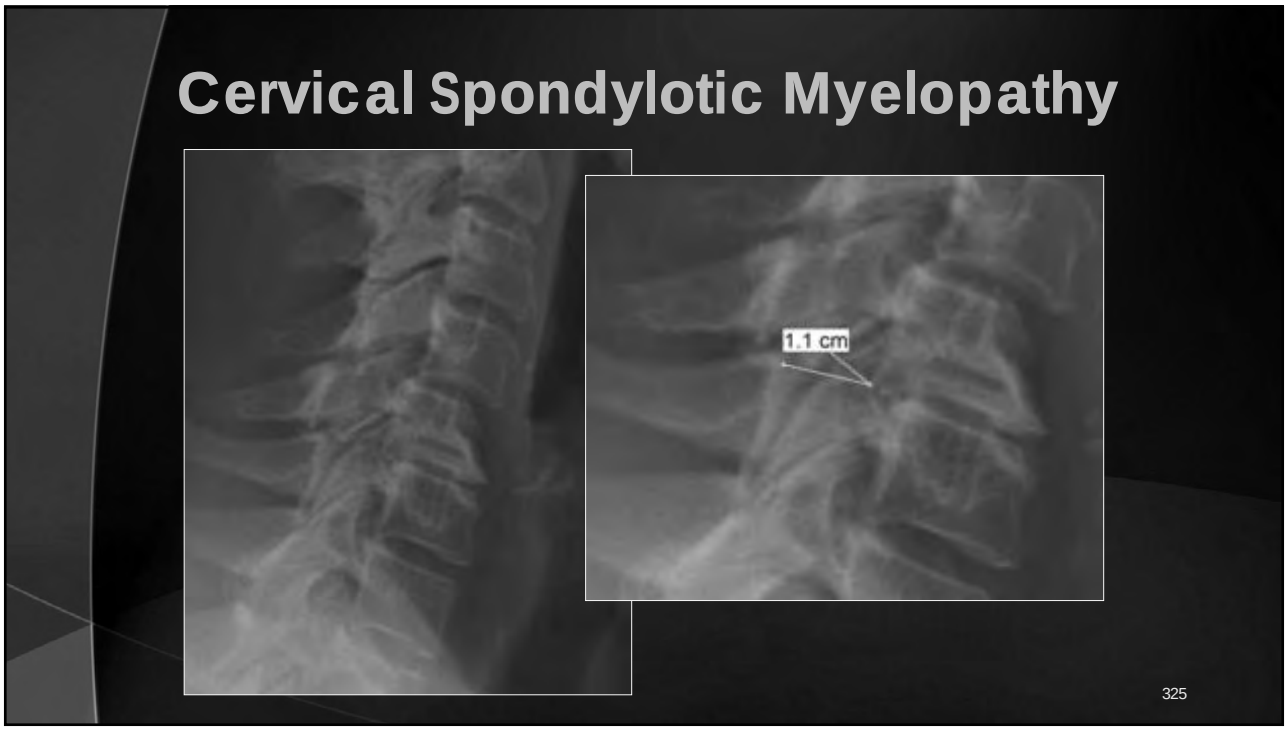
Cervical Spondylotic Myelopathy
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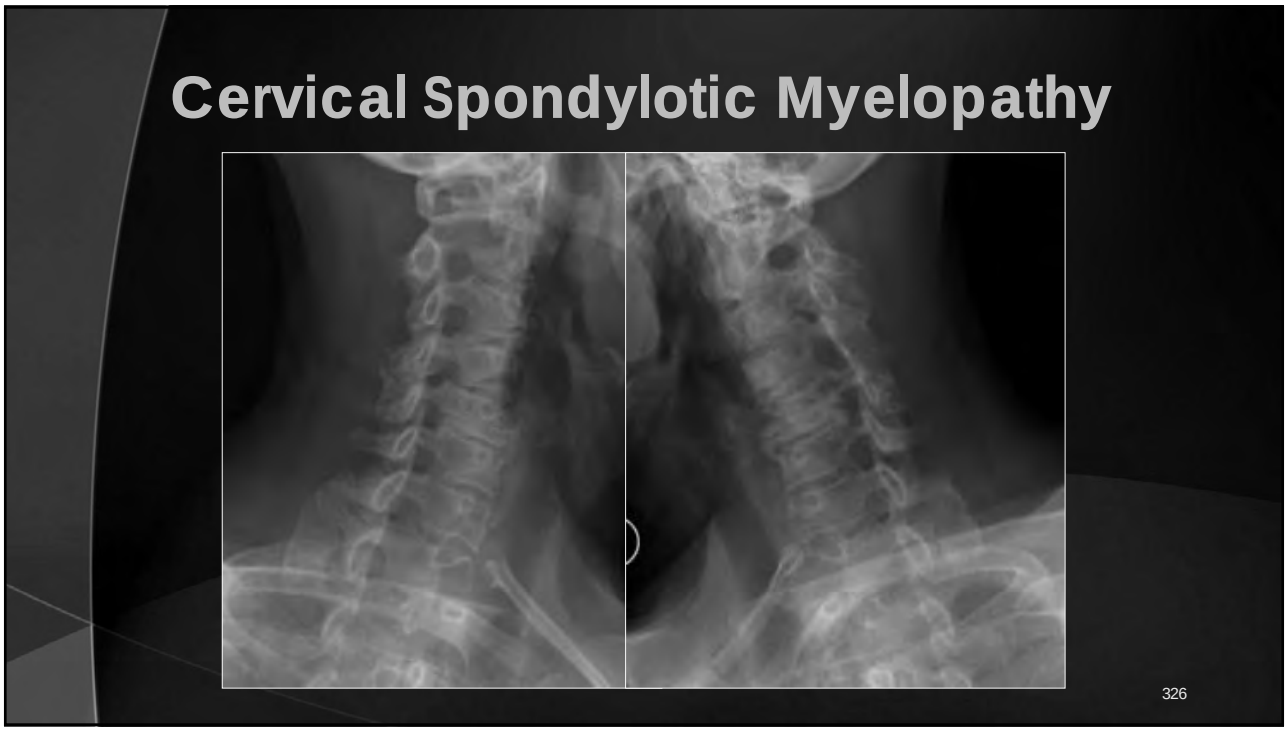
Cervical Spondylotic Myelopathy
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Cervical Spondylotic Myelopathy

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Hoffman's Sign

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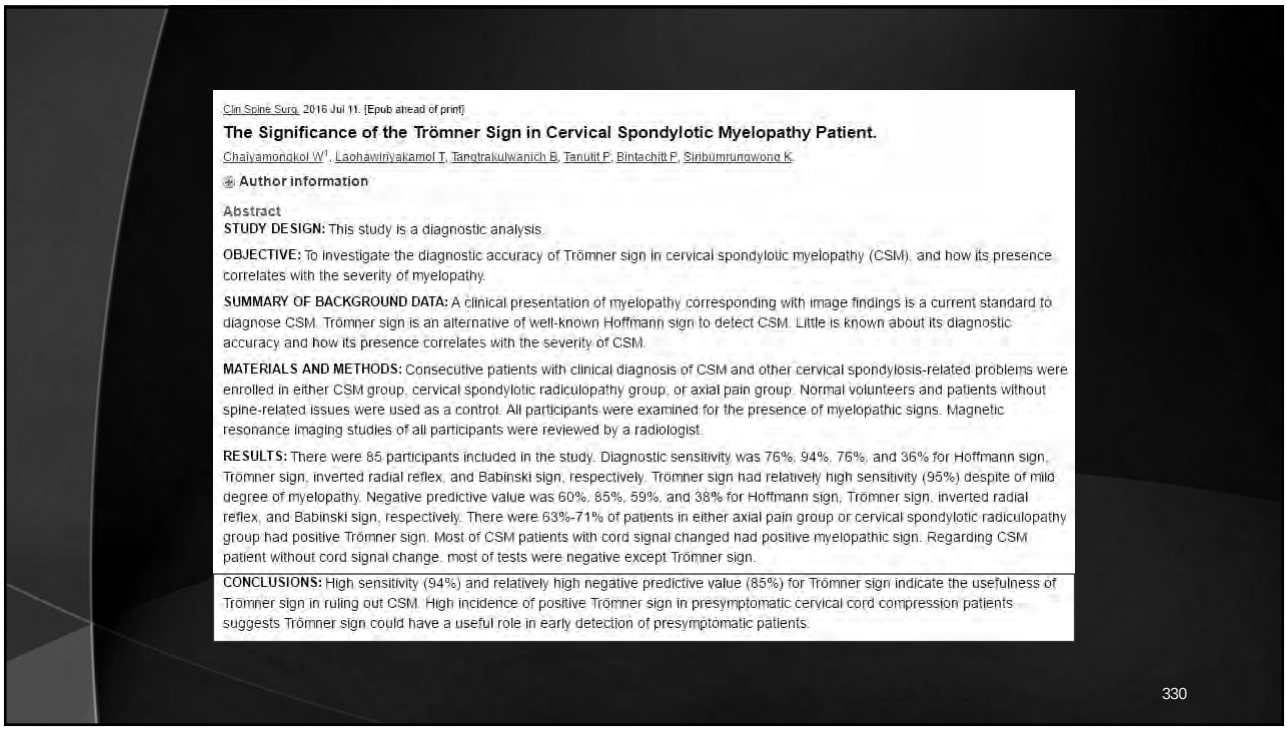
Clin Spine Surg. 2016 Jul 11. [Epub ahead of print]
The Significance of the Trömner Sign in Cervical Spondylotic Myelopathy Patient.
Chaiyamongkol W[1], Laohawiriyakamol T, Tangtrakulwanich B, Tanulit P, Bintachitt P, Siribumrungwong K
Author information
Abstract
STUDY DESIGN: This study is a diagnostic analysis.
OBJECTIVE: To investigate the diagnostic accuracy of Trömner sign in cervical spondylotic myelopathy (CSM), and how its presence correlates with the severity of myelopathy.
SUMMARY OF BACKGROUND DATA: A clinical presentation of myelopathy corresponding with image findings is a current standard to diagnose CSM. Trömner sign is an alternative of well-known Hoffmann sign to detect CSM. Little is known about its diagnostic accuracy and how its presence correlates with the severity of CSM.
MATERIALS AND METHODS: Consecutive patients with clinical diagnosis of CSM and other cervical spondylosis-related problems were enrolled in either CSM group, cervical spondylotic radiculopathy group, or axial pain group. Normal volunteers and patients without spine-related issues were used as a control. All participants were examined for the presence of myelopathic signs. Magnetic resonance imaging studies of all participants were reviewed by a radiologist.
RESULTS: There were 85 participants included in the study. Diagnostic sensitivity was 76%, 94%, 76%, and 36% for Hoffmann sign, Trömner sign, inverted radial reflex, and Babinski sign, respectively. Trömner sign had relatively high sensitivity (95%) despite of mild degree of myelopathy. Negative predictive value was 60%, 85%, 59%, and 38% for Hoffmann sign, Trömner sign, inverted radial reflex, and Babinski sign, respectively. There were 63%-71% of patients in either axial pain group or cervical spondylotic radiculopathy group had positive Trömner sign. Most of CSM patients with cord signal changed had positive myelopathic sign. Regarding CSM patient without cord signal change, most of tests were negative except Trömner sign.
CONCLUSIONS: High sensitivity (94%) and relatively high negative predictive value (85%) for Trömner sign indicate the usefulness of Trömner sign in ruling out CSM. High incidence of positive Trömner sign in presymptomatic cervical cord compression patients suggests Trömner sign could have a useful role in early detection of presymptomatic patients.
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Two Point Discrimination

Scheme of discrimination sensation

Ending of tongue	1,1мм
Tips	2,2мм
Red part of the lips	4,5мм
The back of tongue	9,0
The skin of cheek	11,2
The back of hand	31,5мм
The forearm	40,5мм
The leg	40,5мм
The upper part of trunk	53,0мм
The middle part of trunk	67,5мм
The back of neck	67,5мм

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Vibration Sense

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Joint Position Sense

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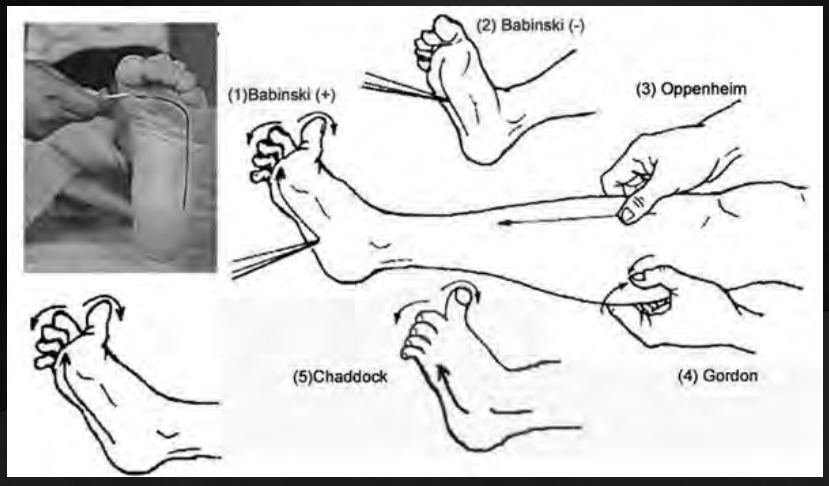
LE Pathologic Reflexes



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SPINAL NEWS
International
Issue 24 July 2012

Managing cervical spondylotic myelopathy

The management of cervical spondylotic myelopathy remains controversial and the topic is the focus of a session at this year's IMAST. The moderator of the session, K Daniel Riew, Mildred B Simon professor of Orthopedic Surgery, chief of Cervical Spine Surgery, Washington University Orthopedics, St Louis, USA, talked to *Spinal News International* about these controversies and the dangers of bad surgery

Conservative treatment for cervical spondylotic myelopathy is often initiated on the basis of clinician preference. Which conservative treatments do you prefer to use?

I use anti-inflammatories, neck immobilisation with a collar, and observation.

The *BMJ* recently ran a debate on cervical spinal manipulation for mechanical neck pain in which one side[1] argued that the practice should be abandoned

The *BMJ* recently ran a debate on cervical spinal manipulation for mechanical neck pain in which one side[1] argued that the practice should be abandoned because its risks outweighed its benefits. What is your view?

Most patients can receive spinal manipulation. If they have severe spinal cord compression, then I do not recommend it. However, I have seen thousands of patients who have undergone chiropractic spinal manipulation and I can count on one hand the number of patients who have been harmed by it—there are many more patients who have been harmed by bad spinal operations.

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Interesting Case...
SGEMS
SA
New Hanover H ar
RICHARD
1950 December
Acc:
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IP
FO
GEMS
SA
New Hanover H
RICHA
1950 Decemt
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IP
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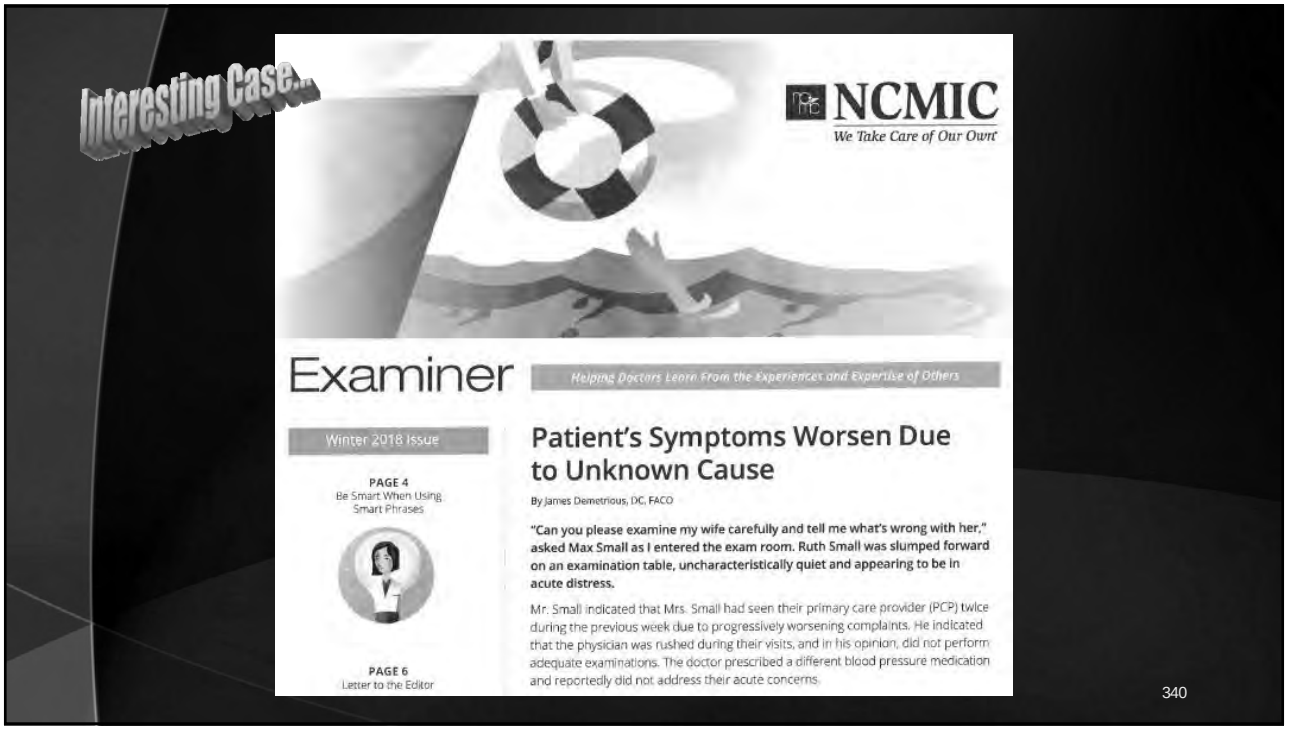
Interesting Case...
NCMIC
We Take Care of Our Own
Examiner
Helping Doctors Learn From the Experiences and Expertise of Others
Winter 2018 Issue
PAGE 4
Be Smart When Using Smart Phrases
PAGE 6
Letter to the Editor
Patient's Symptoms Worsen Due to Unknown Cause
By James Demetrious, DC, FACO
"Can you please examine my wife carefully and tell me what's wrong with her," asked Max Small as I entered the exam room. Ruth Small was slumped forward on an examination table, uncharacteristically quiet and appearing to be in acute distress.
Mr. Small indicated that Mrs. Small had seen their primary care provider (PCP) twice during the previous week due to progressively worsening complaints. He indicated that the physician was rushed during their visits, and in his opinion, did not perform adequate examinations. The doctor prescribed a different blood pressure medication and reportedly did not address their acute concerns.
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Image 1. Image A. T1WI contrast images revealed an ovoid area of enhancement involving the right lateral aspect of the cervical cord from C3-C5, approximately 23 x 5 x 3 millimeters in diameter. Image B. T2 signal change and minimal cord expansion seen from C2 through the C6 levels.

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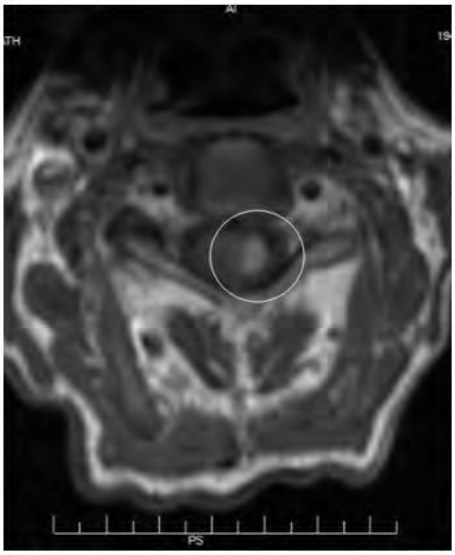
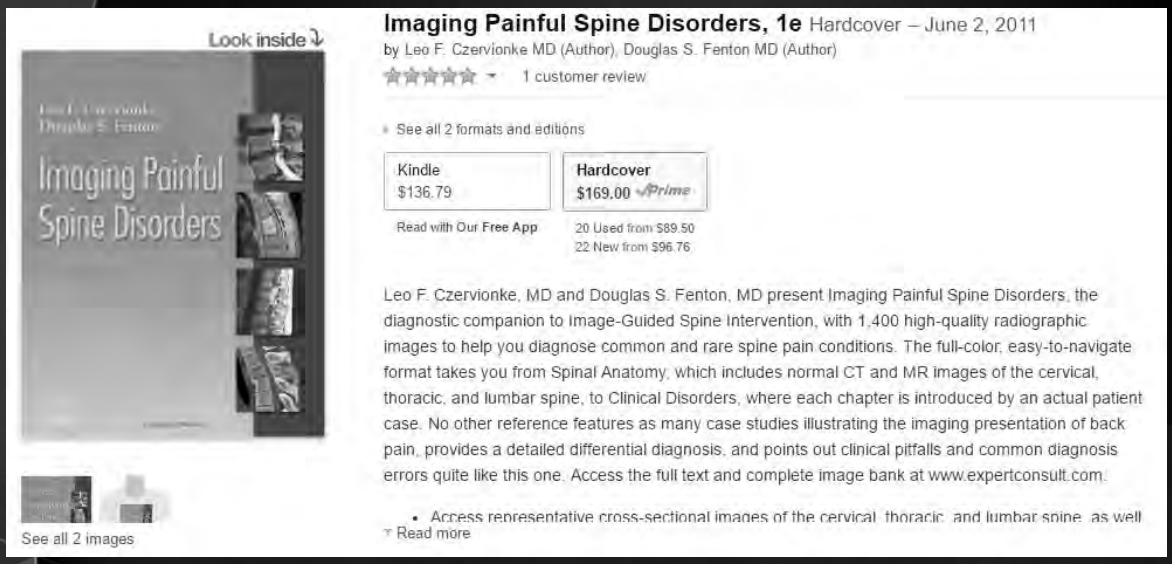


Image 2. Axial T1WI with contrast reveals the abnormality involved the left lateral aspect of the cord substance both anteriorly and posteriorly.

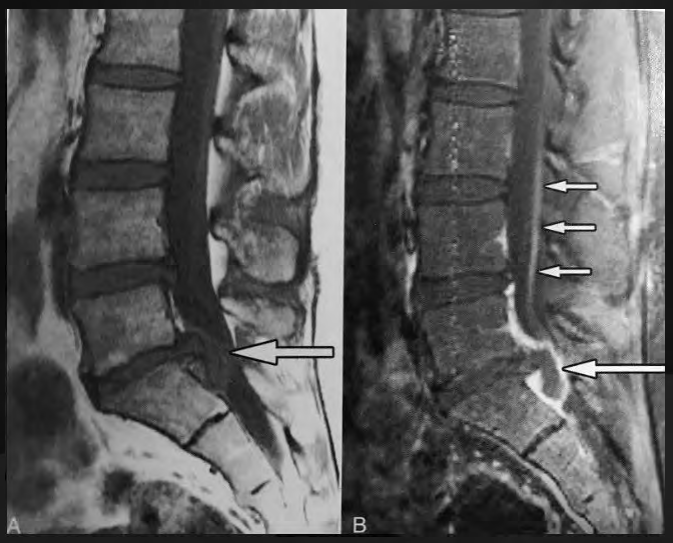
342

342



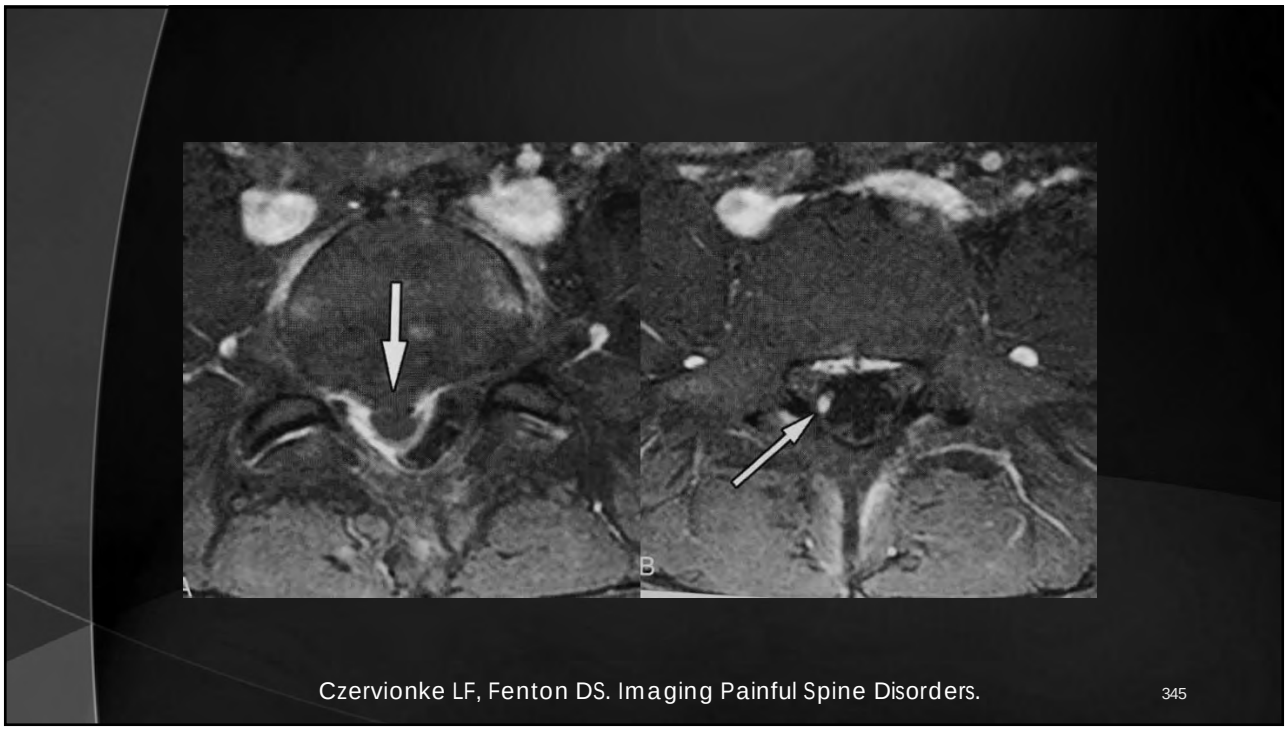
Czervionke LF, Fenton DS. Imaging Painful Spine Disorders. 343

343

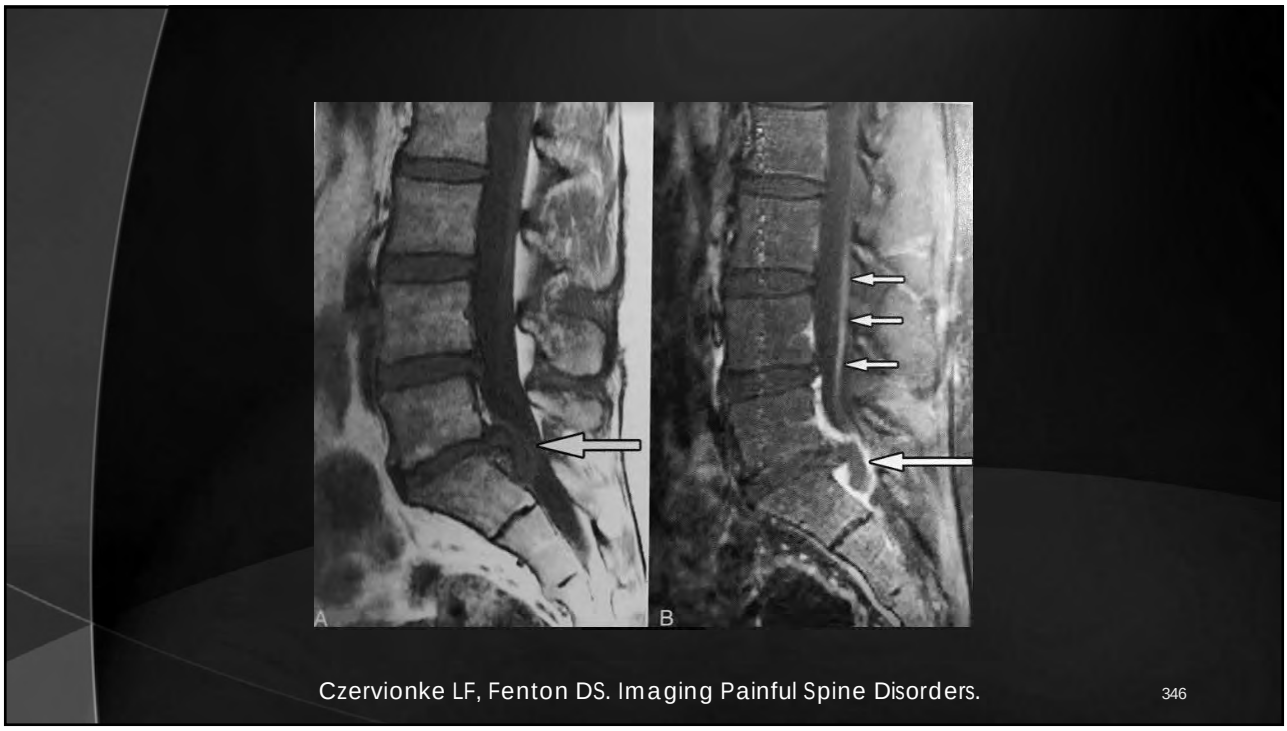


Czervionke LF, Fenton DS. Imaging Painful Spine Disorders. 344

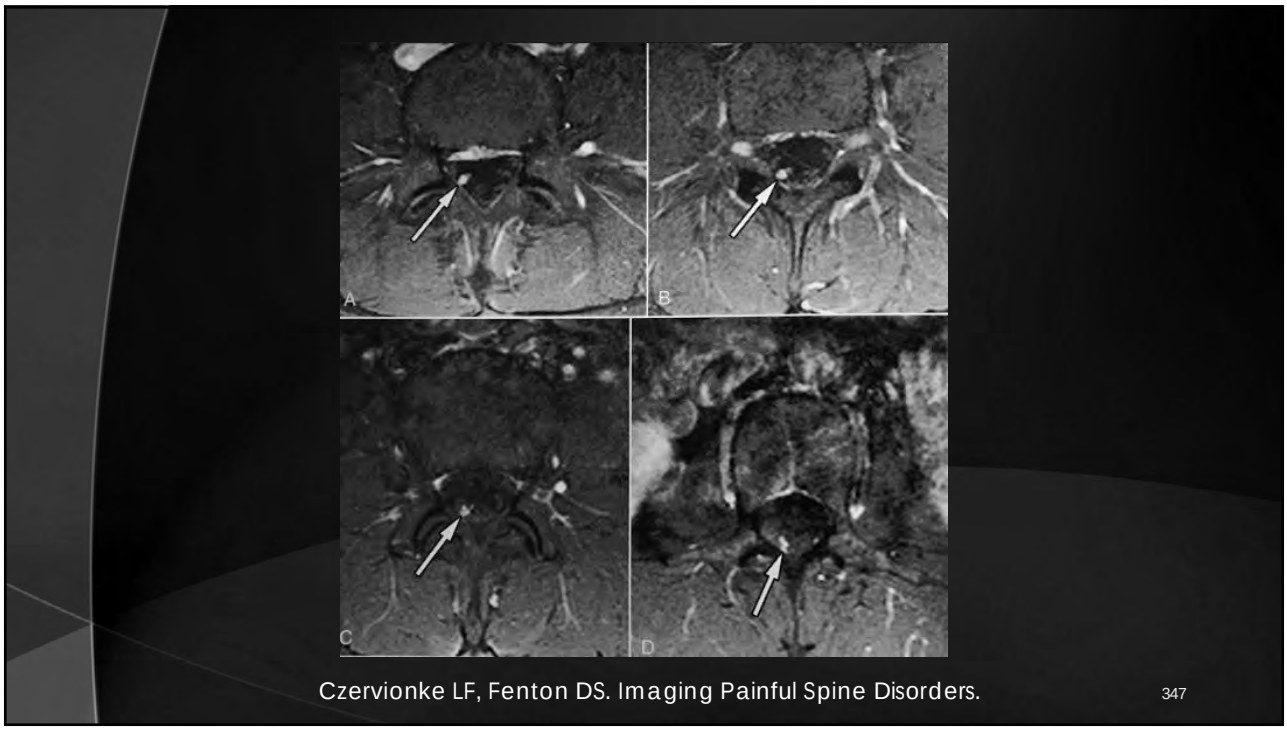
344


B
Czervionke LF, Fenton DS. Imaging Painful Spine Disorders.
345

345


A
B
Czervionke LF, Fenton DS. Imaging Painful Spine Disorders.
346

346


A
B
C
D
Czervionke LF, Fenton DS. Imaging Painful Spine Disorders.
347

347


A
B
Czervionke LF, Fenton DS. Imaging Painful Spine Disorders.
348

348


Czervionke LF, Fenton DS. Imaging Painful Spine Disorders.
349

349


350

350

CNS/Radiculitis/Neuritis/Myelitis

- **T or F** Normal Pressure Hydrocephalus presents with initial clinical triad of dementia, urinary incontinence and gait abnormalities.
- **T or F** Chiropractic care is not an absolute contraindication for those patients exhibiting spinal stenosis.

351

351

Spine and Trunk

352

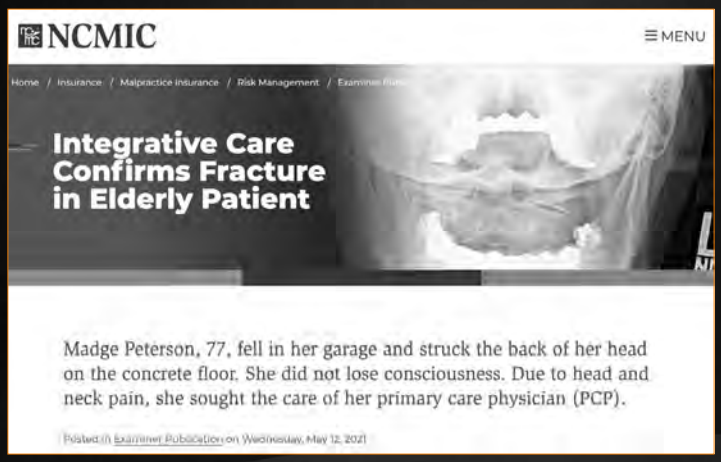
352

What Do You See?

- Patient fell, struck back of head.
- Radiologist reports no acute abnormality.

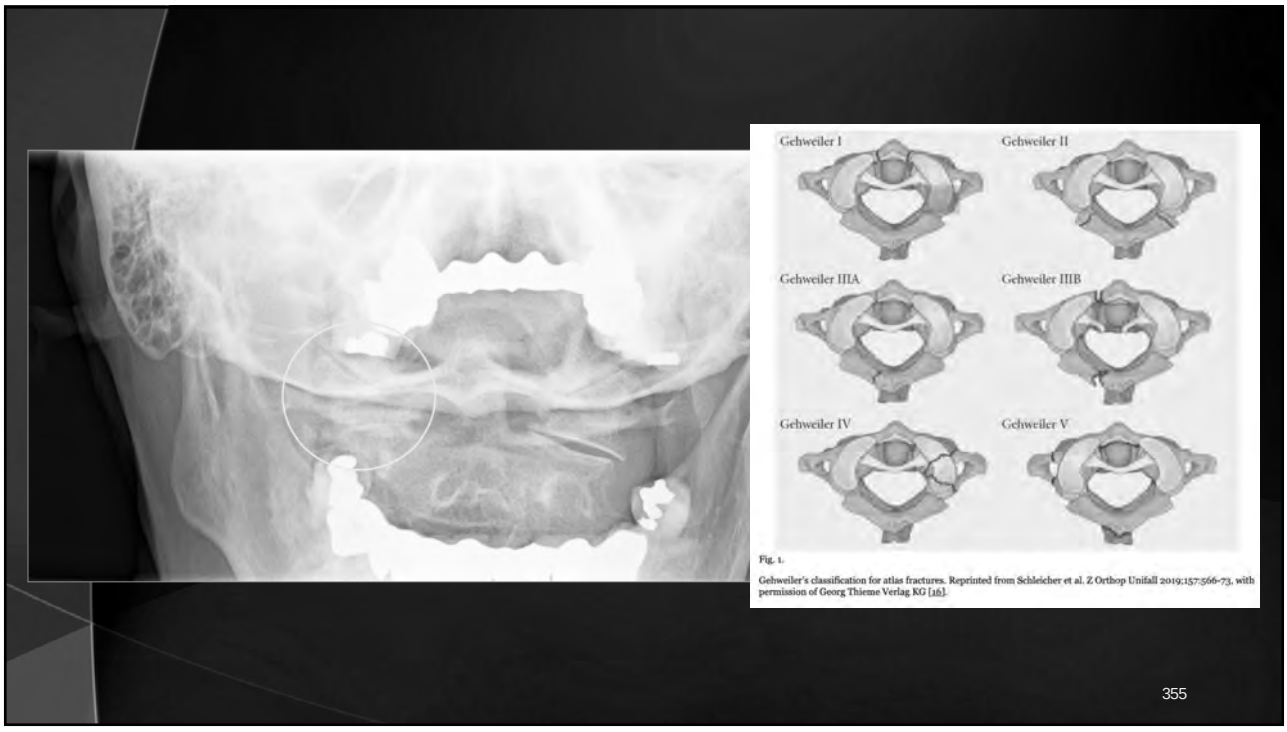
353

353

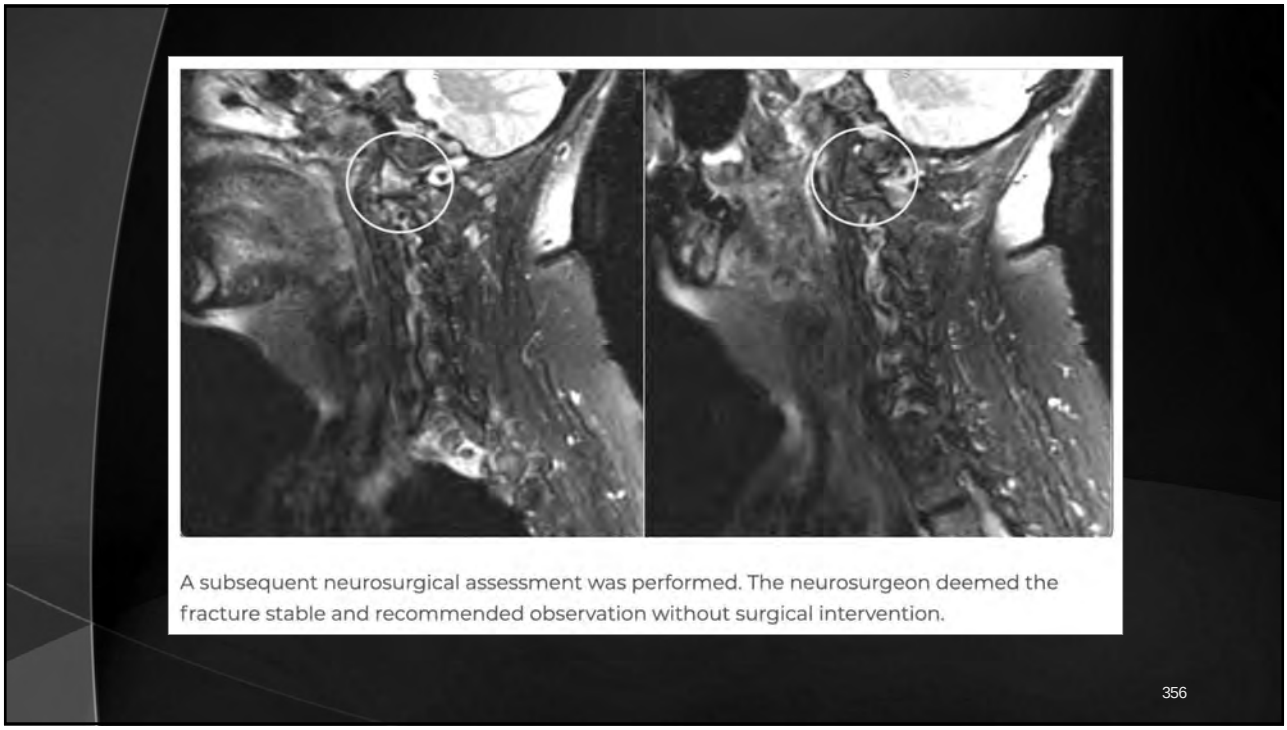


354

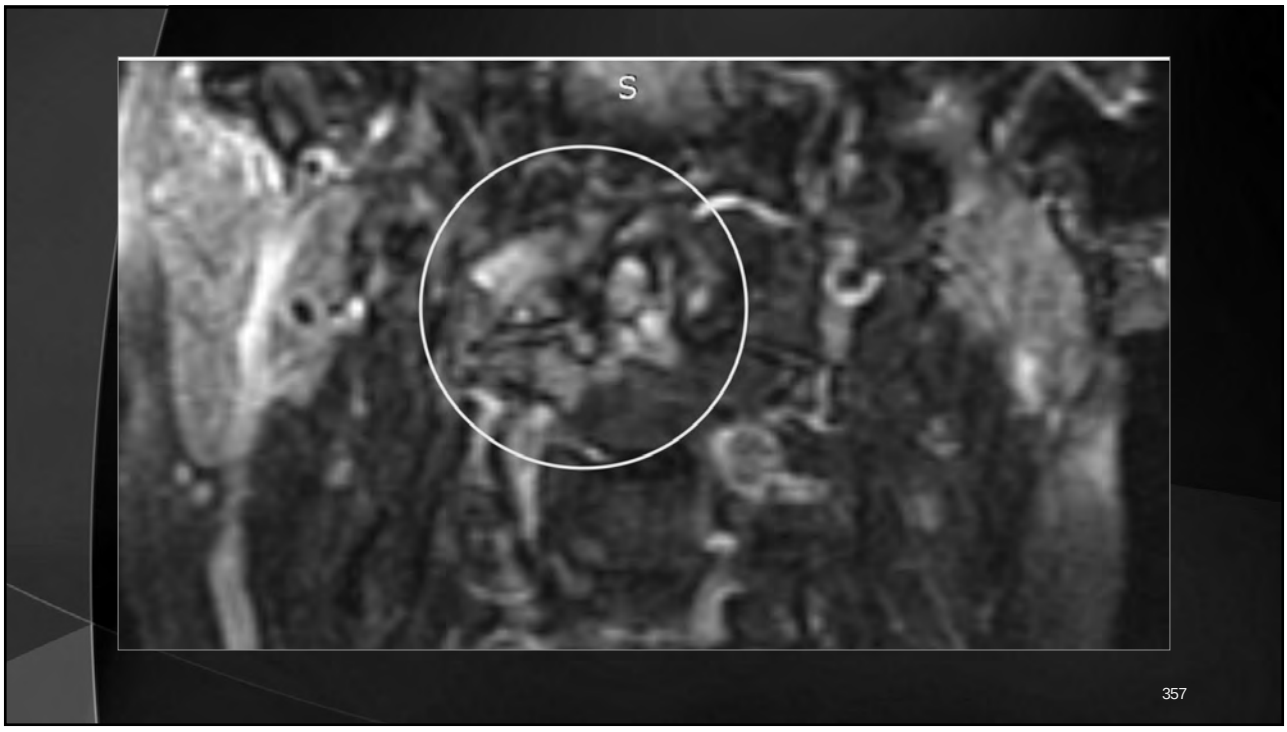
354


Gehweiler I
Gehweiler II
Gehweiler IIIA
Gehweiler IIIB
Gehweiler IV
Gehweiler V
Fig. 1.
Gehweiler's classification for atlas fractures. Reprinted from Schleicher et al. Z Orthop Unifall 2019;157:566-73, with permission of Georg Thieme Verlag KG [16].
355

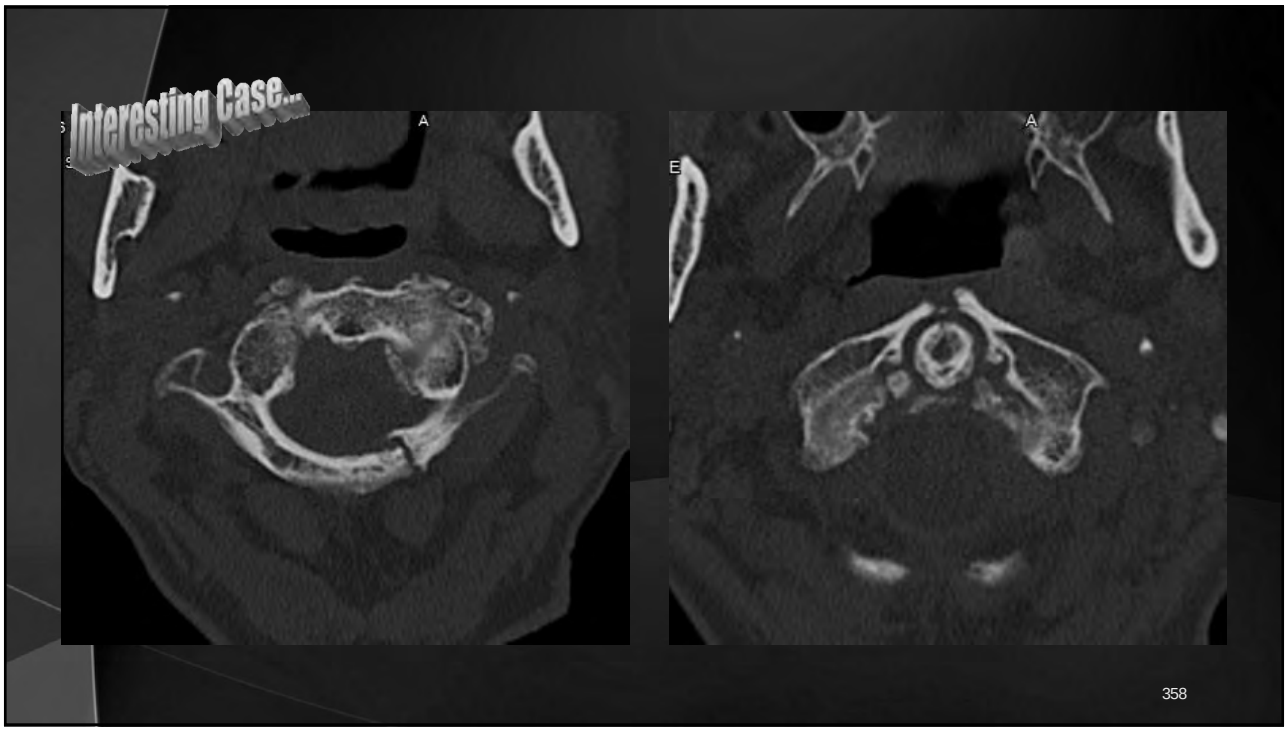
355


A subsequent neurosurgical assessment was performed. The neurosurgeon deemed the fracture stable and recommended observation without surgical intervention.
356

356



357



358

JNMS: Journal of the Neuromusculoskeletal System

Vol. 3, No. 1, Printed in the U.S.A.
1067-8239/$3.00/95

Interesting Case...

CASE REPORTS

Metastatic Renal Cell Carcinoma of the Sternum and Spine That Mimicked Costochondritis: A Case Report

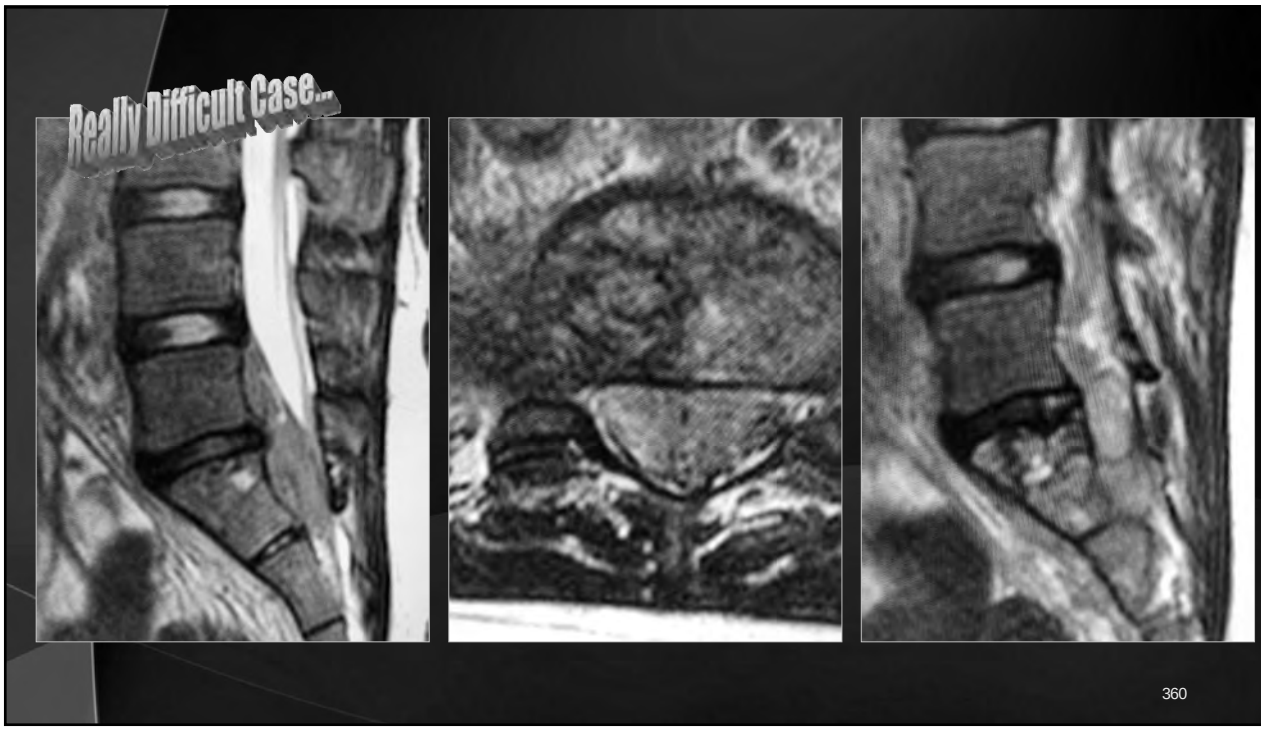
James Demetrious, D.C., D.A.B.C.O., Chester, New York

A CASE OF RENAL CELL CARCINOMA with metastasis to the sternum and multiple vertebral levels is presented. Renal cell carcinoma is the most common renal malignancy afflicting adults. Early clinical findings in this case were suggestive of costochondritis and chiropractic vertebral subluxation. However, highly insidious and progressive metastatic disease rapidly overwhelmed the patient. Of interest, the patient reported early relief of painful symptoms through chiropractic and conservative means of care. Chiropractic evaluative procedure mandates that potential pathoclinical contraindications to spinal adjustments be identified as quickly as possible. Palliative relief of early-onset symptoms served to veil the true character of an extremely virulent form of cancer. (JNMS: Journal of the Neuromusculoskeletal System 3:16-19, 1995)

Key words: Chiropractic, Costochondritis, Metastases, Renal cell carcinoma, Spine, Sternum

359

359



360

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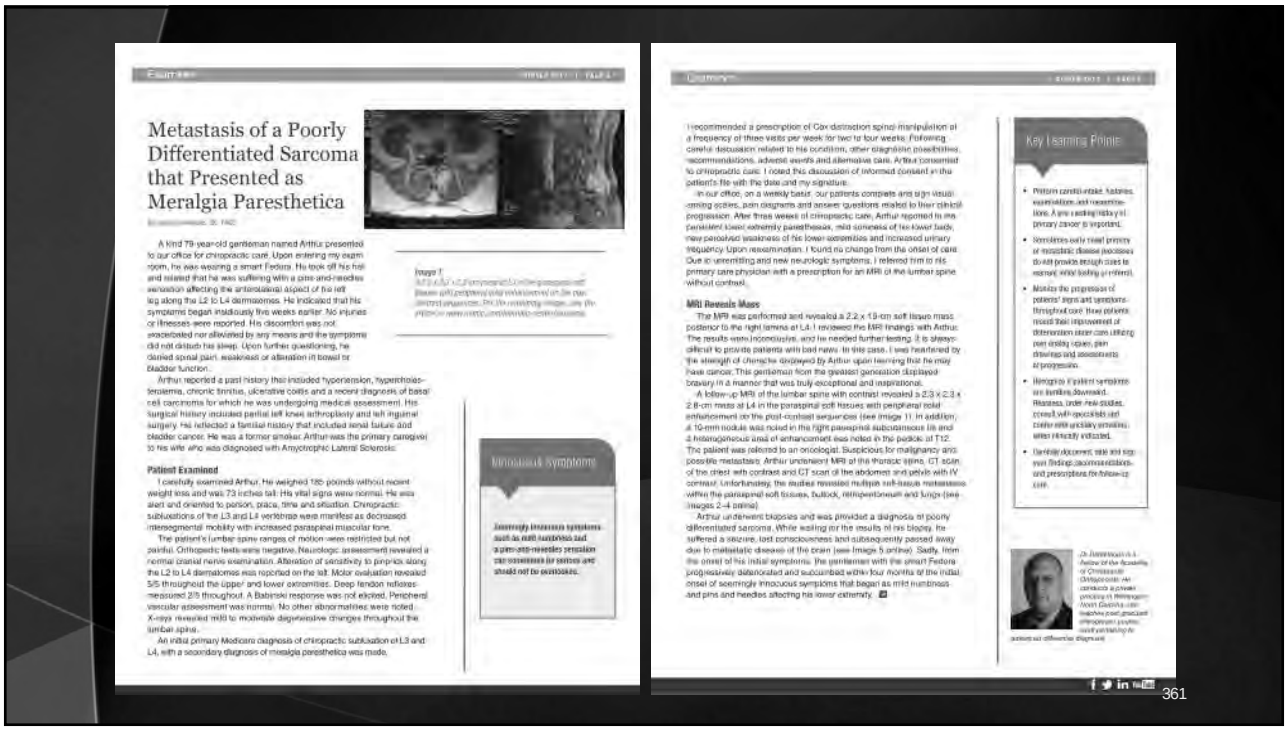
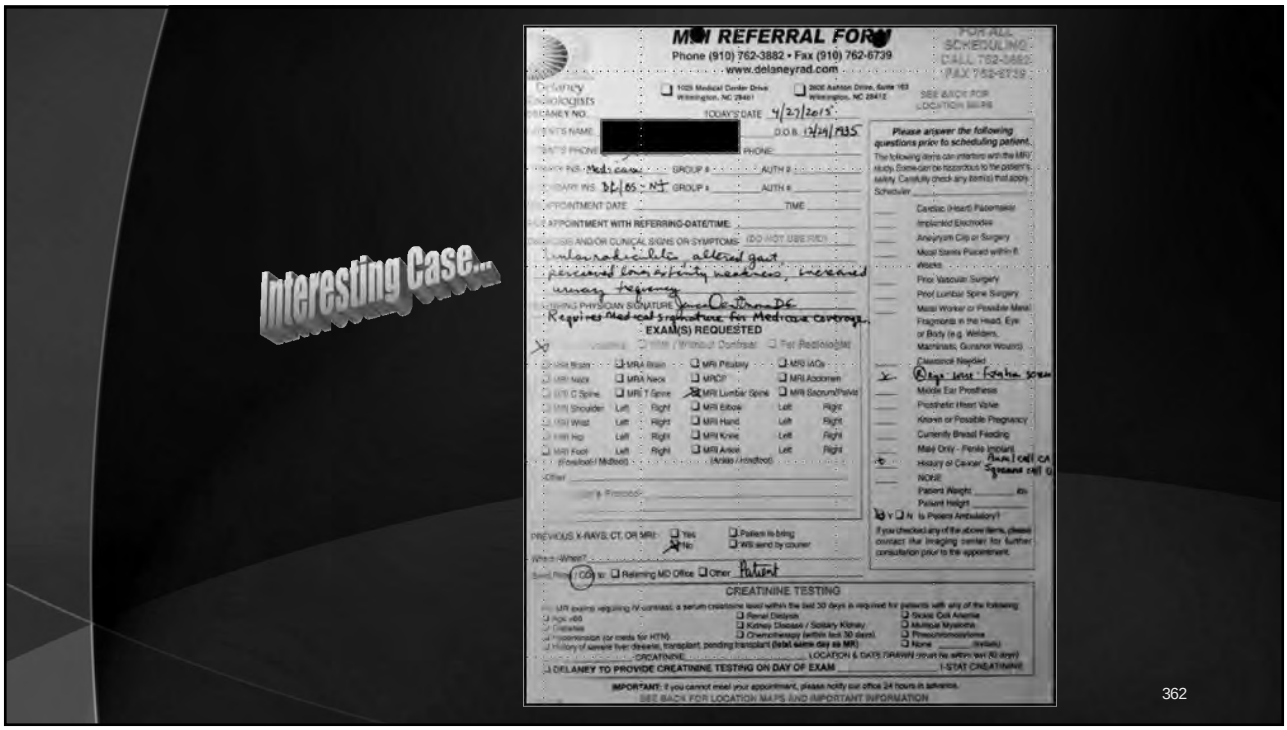

Metastasis of a Poorly Differentiated Sarcoma that Presented as Meralgia Paresthetica
Image 1
Metastatic Symptoms
Seemingly innocuous symptoms such as mild numbness and a pins-and-needles sensation can sometimes be serious and should not be dismissed.
Patient Examined
Diagnosis
Treatment
Key Learning Points
361

361


Interesting Case...
MRI REFERRAL FORM
Phone (910) 762-3882 • Fax (910) 762-6739
www.delaneyrad.com
Delaney Radiologists
TODAY'S DATE 4/27/2015
DOB 12/29/1935
Please answer the following questions prior to scheduling patient.
EXAM(S) REQUESTED
CREATININE TESTING
IMPORTANT: If you cannot meet your appointment, please notify our office 24 hours in advance.
362

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AX T1 STACK +C
C:16 OPTIMARK
Se: 4/3
Im: 29 (ASC)
Ax: S55.4
Mag: 1.1
(BSpline)
1935 December 29 M 430659
Acc: 02460186
2015 May 10
Acq Tm: 11:17:46
320 x 192
RS
L
ETL: 3
TR: 583.3
TE: 9.7
4.0thk
P
363

363


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(BSpline)
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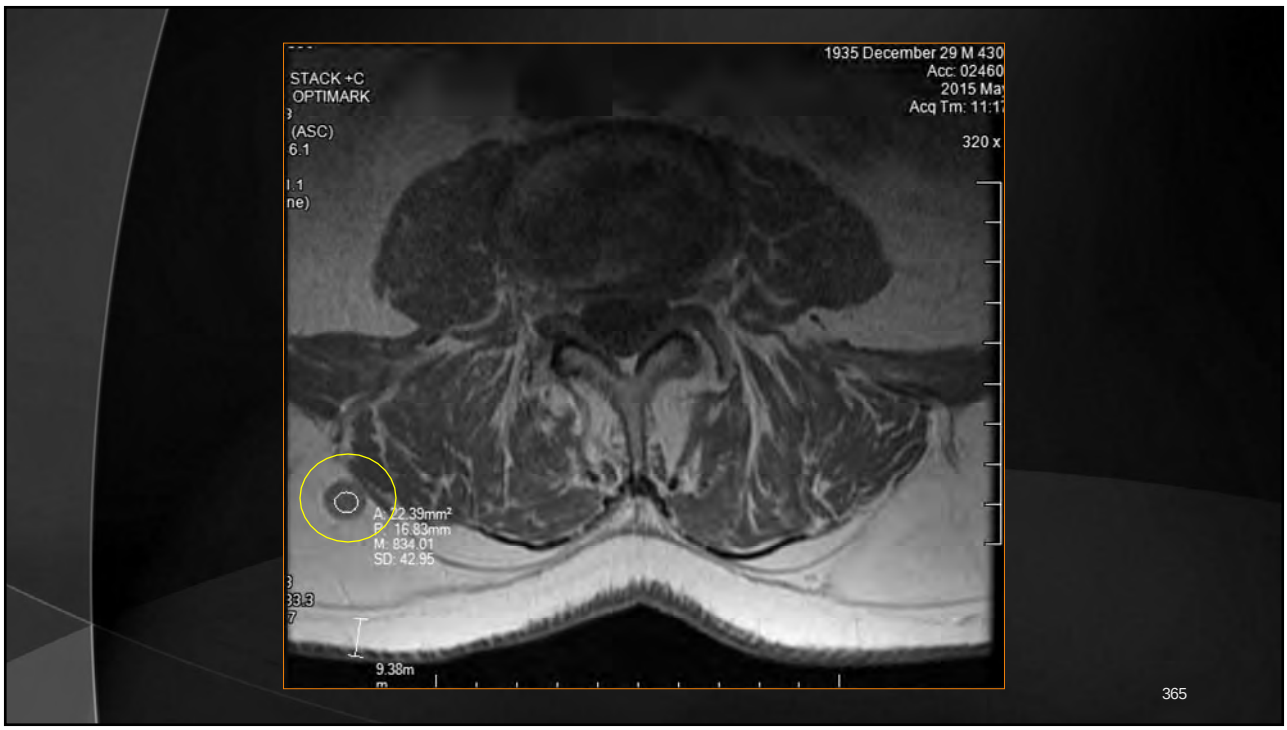
IR
364

364


STACK +C
OPTIMARK
(ASC)
6:1
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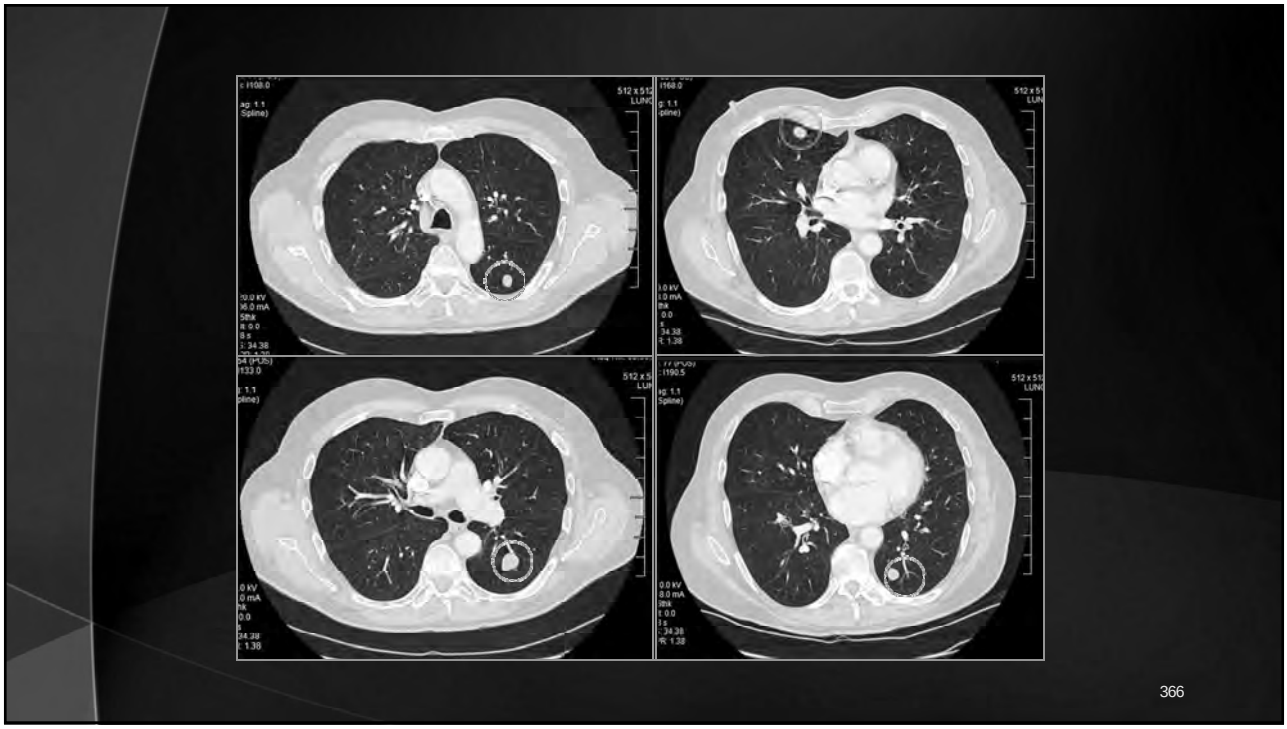
M: 834.01
SD: 42.95
9.38m
365

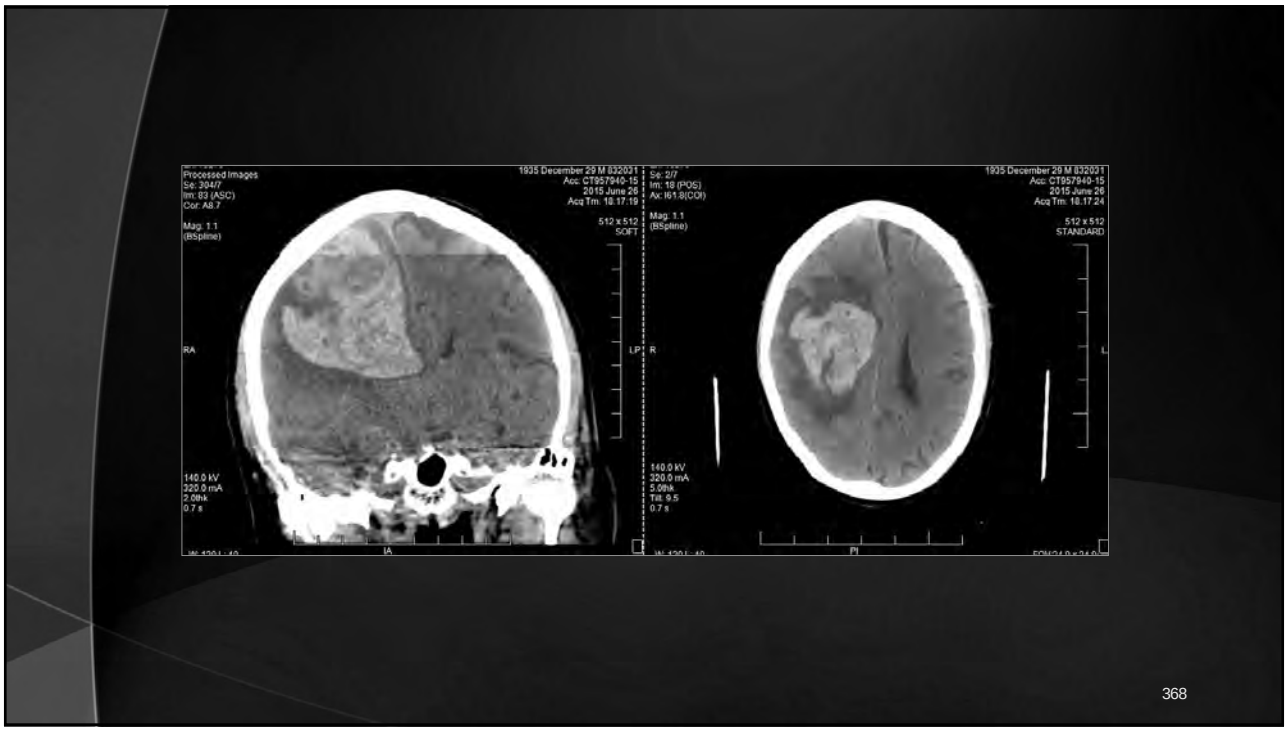
365


366

366


Mag: 1.1
(BSpline)
B31f
R
L
120.0 kV
366.0 mA
3.0thk
Tilt: 0.0
0.5 s
TS: 24.00
SPR: 1.00
P
367

367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2015 June 26
Acq Tm: 18.17.19
512 x 512
SOFT
Se: 2/7
Im: 18 (POS)
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Mag: 1.1
(BSpline)
1935 December 29 M 832031
Acc: CT957940-15
2015 June 26
Acq Tm: 18.17.24
512 x 512
STANDARD
RA
LP
R
140.0 kV
320.0 mA
2.0thk
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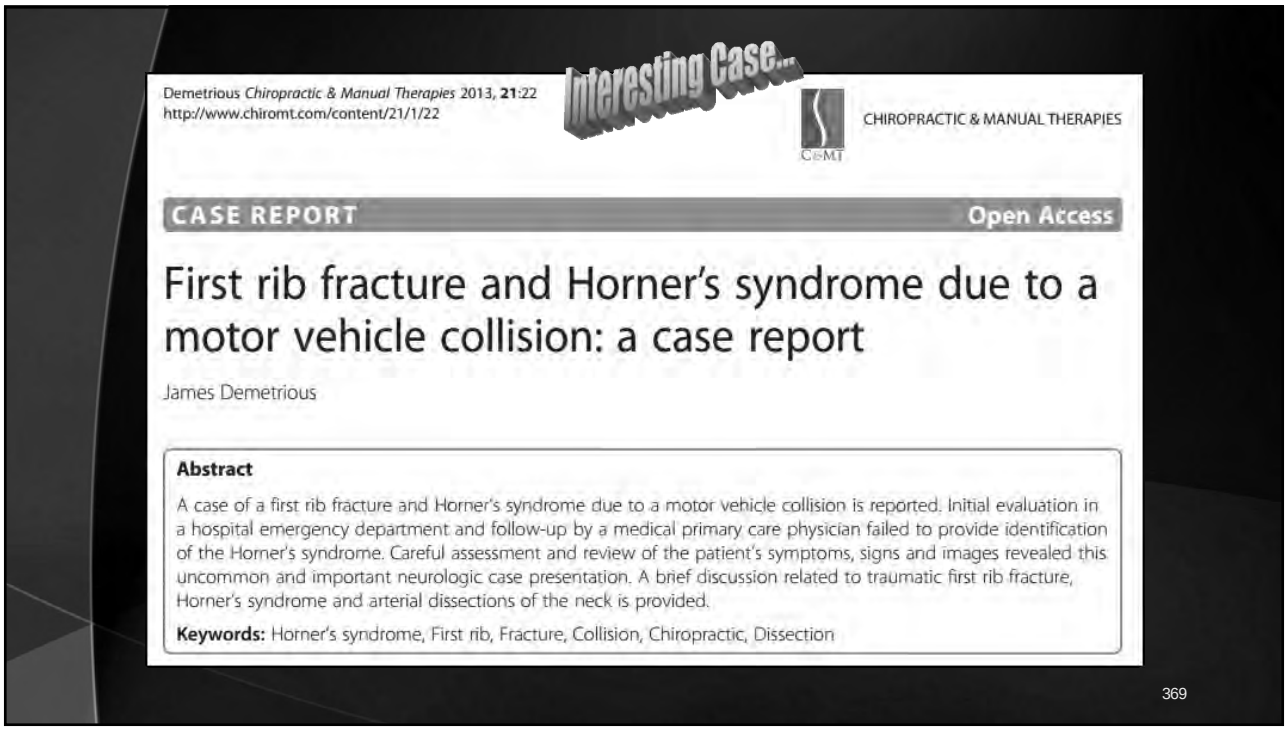
3.0thk
Tilt: 9.5
0.7 s
IA
PI
368

368



369

- A 73-year-old man presented to our chiropractic office eight-weeks following a vehicular accident.
- While driving, he suffered a head on collision with an oncoming vehicle.
- He was transported via ambulance to a local hospital where evaluation and extensive imaging was performed.
- The attending emergency medical physician diagnosed rib fractures and the patient was subsequently released from the hospital.
- He sought care with his medical primary care physician (PCP) and received a prescription for pain medication.
- No other recommendations were provided to the patient.

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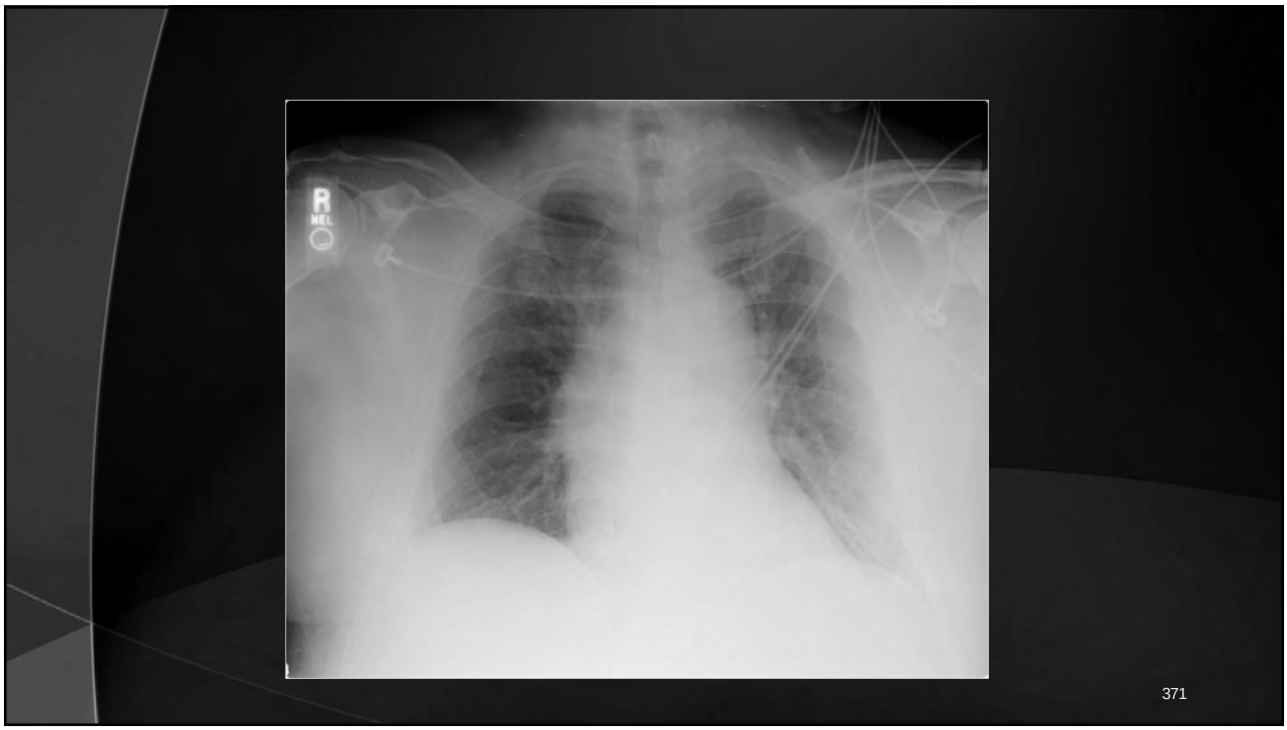

371

- The patient sought care in our chiropractic office eight-weeks following the vehicular collision.
- The patient's wife reported that while visiting the patient at the hospital immediately following the car accident, she noted asymmetry and partial drooping of his right eyelid.
- The patient and his wife indicated that previous attending physicians neither mentioned nor assessed this condition.
- His past history was negative for contributory medical, neurologic or ophthalmologic disorders.

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- The patient's vital signs were normal. He was alert and oriented. Initial visual inspection revealed miosis and partial ptosis of the right eye.
- His right eye was not responsive to direct or consensual light. Cardinal fields of gaze were normal.
- The patient denied alteration of facial sensation or hemi-facial anhidrosis of the affected side. No other abnormalities were noted on neurologic examination.
- Auscultation of the carotid and subclavian arteries revealed no bruits.

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- The lungs were clear to auscultation.
- Globally decreased cervical range of motion and localized tenderness was noted at C7/T1.
- Palpation revealed tenderness of the first rib at the apex of the right lung.
- The patient reported localized discomfort at C7/T1 upon cervical compression, Spurling's test and Valsalva maneuver.
- No radiating pain was elicited. No other abnormalities were identified during physical examination.

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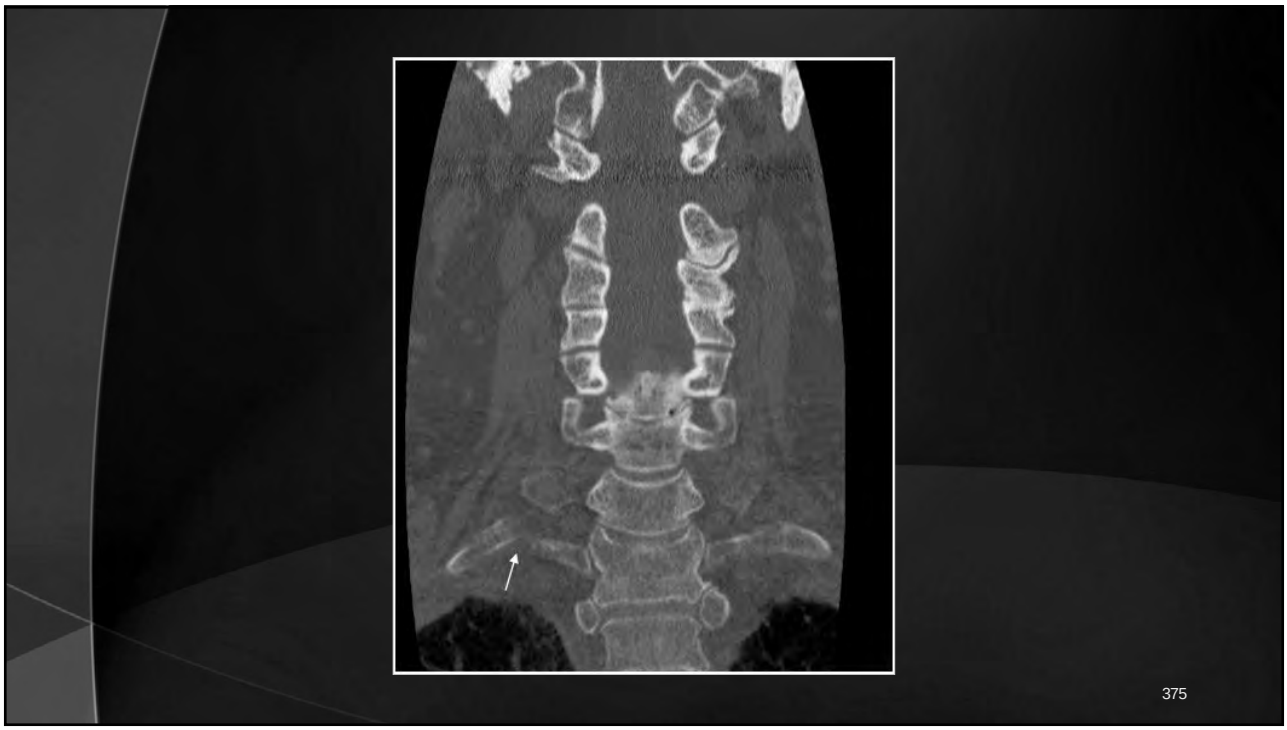
374



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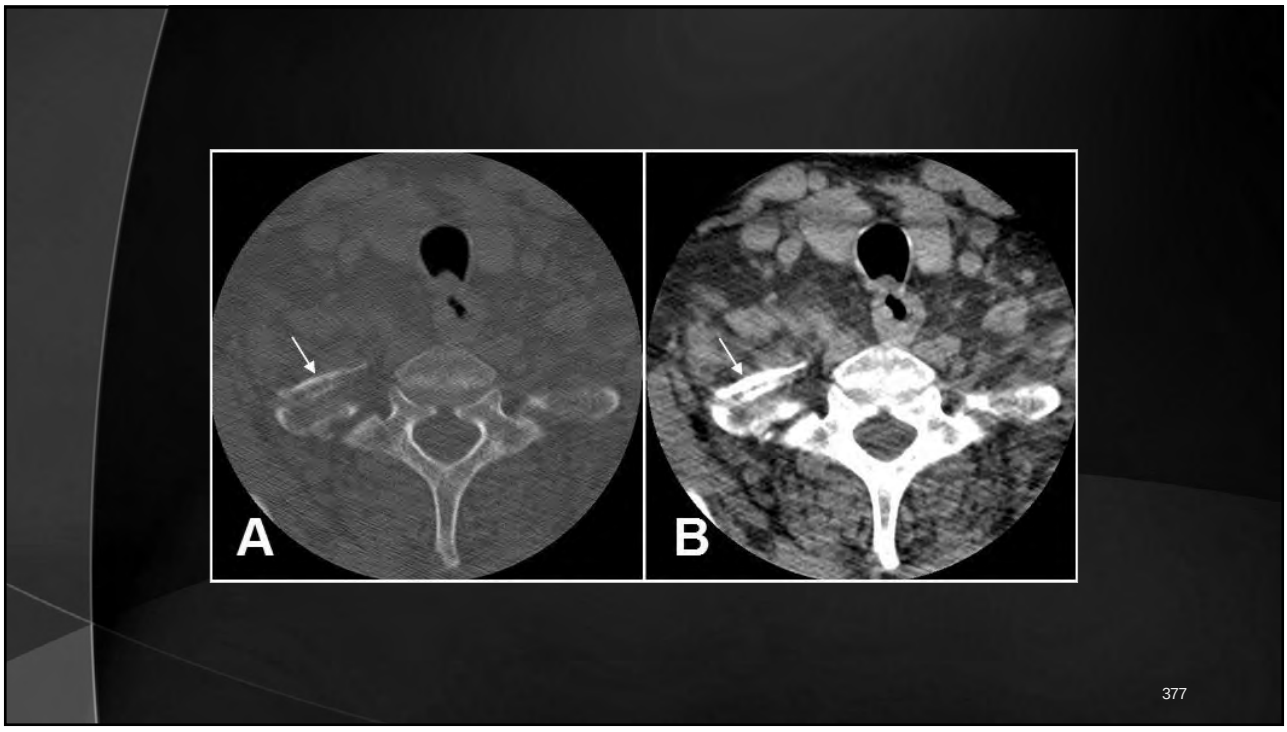
376



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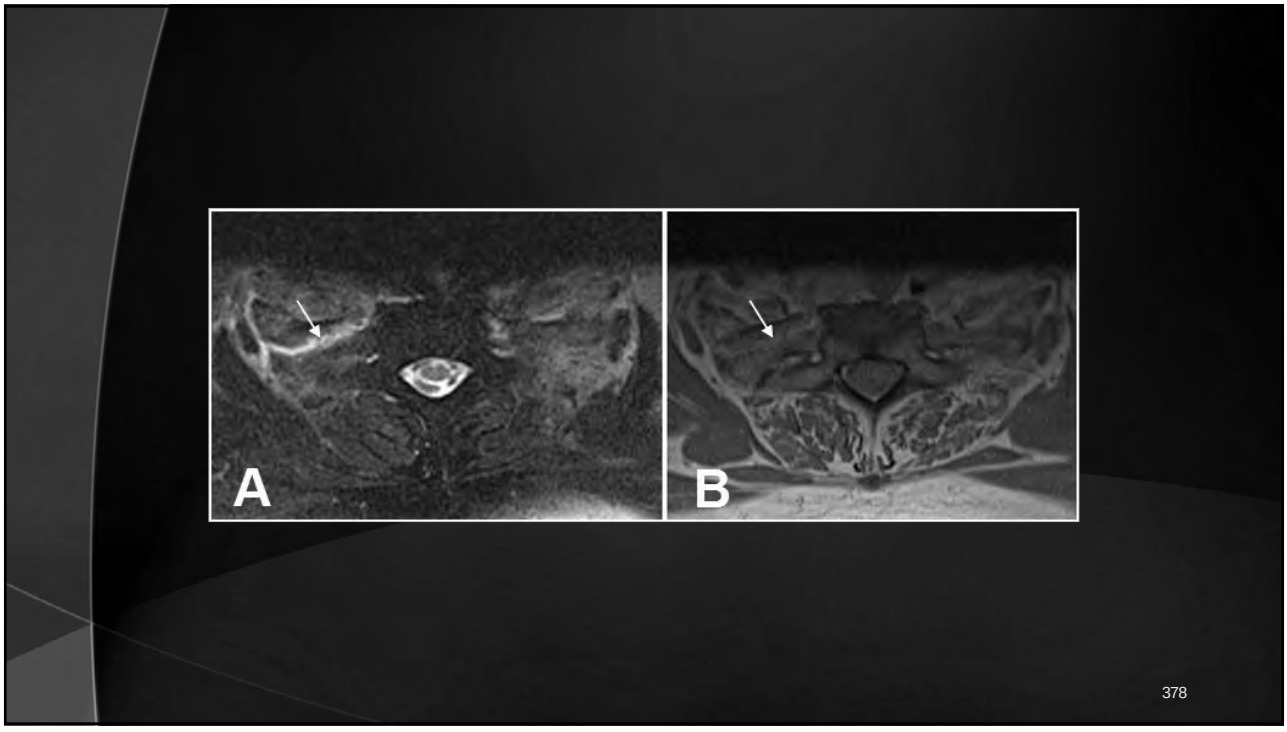

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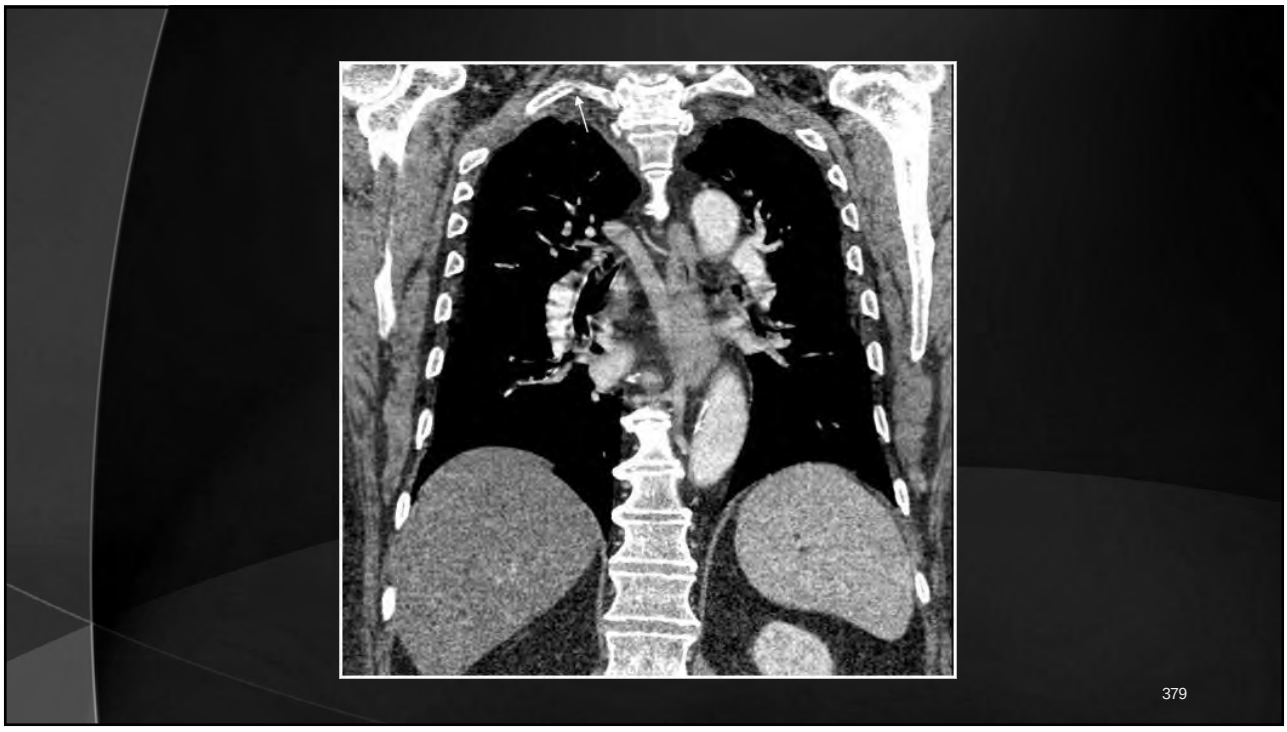
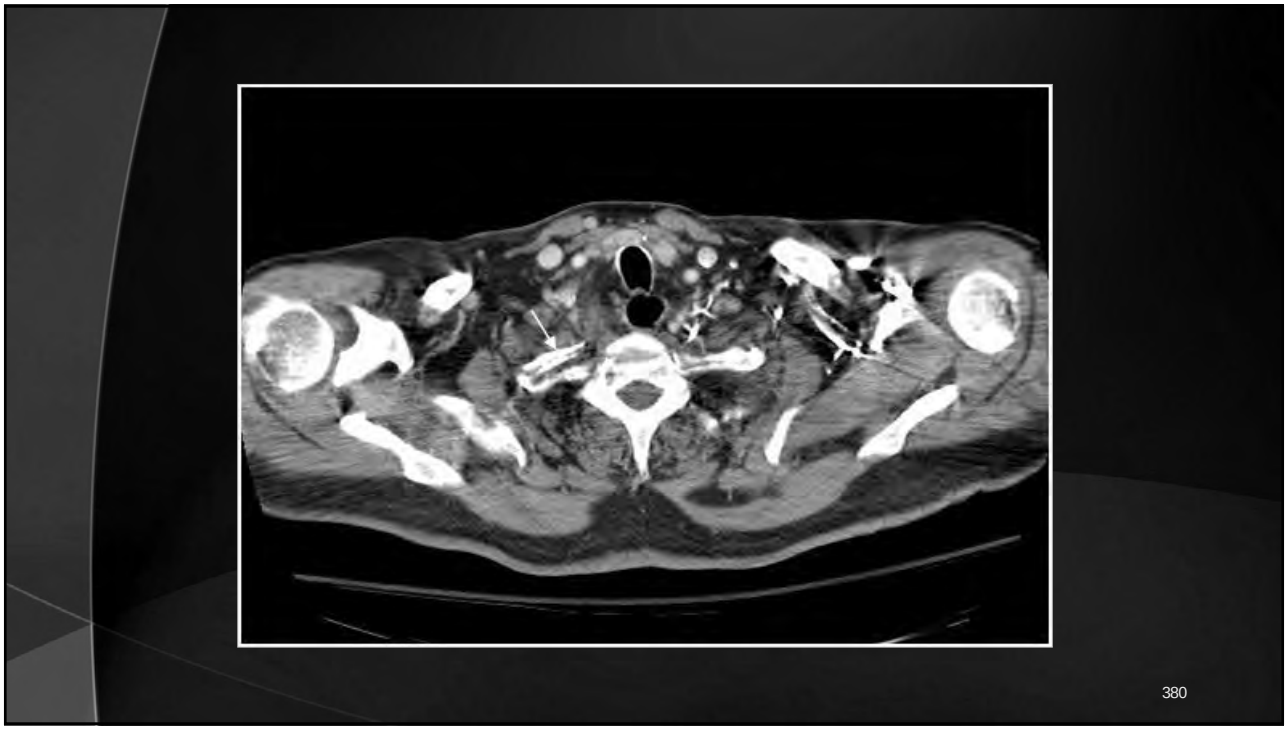
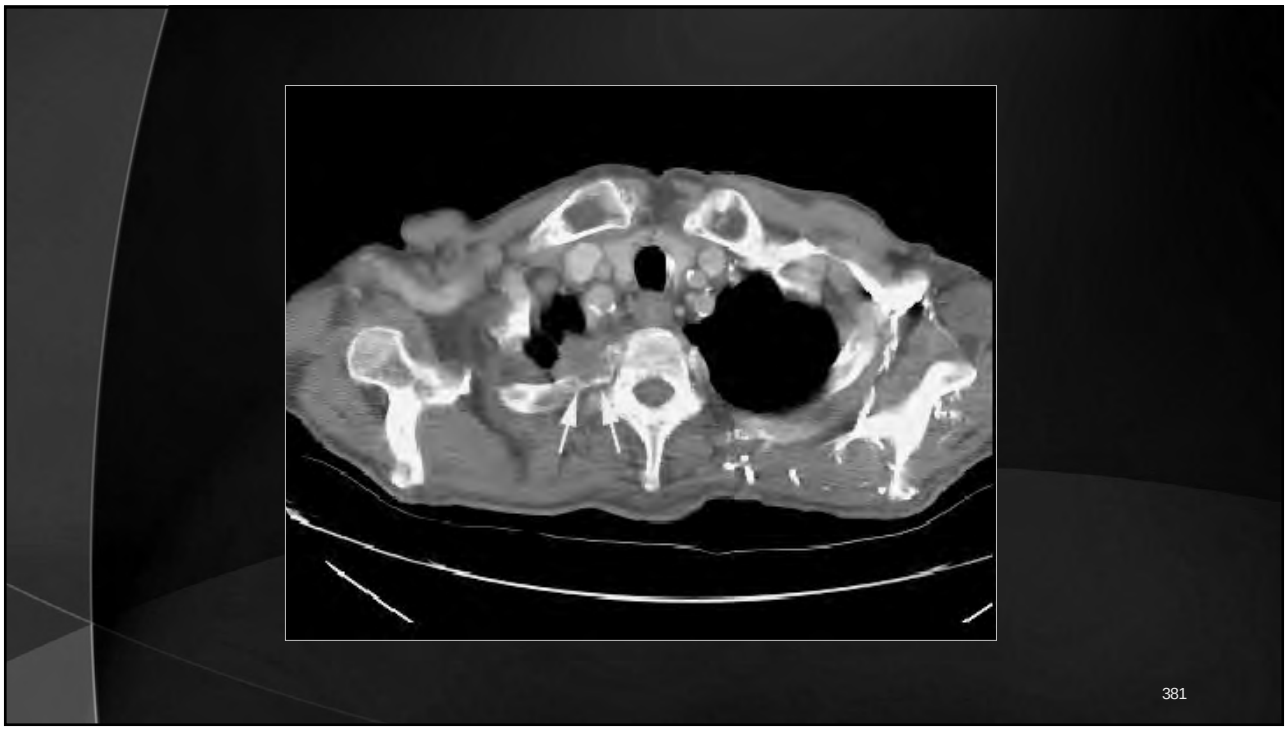


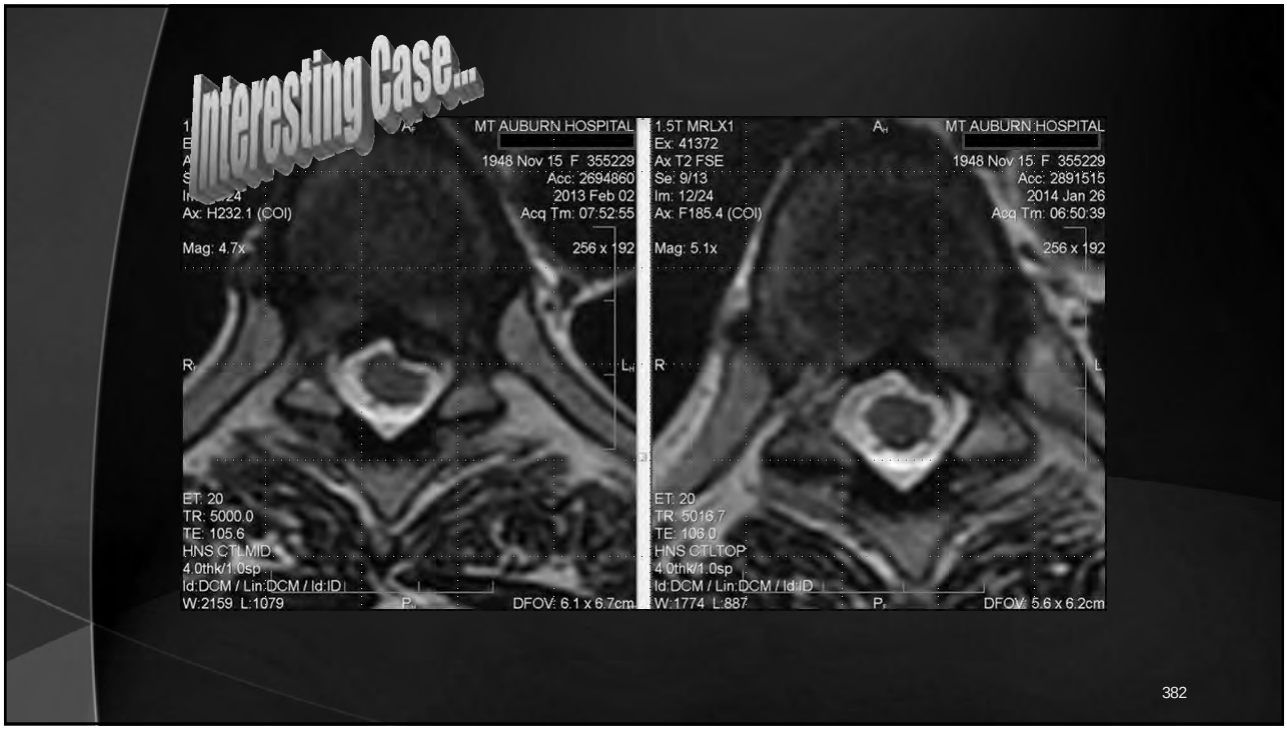
379



380


381

381


Interesting Case...
MT AUBURN HOSPITAL
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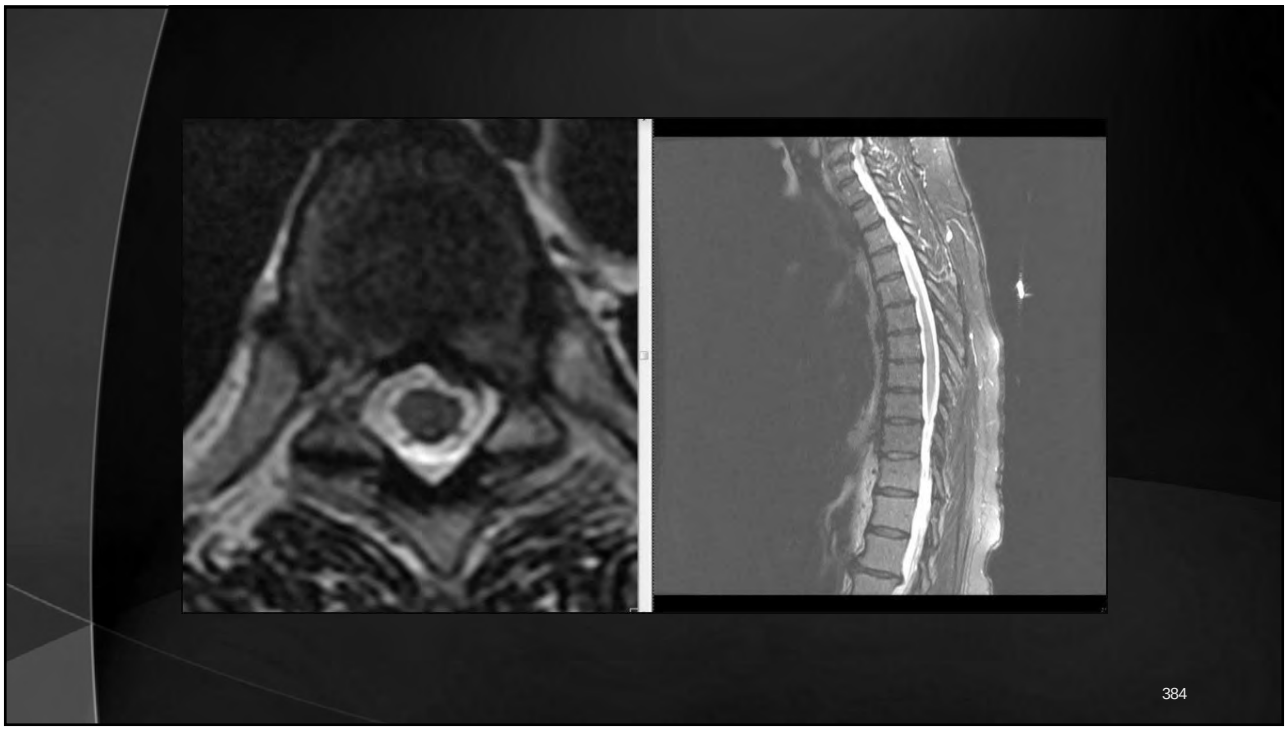
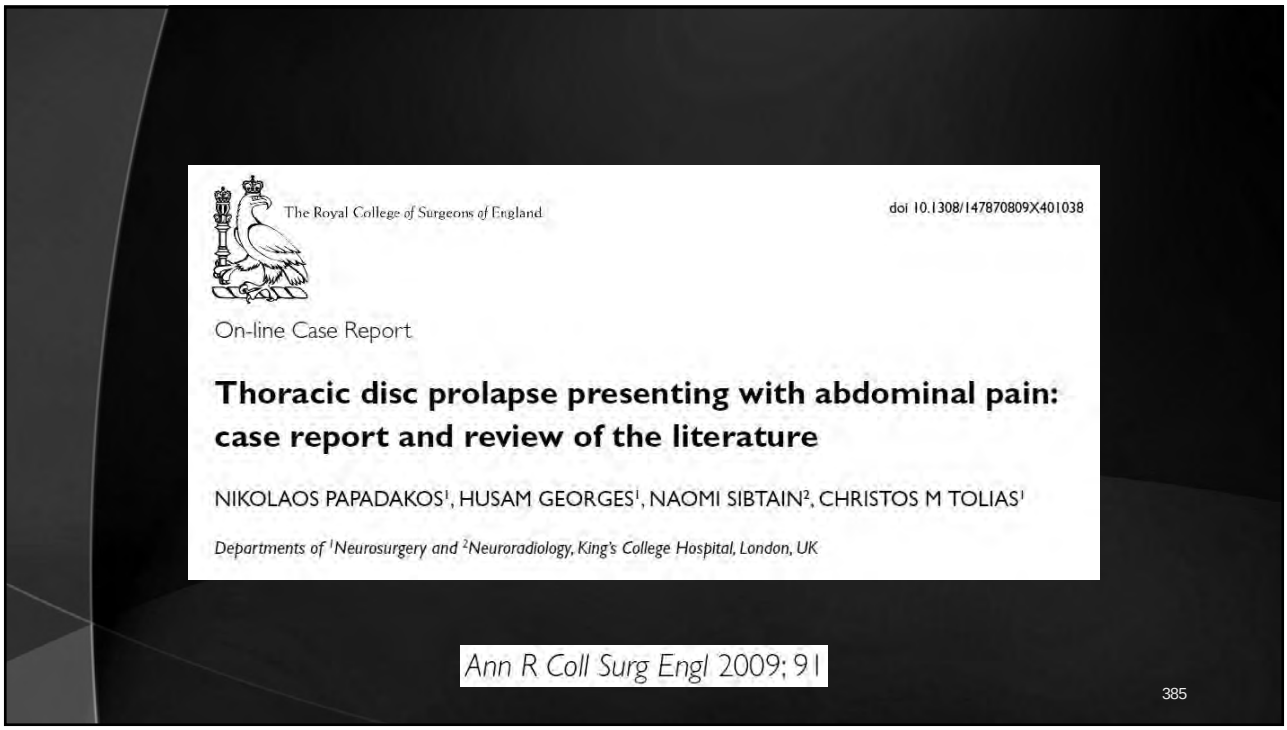
Acc: 2694860
2013 Feb 02
Acq Tm: 07:52:55
Ax: H232.1 (COI)
Mag: 4.7x
256 x 192
ET: 20
TR: 5000.0
TE: 105.6
HNS CTLMID
4.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:2159 L:1079
DFOV: 6.1 x 6.7cm
1.5T MRLX1
Ex: 41372
Ax T2 FSE
Se: 9/13
Im: 12/24
Ax: F185.4 (COI)
MT AUBURN HOSPITAL
1948 Nov 15 F 355229
Acc: 2891515
2014 Jan 26
Acq Tm: 06:50:39
Mag: 5.1x
256 x 192
ET: 20
TR: 5016.7
TE: 106.0
HNS CTLTOP
4.0thk/1.0sp
Id:DCM / Lin:DCM / Id:ID
W:1774 L:887
DFOV: 5.6 x 6.2cm
382

382

383



384



385

- The incidence of thoracic disc prolapse is reported to be between 0.15% and 4% of all intervertebral disc prolapses.1,2
- Due to the rarity of this condition, the presenting symptoms are often attributed to pulmonary, cardiac, gastrointestinal or genito-urinary causes.1
- This can lead to unnecessary investigations and procedures. Moreover, a missed diagnosis can potentially have a high morbidity.1

Ann R Coll Surg Engl 2009; 91

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386

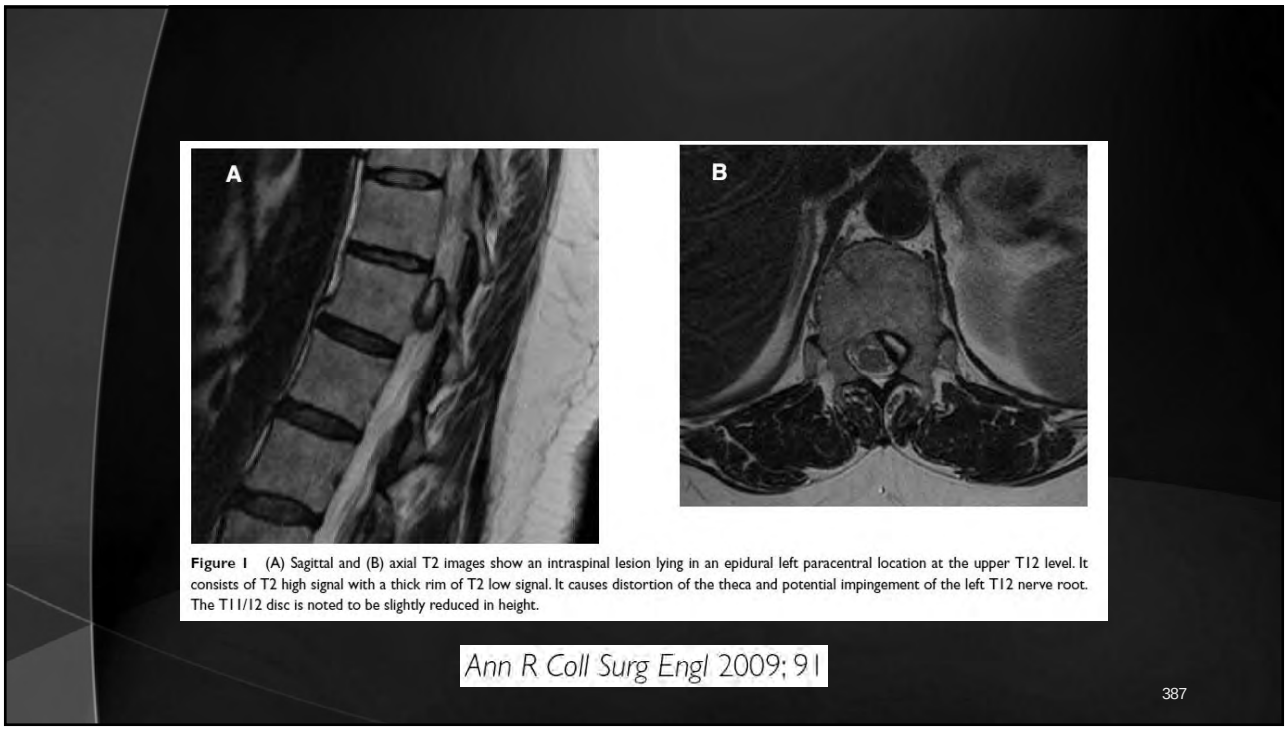

Figure 1 (A) Sagittal and (B) axial T2 images show an intraspinal lesion lying in an epidural left paracentral location at the upper T12 level. It consists of T2 high signal with a thick rim of T2 low signal. It causes distortion of the theca and potential impingement of the left T12 nerve root. The T11/12 disc is noted to be slightly reduced in height.

Ann R Coll Surg Engl 2009; 91

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387

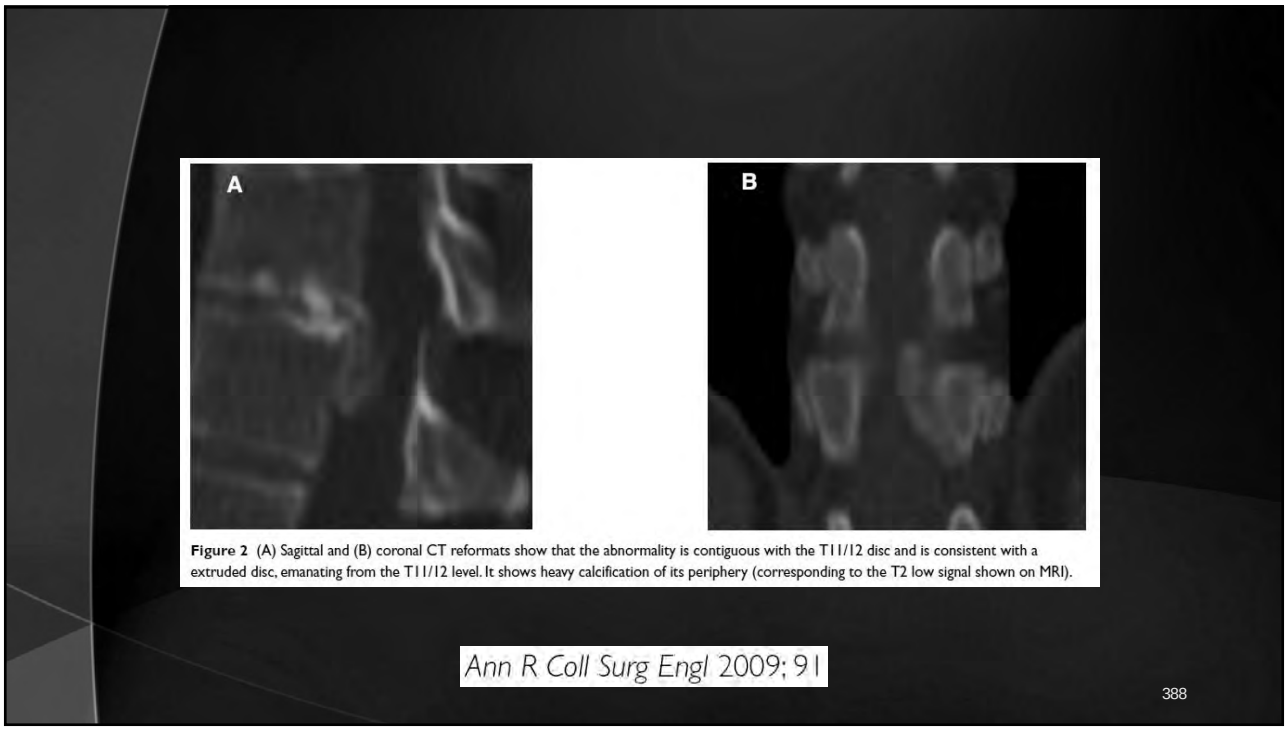

Figure 2 (A) Sagittal and (B) coronal CT reformats show that the abnormality is contiguous with the T11/12 disc and is consistent with a extruded disc, emanating from the T11/12 level. It shows heavy calcification of its periphery (corresponding to the T2 low signal shown on MRI).

Ann R Coll Surg Engl 2009; 91

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- Symptomatic thoracic disc prolapse is a rare pathology, reported to occur in 1 per million per year,2,3 accounting for 0.15–4% of all symptomatic disc prolapses.1,2
- Wood *et al.4 reported* 37% of the subjects in their study to have asymptomatic thoracic disc prolapse evident on MRI.
- Up to 75% of thoracic disc prolapses occur below T8, with T11/12 being the commonest level.1–3
- Disc calcification is common and is reported to occur in up to 65% of case.2

Ann R Coll Surg Engl 2009; 91

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- Pain is the commonest symptom associated with thoracic disc prolapse.1,2
- Typical thoracic spinal pain can be unilateral, bilateral or radicular.1,2
- Its nature can be variable – sharp, cutting, shooting, constant or intermittent.1,2
- Pain can also present as non-spinal pain including abdominal pain, testicular or groin pain, upper limb and cardiac pain.1,5–9

Ann R Coll Surg Engl 2009; 91

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- Abnormal neurological symptoms are the second most common presentation.1–3
- These include, sensory (paraesthesia, dysaesthesia and numbness), motor and bladder or bowel disturbance.1–3

Ann R Coll Surg Engl 2009; 91

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- 40-year-old female-Triathlete
- Thoracic/lumbar pain-with radiation to anterior lower ribs
- Onset-13 years previously related to training. Negative trauma or illnesses.
- Symptoms wax and wane depending upon activity.
- Negative relief elsewhere. Sought medical, PT, acupuncture, chiropractic care locally with the consultations at Duke University, and Mayo Clinic without relief. Diagnoses provided thus far:
  - Ankylosing spondylitis
  - Inflammatory bowel disease related spondyloarthropathy
  - Parasitic infection
  - Chiropractic subluxation

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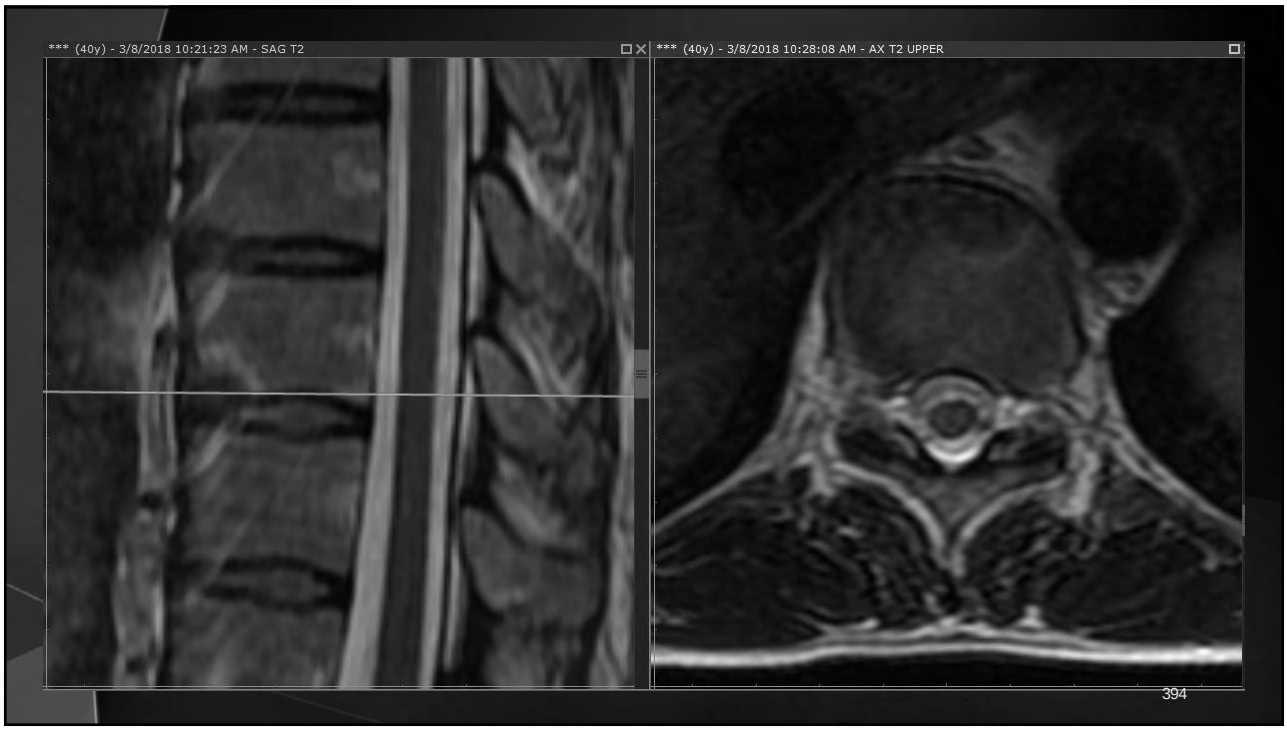
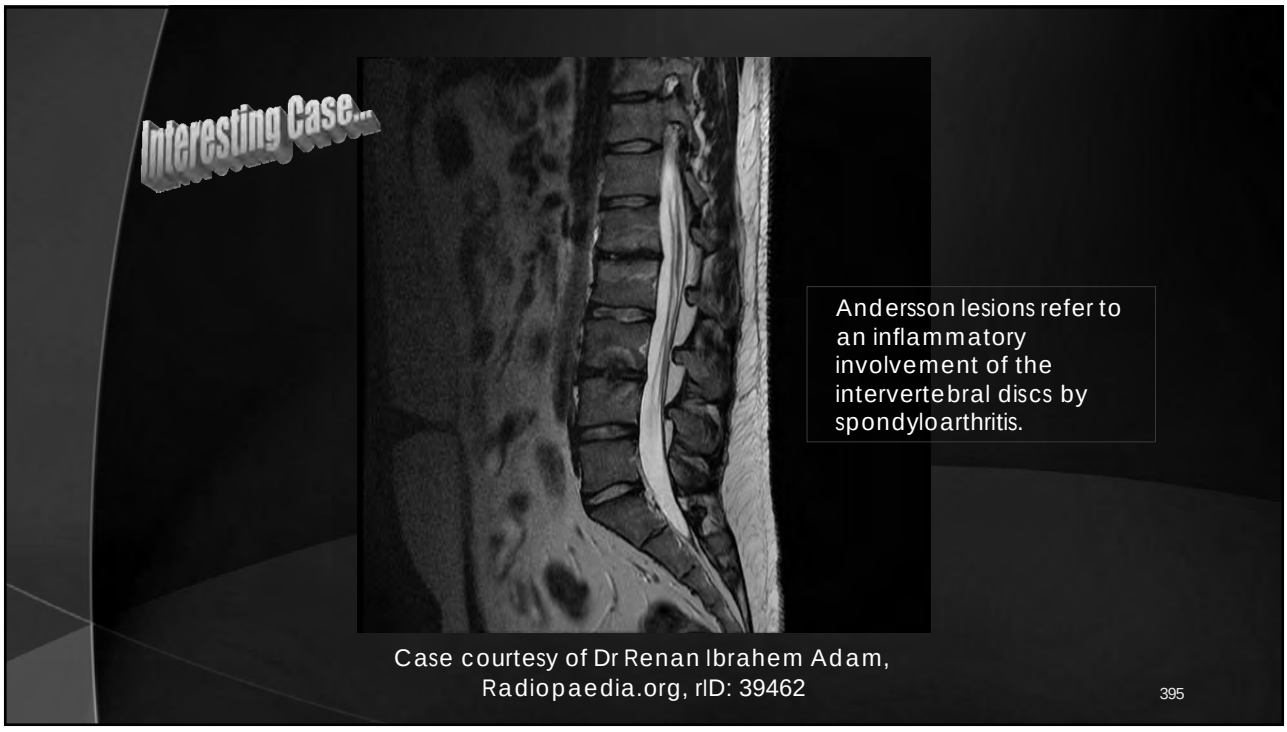
*** (40y) - 3/8/2018 10:21:23 AM - SAG T2
*** (40y) - 3/8/2018 10:24:39 AM - SAG T1
393

393


*** (40y) - 3/8/2018 10:21:23 AM - SAG T2
*** (40y) - 3/8/2018 10:28:08 AM - AX T2 UPPER
394

394


Interesting Case...
Andersson lesions refer to an inflammatory involvement of the intervertebral discs by spondyloarthritis.
Case courtesy of Dr Renan Ibrahem Adam, Radiopaedia.org, rID: 39462
395

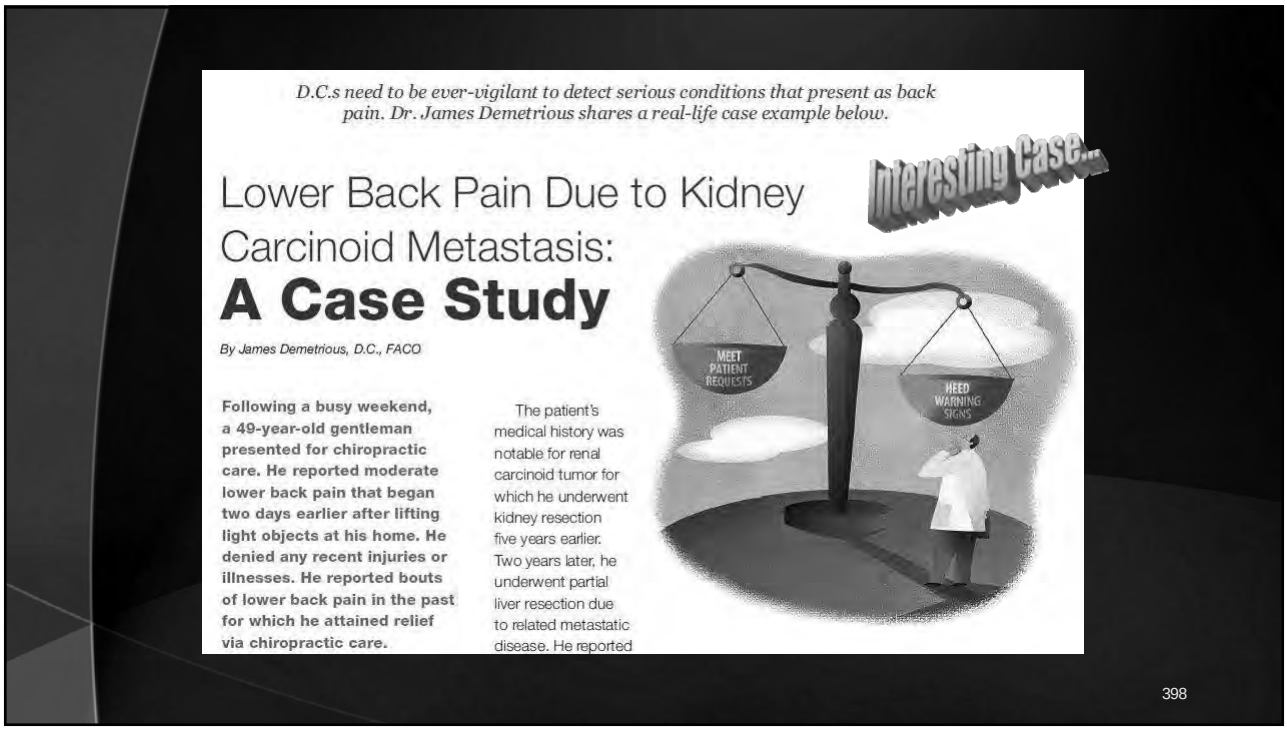
395


Interesting Case...
396

396


Interesting Case...
R
R
66.37 mm
397

397


D.C.s need to be ever-vigilant to detect serious conditions that present as back pain. Dr. James Demetrious shares a real-life case example below.
Interesting Case...
Lower Back Pain Due to Kidney Carcinoid Metastasis:
A Case Study
By James Demetrious, D.C., FACO
Following a busy weekend, a 49-year-old gentleman presented for chiropractic care. He reported moderate lower back pain that began two days earlier after lifting light objects at his home. He denied any recent injuries or illnesses. He reported bouts of lower back pain in the past for which he attained relief via chiropractic care.
The patient's medical history was notable for renal carcinoid tumor for which he underwent kidney resection five years earlier. Two years later, he underwent partial liver resection due to related metastatic disease. He reported
MEET PATIENT REQUESTS
HEED WARNING SIGNS
398

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Lower Back Pain Due to Kidney Carcinoid Metastasis: A Case Study

James Demetrious, DC, FACO

Following a busy weekend, a pleasant 49-year-old gentleman presented to a chiropractor with complaints of lower back pain. He indicated that the pain began two days earlier while preparing for a party at his home. Discomfort was localized to the lower back without radiation into the extremities. No other symptoms were reported. He indicated that the pain worsened while sitting and driving. Nothing seemed to give him relief. He reported relief via chiropractic care in the past and sought relief for this exacerbation.

The patient's medical history was non-contributory with the notable exception of renal carcinoid with metastasis. The patient underwent kidney resection nine years earlier and partial liver resection four years earlier. He reported that subsequent yearly examinations revealed, "spots on the spine," that were assessed annually by his oncologist. He did not provide reports or images for the chiropractor to review.

Physical examination was performed. The patient's vital signs were negative. Restricted and painful lumbar ranges of motion were noted. Palpation revealed spinous process tenderness localized to the L2/3 vertebrae with increased tonicity of the paraspinal musculature at that level. Positive orthopedic tests including Kemp's and Valsalva maneuver reproduced localized back pain. The patient exhibited a positive Minor's sign. Neurologic examination was negative. Chiropractic evaluation revealed poor intersegmental mobility affecting L2/3. The remainder of the examination revealed no other apparent abnormalities.

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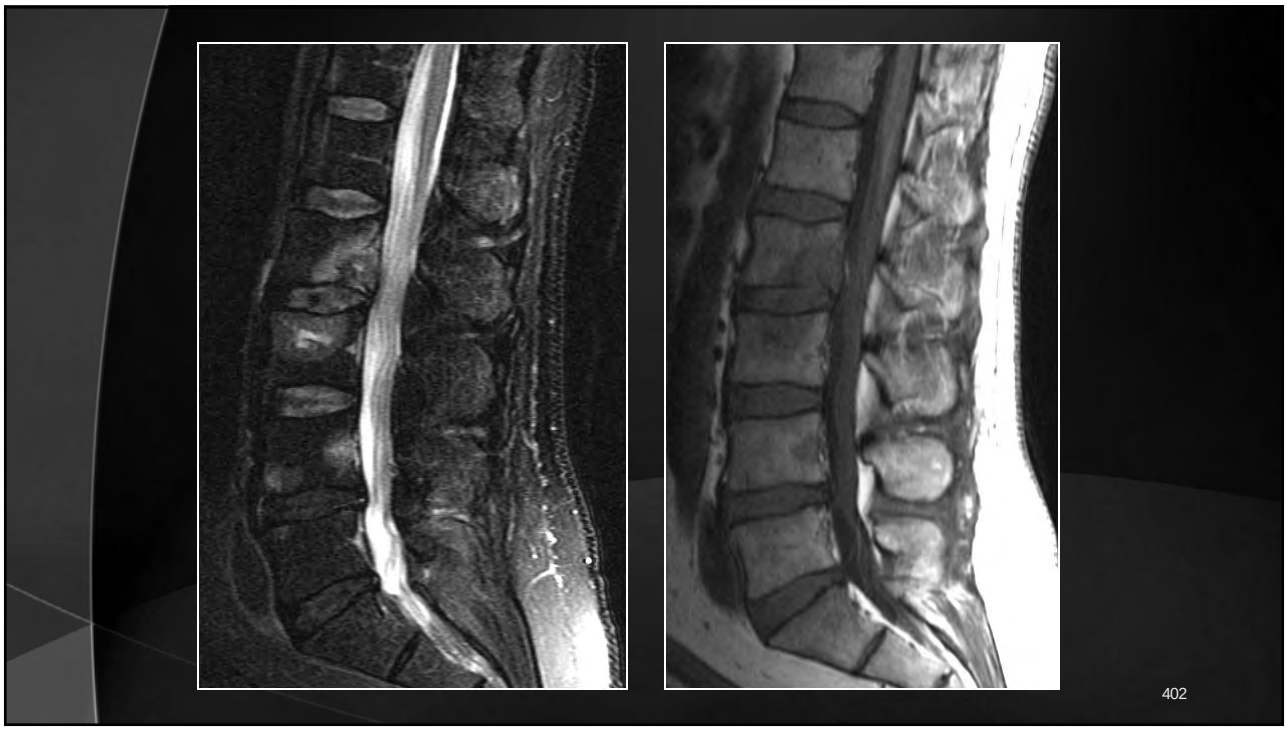

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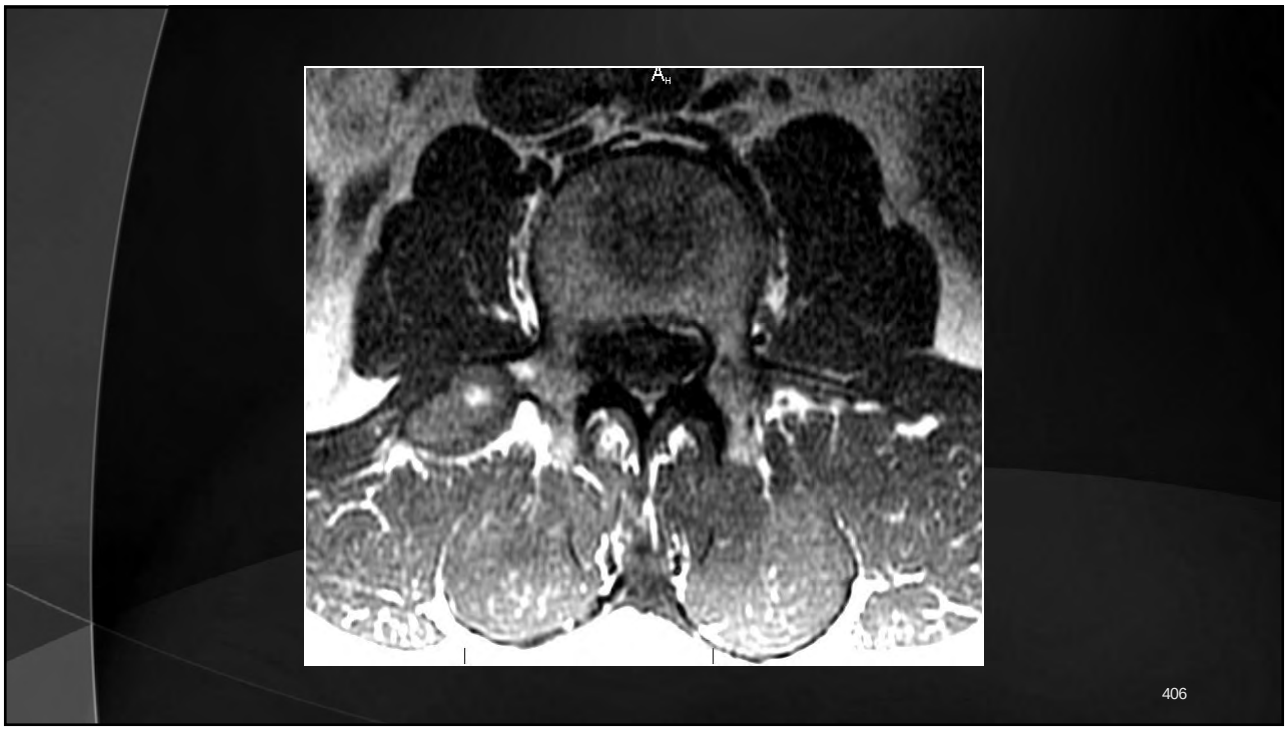

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What Can We Learn?

- **Take proper history and identify contraindications to chiropractic care.** Proper and thorough evaluation of patients' past history is vitally important. Patients with a prior history of cancer need to be identified and carefully assessed.
- **Resist the urge to provide chiropractic care for patients who may have a contraindication to care.** While the patient in this case appeared to have an uncomplicated mechanical lower back pain, review of his past history revealed a possible contraindication to chiropractic care. The urge and desire to negate the recurrence of cancer should not supersede clinical need.
- **Do not accept the waivers of liability from patients.** Despite the patient's willingness to provide a waiver of liability to the chiropractor, ultimately, clinical assessment and decision-making should supersede such requests.
- **Consider complicated diagnostic issues and integrative discussion with attending physicians.** Intrinsic issues related to specific patients must be identified and managed. In this case, the patient's had one kidney due to a prior surgery. Due to inherent susceptibility of complications related to gadolinium contrast, careful assessment and medical integration should be considered when ordering advanced diagnostic testing.
- **Seek continuing education to stay apprised of complicated courses of action.** NCMIC provides expert continuing education on behalf of the chiropractic profession.
- **Follow up.** Make proper recommendations and referrals. Follow-up with telephone calls and written letters to assure that the patient understands their condition and your referral recommendations.

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Interesting Case...
1.5T 1.5
Ex: 23430
SAG T1
Se: 4/7
Im: 9 (ASC)
Sag: L 0.85
Mag: 1
(BSpline)
Delaney at MCD
Station: tx-mr2
Technologist CB
1937 July 27 F
307568
Acc: 02885740
2017 November 16
Acq Tm: 11:39:12
384 x 192
ETL: 3
TR: 466.7
TE: 17.5
4.0thk
W: 1983 L: 991
FOV:27.9 x 27.9cm
1.5T 1.5
Ex: 23430
SAG T2 FS
Se: 3/7
Im: 9 (ASC)
Sag: L 0.85
Mag: 1
(BSpline)
Delaney at MCD
Station: tx-mr2
Technologist CB
1937 July 27 F
307568
Acc: 02885740
2017 November 16
Acq Tm: 11:34:20
416 x 192
ETL: 17
TR: 4,033.3
TE: 107.8
4.0thk
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FOV:27.9 x 27.9cm
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Interesting Case...
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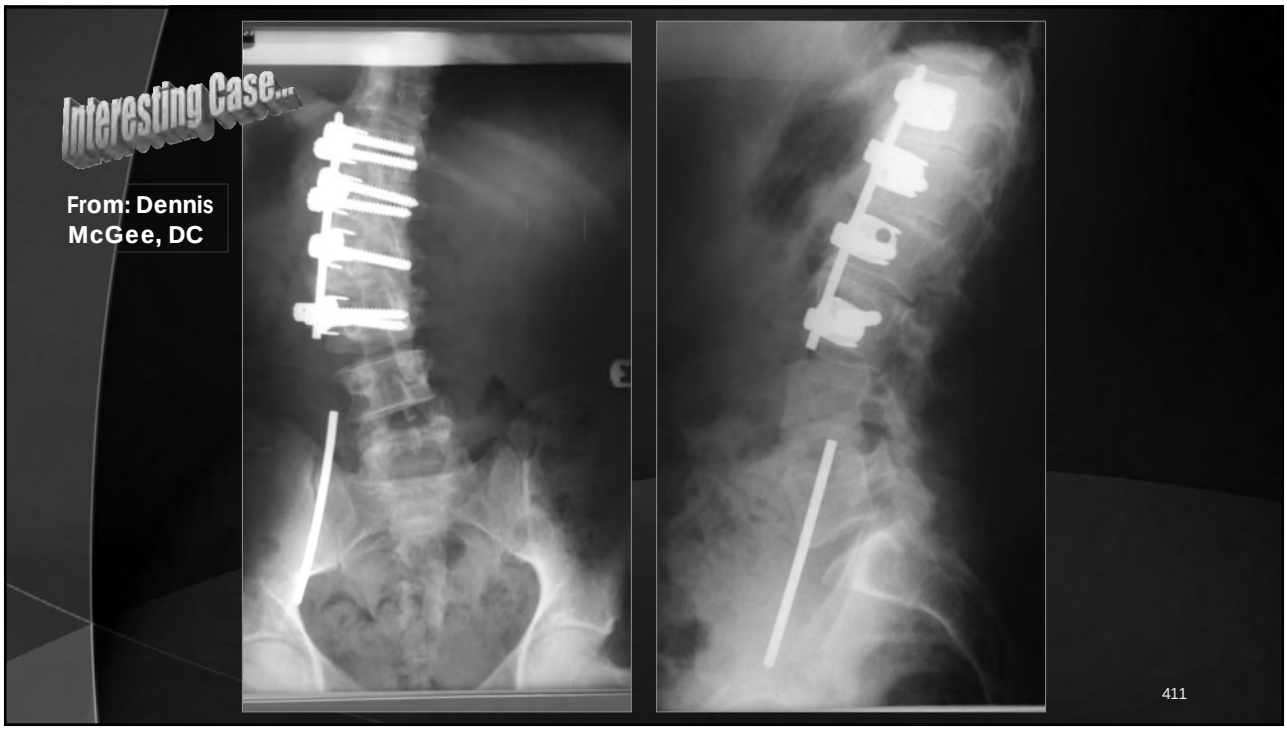
Interesting Case...
From: Dennis McGee, DC
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Interesting Case...
FLEXION
UPRIGHT
EXTENSION
UPRIGHT

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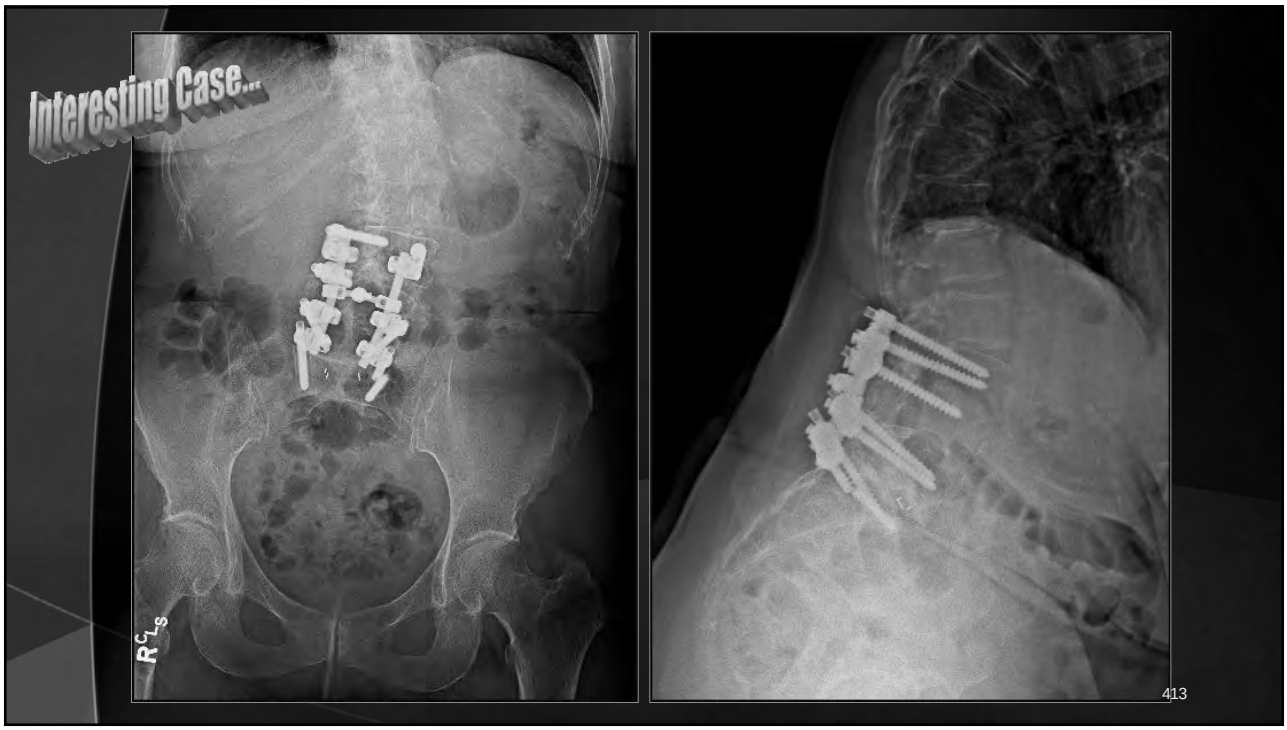
Interesting Case...
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Somaris/5 3D
Ex: CLSPS
STACK BONE<MPR Thick Range>
Se: 608/10
Im: 17/54
Ax: I249.4 (COI)
CAPE FEAR HOSPITAL
Acc: F14908-05
2005 Nov 22
Acq Tm: 07:46:34.767970
Spin: -8
Tilt: -99
512 x 512
B70s
120.0 kV
0.0 mA
3.0 mm/0.0:1
Tilt: 0.0
0.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1250 L:250
DFOV: 11.8 x 11.8cm
Somaris/5 3D
Ex: CLSPS
CORONAL BONE<MPR Thick Range>
Se: 612/10
Im: 9/84
Cor: A143.5 (COI)
CAPE FEAR HOSPITAL
Acc: F14908-05
2005 Nov 22
Acq Tm: 07:46:34.767970
Spin: -0
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512 x 512
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Interesting Case...
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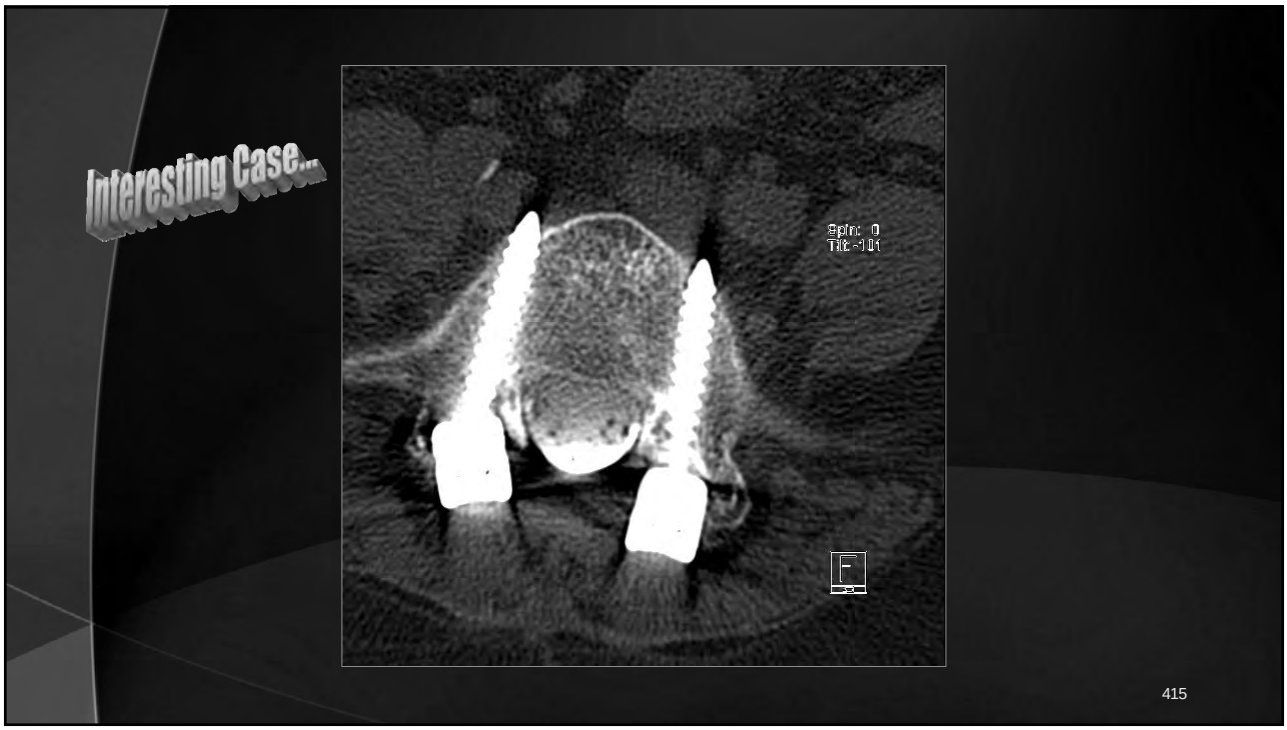
Interesting Case...
Spin: 0
Tilt: -1.01
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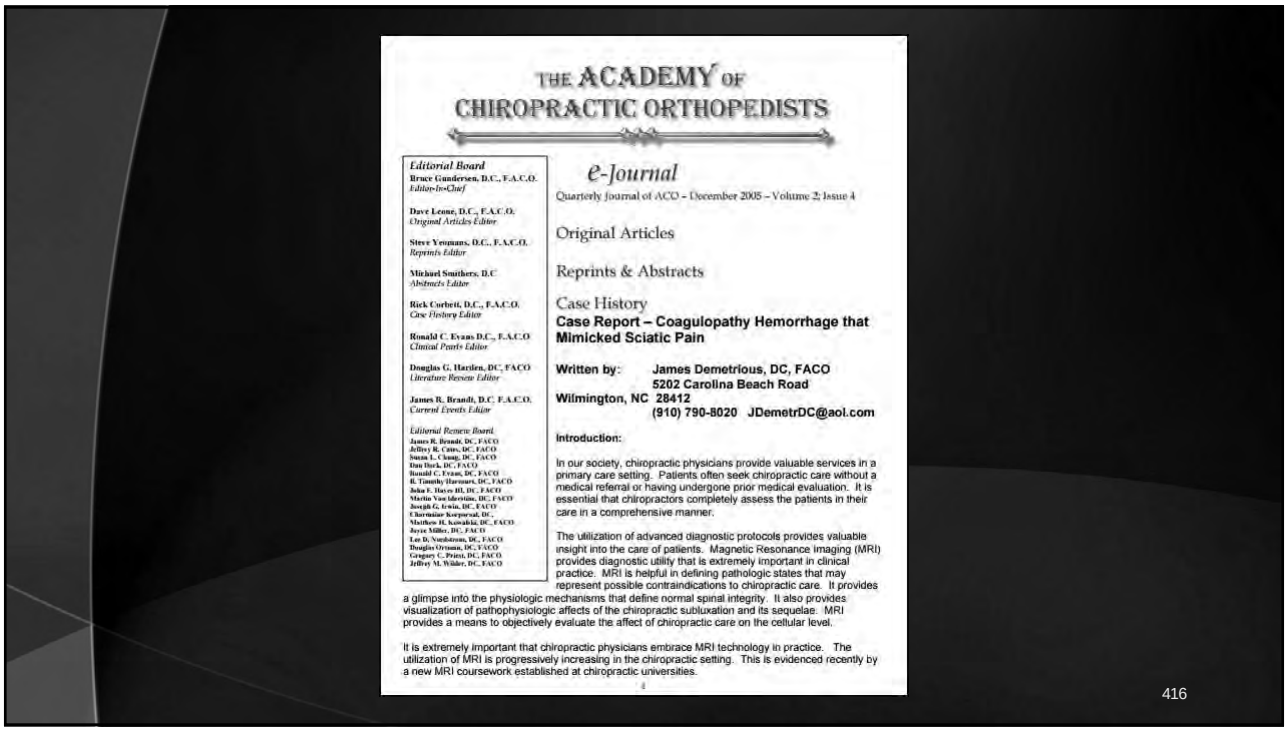
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Written by: James Demetrious, DC, FACO
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Wilmington, NC 28412
(910) 790-8020 JDemetrDC@aol.com
Introduction:
In our society, chiropractic physicians provide valuable services in a primary care setting. Patients often seek chiropractic care without a medical referral or having undergone prior medical evaluation. It is essential that chiropractors completely assess the patients in their care in a comprehensive manner.
The utilization of advanced diagnostic protocols provides valuable insight into the care of patients. Magnetic Resonance Imaging (MRI) provides diagnostic utility that is extremely important in clinical practice. MRI is helpful in defining pathologic states that may represent possible contraindications to chiropractic care. It provides a glimpse into the physiologic mechanisms that define normal spinal integrity. It also provides visualization of pathophysiologic affects of the chiropractic subluxation and its sequelae. MRI provides a means to objectively evaluate the affect of chiropractic care on the cellular level.
It is extremely important that chiropractic physicians embrace MRI technology in practice. The utilization of MRI is progressively increasing in the chiropractic setting. This is evidenced recently by a new MRI coursework established at chiropractic universities.
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Spine and Trunk

- **T or F** Thoracic spine disc herniations are often attributed to pulmonary, cardiac, gastrointestinal or genitourinary causes.
- **T or F** Gadolinium MRI contrast has been associated with kidney toxicity requiring careful assessment of renal compromised patients.

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Upper Extremities

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- At present, injuries to these tissues are treated by surgical repair and/or conservative approaches, including biophysical modalities such as physical rehabilitation and cryotherapy.
- Unfortunately, the healing tissue forms fibrovascular scar and possesses inferior mechanical and biochemical properties as compared to native tendon and ligament.

Birth Defects Res C Embryo Today. 2013 September ; 99(3): 203–222.

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Rotator Cuff Tendon

- Novel surgical techniques improve repair strength at time 0, but fail to provide superior clinical scores when compared against older approaches (Dines et al., 2010; Lorbach and Tompkins, 2012).
- Likewise, rehabilitation protocols implementing early mobilization have been developed with the hope of improving the rate of healing while minimizing long-term stiffness.
- Unfortunately, such approaches show little benefit over more conservative protocols (Kim et al., 2012; Parsons et al., 2010).

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Rotator Cuff Tendon

- Despite advances in surgical techniques and in the understanding of shoulder pathology, **chronic tears fail to heal in 20-95%** of cases (Derwin et al., 2010; Galatz et al., 2004).
- In particular, the bone-tendon interface that forms following surgical repair fails to recapitulate the native enthesis, with a fibrovascular scar forming in place of the complex fibrocartilage transition seen between native tendon and bone (Newsham-West et al., 2007).
- The intra-articular environment may partly explain this poor outcome (Bedi et al., 2009), as the synovial fluid, which contains the anti-adhesive protein lubricin, has been shown to inhibit bone-tendon healing (Funakoshi et al., 2010; Sun et al., 2012).

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- Tendinopathy and partial tears of the rotator cuff tendons are often treated conservatively with physical therapy and corticosteroid injections.
- A randomized, controlled study in which patients with full-thickness rotator cuff tears received subacromial injections of triamcinolone reported improved pain relief for at least 3 months, as compared to controls (Gialanella and Prometti, 2011).
- However, a recent systematic review concluded that there was little reproducible evidence to support the efficacy of subacromial corticosteroid injections in managing rotator cuff disease (Koester et al., 2007).

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Achilles Tendon

- The Achilles tendon is the largest and strongest tendon in the body, but one of the most likely to be injured (Calleja and Connell, 2010).
- Whereas rotator cuff tears are increasingly prevalent with age, Achilles ruptures are most commonly seen in men aged 30-50 (Longo et al., 2009).
- Achilles tendinopathy is increasingly common due to increasing participation in recreational sports, with Achilles pathology accounting for 30-50% of all sports-related injuries (Sadoghi et al., 2013).

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- Nevertheless, Achilles tendon ruptures are also seen in elite athletes and, despite the research interest this garners, this injury is notorious for its poor quality and slow rate of healing (Maffulli et al., 2011).
- Just as full-thickness rotator cuff tears are almost always preceded by partial tears and tendon degeneration (Oh et al., 2011), noninflammatory tendinosis and chronic tendinopathy predispose the Achilles tendon to complete rupture (Hess, 2010).
- **It is worth noting that conservative approaches – including reduced activity, cryotherapy, eccentric loading, deep friction massage, orthotics, and therapeutic ultrasound – produce good to excellent outcomes in up to 75% of cases**.

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- In recalcitrant Achilles tendinopathy, surgical excision of adhesion, removal of degenerative nodules, and tenotomies intended to promote angiogenesis, can be performed (Maffulli et al., 2004).
- Likewise, complete Achilles ruptures can be treated both conservatively and surgically with satisfactory results.
- However, a recent Cochrane Review found that open surgical repair significantly reduced the re-rupture rate (4.4%) compared with nonoperative treatment (10.6%) (Jones et al., 2012).
- A percutaneous surgical approach did not reduce the re-rupture rate compared with open repair, but did result in significantly fewer postoperative infections.

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Flexor Tendons

- Tendons of the flexor pollicis longus, flexor digitorum profundus, and flexor digitorum superficialis muscles attach to the distal and middle phalanges of the hand, allowing flexion at the distal and proximal interphalangeal joints, respectively.
- Portions of the flexor tendons are enveloped in synovial sheaths, which condense at certain locations to create an arrangement of pulleys that act as fulcrums for the tendon (Griffin et al., 2012).
- Located immediately beneath the palmar skin and fascia, the flexor tendons are prone to laceration and crush injuries.

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- Rupture of intrasynovial flexor tendons presents unique repair challenges for three reasons:
  - (1) ruptures do not heal without surgical intervention,
  - (2) careful postoperative management of healing tendons is necessary to prevent adhesions and improve gliding function between the tendon and sheath, but mobilization increases the risk of re-rupture,
  - (3) hypertrophy of healing tendon must be avoided so as to minimize gliding resistance (Griffin et al., 2012).

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- **Both early active motion protocols and regimens combining passive flexion with active extension result in low rates of tendon re-rupture and good range of motion following repair.**
- Nevertheless, there exists no universally accepted gold standard for suture material or technique, nor rehabilitation protocol.

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Mechanical Stimulation

- As tendons permit the transmission of force from muscles to bone, their mechanical properties have been extensively studied (Wang, 2006; Woo et al., 2006).
- In the context of tendon injury and repair, **it is recognized that controlled mobilization of healing tendons is needed to improve outcomes,** although the optimal timing and magnitude of loading is largely debated (Killian et al., 2012b).

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- In animal models, the **complete removal of load in healing tendons results in inferior mechanical properties** (Galatz et al., 2009; Murrell et al., 1994), while increased loading in the form of exercise is also detrimental to tendon properties if implemented too quickly (Gimbel et al., 2007; Thomopoulos et al., 2003).
- Although strong clinical evidence for an optimal rehabilitation protocol for tendon injuries does not exist, it is well accepted that healing tissues should be loaded in a controlled manner to promote favorable remodeling and functional outcomes (Killian et al., 2012b).

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Tendon Tissue Engineering

- In cases of severe tendon injury, surgical treatments may be used to repair or replace the damaged tendon with autografts, allografts, xenografts, or prosthetic devices (Lui et al., 2011).
- However, the clinical outcomes remain unsatisfactory due to limitations including donor site morbidity, high failure rates, risk of injury recurrence and limited long-term function recovery (Klepps et al., 2004; Krueger-Franke et al., 1995; Voleti et al., 2012).

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- These limitations have spurred the development of tissue engineering strategies, which apply a combination of
  - cells,
  - scaffolds,
  - bioactive molecules,
  - and ex vivo mechanical stimulation to create functional replacements or to bolster the innate healing of tendon defects (Kuo et al., 2010).
- Ultimately, tissue engineering aims at improving the quality of healing in order to promote full restoration of tendon function.

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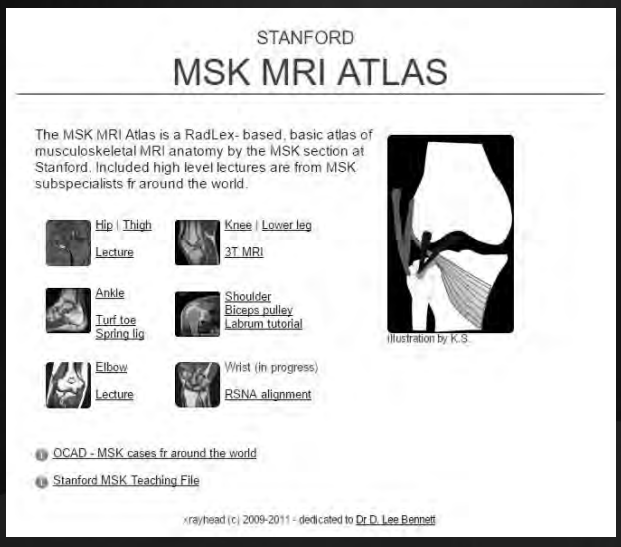

Xrayhead.com

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Rotator Cuff

Plain radiograph

- Typically these are normal in acute tears with chronic tears showing degenerative-type changes [1]:
- may show a decreased acromiohumeral interval
  - <7 mm on true AP shoulder radiograph in chronic tears
  - <2 mm on an 'active abduction' view in acute tears
- may show decreased supraspinatus opacity and decreased bulk due to fatty atrophy in chronic tears
- humeral subluxation superiorly may be seen in chronic tears
- may show features of acromial impingement
  - spur formation on the undersurface of acromioclavicular joint
  - acromion with an inferolateral tilt seen on outlet view (i.e. modified 'Y' view)
  - type III acromion
- secondary degenerative changes: sclerosis, subchondral cysts, osteolysis, and notching/pitting of greater tuberosity

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Rotator Cuff

One method of **grading rotator cuff tears on MRI** is as follows:

- **grade 0:** normal
- **grade I:** increased T2 signal with normal morphology
- **grade II:** increased T2 signal with abnormal morphology (thickening, or irregularity of the tendon)
- **grade III:** defined tear (e.g. partial or full thickness, complete or incomplete)

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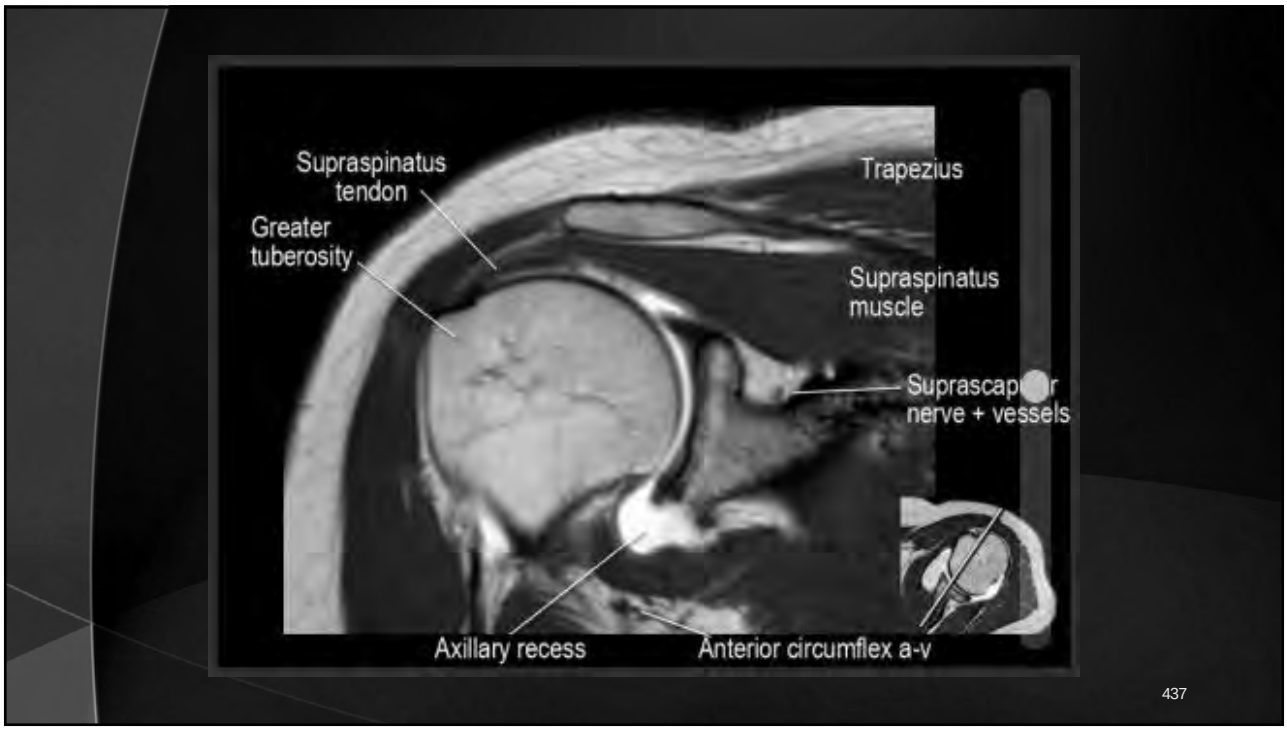
Supraspinatus tendon
Greater tuberosity
Trapezius
Supraspinatus muscle
Suprascapular nerve + vessels
Axillary recess
Anterior circumflex a-v
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Interesting Case...
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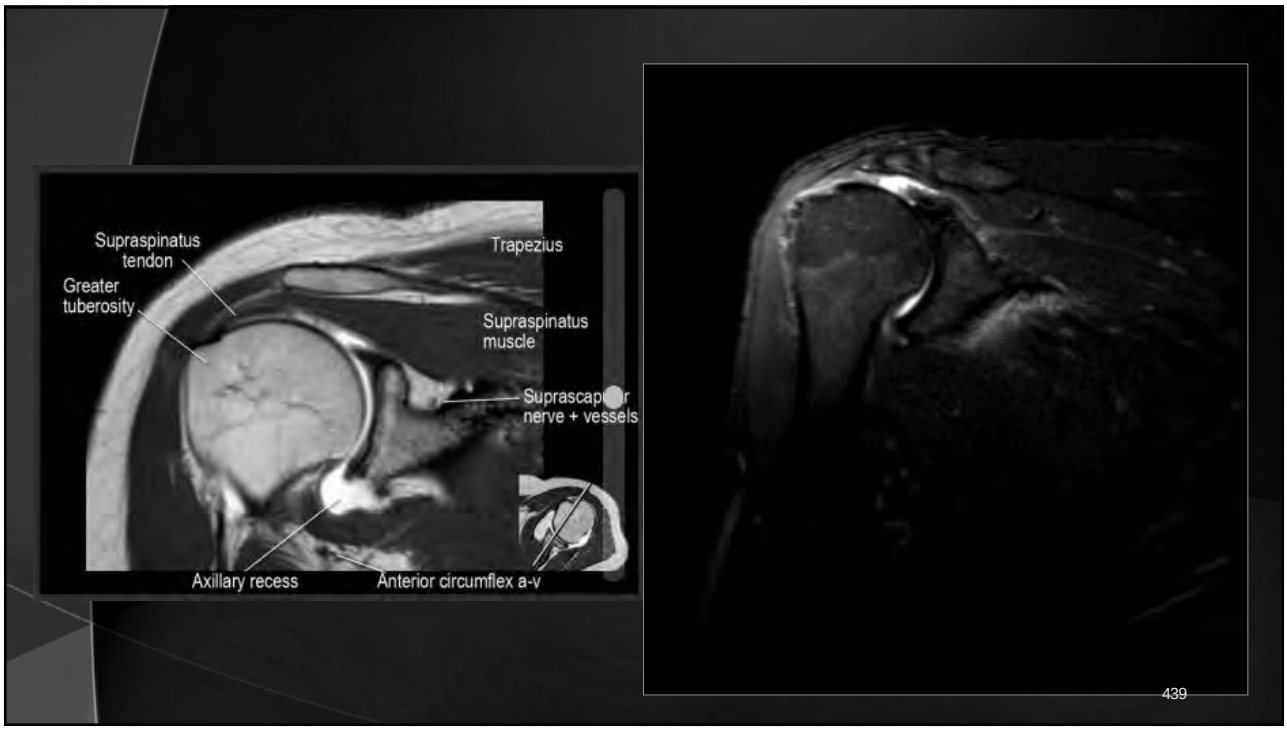
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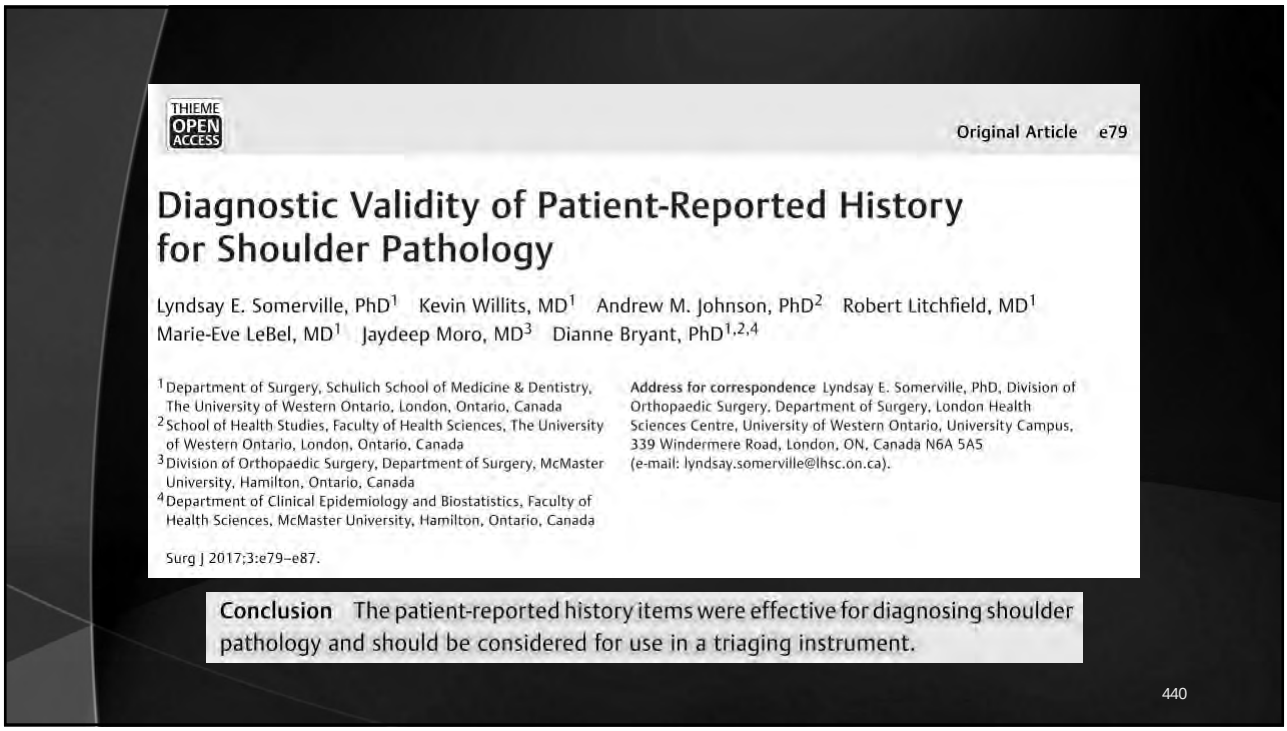
THIEME OPEN ACCESS
Original Article e79
Diagnostic Validity of Patient-Reported History for Shoulder Pathology
Lyndsay E. Somerville, PhD[1] Kevin Willits, MD[1] Andrew M. Johnson, PhD[2] Robert Litchfield, MD[1]
Marie-Eve LeBel, MD[1] Jaydeep Moro, MD[3] Dianne Bryant, PhD[1,2,4]
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Address for correspondence Lyndsay E. Somerville, PhD, Division of Orthopaedic Surgery, Department of Surgery, London Health Sciences Centre, University of Western Ontario, University Campus, 339 Windermere Road, London, ON, Canada N6A 5A5 (e-mail: lyndsay.somerville@lhsc.on.ca).
Surg J 2017;3:e79–e87.
Conclusion The patient-reported history items were effective for diagnosing shoulder pathology and should be considered for use in a triaging instrument.
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Table 1 Patient-reported history questionnaire items

Q1: Did you try any new activities in the days preceding the onset of pain?
Q2: Do you experience pain when performing overhead activities?
Q3: Do you feel pain in your shoulder during rest?
Q4: Do you have difficulty lifting objects?
Q5: At the time of injury, did you feel a snap/tear in your shoulder?
Q6: Did the onset of pain in your shoulder occur after a motor vehicle accident (while wearing a seatbelt)?
Q7: Do you have weakness in your shoulder when doing up your seatbelt?
Q8: Do you have weakness when throwing an object overhand?
Q9: Does your occupation or hobbies require elevation of the arm above the level of the shoulder?
Q10: Has your shoulder pain been longstanding (> 6 mo)?
Q11: Do you experience pain at night while lying on the injured shoulder?
Q12: Does pain at night awaken you from your sleep?
Q13: Is the pain worsened by participating in activities where the elbow is level with the shoulder?
Q14: Do you have a feeling of clicking, clunking, or grinding with use of your arm overhead?
Q15: Do you feel weakness in your shoulder without any pain?
Q16: Is the pain in your shoulder worsened by the position of your neck?
Q17: Do you have numbness/tingling in your hand?
Q18: Does your shoulder pain radiate to your hand?
Q19: At the time of injury, did you feel a sudden pull on your arm (e.g., waterskiing, grabbing onto something when falling, sudden pull when losing hold of a heavy object)?
Q20: Do you participate regularly in overhead sports (e.g., tennis, baseball, squash, etc.)?
Q21: Do you experience a catching, locking, popping, or grinding along with pain in your injured shoulder?
Q22: Do you ever experience the feeling of your arm coming out of the socket?
Q23: Has your shoulder ever dislocated from its socket?
Q24: Does your shoulder feel unstable toward the back of your body?
Q25: Did your shoulder become painful after a traumatic event (e.g., motor vehicle accident)?
Q26: At the time of injury, was your arm driven backward (e.g., car accident while holding the wheel, taking a hit from the front)?
Q27: Are you extremely flexible?
Q28: Can you make your shoulder come out?
Q29: Does your shoulder come out with daily activities?
Q30: Do you experience discomfort while doing weight lifting, push-ups, or dips?
Q31: Do you feel like your collar bone moves when raising your arm?

Surg J 2017;3:e79–e87.

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Examination of the Shoulder: The Past, the Present, and the Future

By Xiaofeng Jia, MD, PhD, Steve A. Petersen, MD, Abtin H. Khosravi, MS, Venkat Almareddi, MD, Vinodhkumar Pannirselvam, MD, and Edward G. McFarland, MD

"This summary of the literature is reflective of the complexity of shoulder conditions and their presentation in patients and shows that the results of examination are variable and that statistical analysis may not be a substantial improvement on the original observations of Codman....The shoulder continues to be a challenge for clinicians because of this inexactitude..."

J Bone Joint Surg Am. 2009;91 Suppl 6:10-8

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- Some authors have contended that the spectrum ranging from rotator cuff tendinopathy to full-thickness tears should be called ‘‘rotator cuff disease,’’ rather than impingement 31,32.
- However, most studies of rotator cuff disease have divided these conditions into two groups:
  - (1) tendinosis and partial-thickness rotator cuff tears (early stage of rotator cuff disease); and
  - (2) full-thickness and massive rotator cuff tears.
- Therefore, these entities are presented as ‘‘bursitis’’ (painful tendinosis, or no rotator cuff tearing), partial-thickness tears, or full-thickness tears, while recognizing that there is a continuum of disease and symptoms that overlap.

J Bone Joint Surg Am. 2009;91 Suppl 6:10-8

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Humeral Insertion of the Supraspinatus and Infraspinatus

New Anatomical Findings Regarding the Footprint of the Rotator Cuff

By Tomoyuki Mochizuki, MD, Hiroyuki Sugaya, MD, Mari Uomizu, MD, Kazuhiko Maeda, MD, Keisuke Matsuki, MD, Ichiro Sekiya, MD, Takeshi Muneta, MD, and Keiichi Akita, MD

Investigation performed at the Unit of Clinical Anatomy, Graduate School, Tokyo Medical and Dental University, Tokyo, Japan

Conclusions: The footprint of the supraspinatus on the greater tuberosity is much smaller than previously believed, and this area of the greater tuberosity is actually occupied by a substantial amount of the infraspinatus.

Clinical Relevance: The present study suggests that rotator cuff tears that were previously thought to involve only the supraspinatus tendon may in fact have had a substantial infraspinatus component as well.

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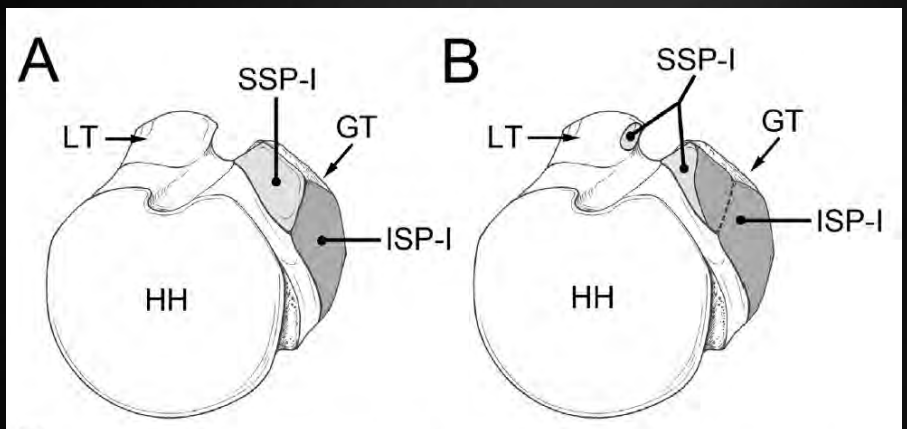

Fig. 6
Illustrations of the superior aspect of the right humerus, showing the humeral insertions of the supraspinatus and infraspinatus. *A:* An illustration based on the generally accepted concept of the anatomy of the humeral insertions. The supraspinatus is shown to insert into the highest impression and the infraspinatus, into the middle impression of the greater tuberosity. *B:* An illustration based on the findings of the present study. The insertion area of the infraspinatus occupies about half of the highest and all of the middle impression of the greater tuberosity. The insertion area of the supraspinatus is located at the anteromedial region of the highest impression and is sometimes located at the superiormost area on the lesser tuberosity. GT = greater tuberosity, HH = humeral head, ISP-I = insertion area of the infraspinatus, LT = lesser tuberosity, and SSP-I = insertion area of the supraspinatus.

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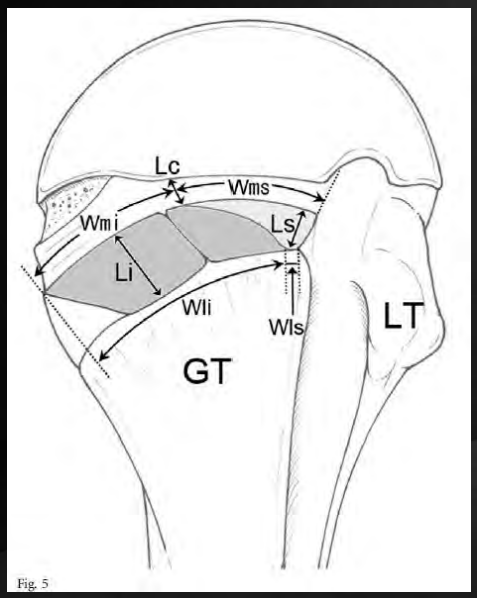

Fig. 5

Fig. 5
Illustration indicating the measurement of the footprints of the supraspinatus and infraspinatus tendons on the superolateral aspect of the right humerus. GT = greater tuberosity, LT = lesser tuberosity, Wli = width of the lateral margin of the footprint of the infraspinatus, Wls = width of the lateral margin of the footprint of the supraspinatus, Wmi = width of the medial margin of the infraspinatus, Wms = width of the medial margin of the supraspinatus, Lc = length of the attachment of the articular capsule at the posterior edge of the footprint of the supraspinatus, Li = maximum length of the footprint of the infraspinatus, and Ls = maximum length of the footprint of the supraspinatus.

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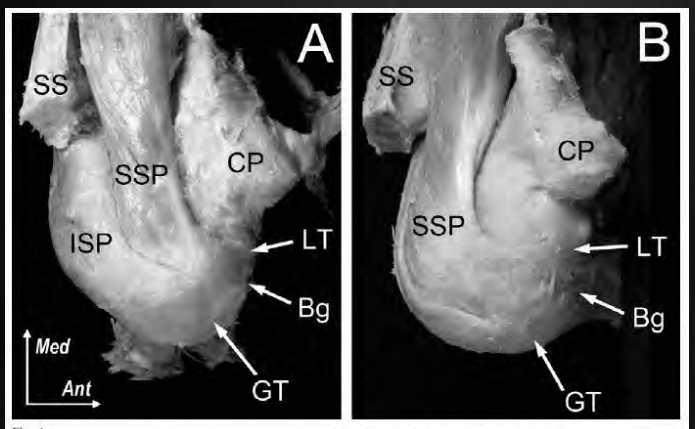

Fig. 4

Photographs showing specimens (superior aspect of the right shoulder) in which the supraspinatus was found to insert into the lesser tuberosity as well as the greater tuberosity. *A:* The anterior portion of the tendon is attached to the lesser tuberosity, while the posterior portion is attached to the most anterior portion of the greater tuberosity. *B:* The anterior tendinous portion inserts more widely into the lesser tuberosity. Bg = bicipital groove, CP = coracoid process, GT = greater tuberosity, ISP = infraspinatus, LT = lesser tuberosity, SS = scapular spine, SSP = supraspinatus, *Ant* = anterior, and *Med* = medial.

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Tendinosis (“Bursitis”) and Partial-Thickness Tears

- Neer postulated that the early stages of rotator cuff disease were inflammation and swelling of the specific rotator cuff tendon.
- Although the literature suggests that the Neer impingement sign is very sensitive for the presence of painful tendinosis, this test is not specific for the presence of rotator cuff disorders.
- In his descriptions of the impingement sign, Neer cautioned that pain elicited with passive flexion of the arm could be indicative of a wide range of shoulder conditions.
- The Hawkins-Kennedy impingement sign has a sensitivity that is similar to that of the Neer sign, but it has a low specificity for the presence of rotator cuff disease.
- Neither of these signs has high sensitivity nor specificity for the presence of full thickness rotator cuff tears.

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Neer's Test

Neer's impingement sign is elicited when the patient's rotator cuff tendons are pinched under the coracoacromial arch. The test[4] is performed by placing the arm in forced flexion with the arm fully pronated *(Figure 5)*. The scapula should be stabilized during the maneuver to prevent scapulothoracic motion. Pain with this maneuver is a sign of subacromial impingement

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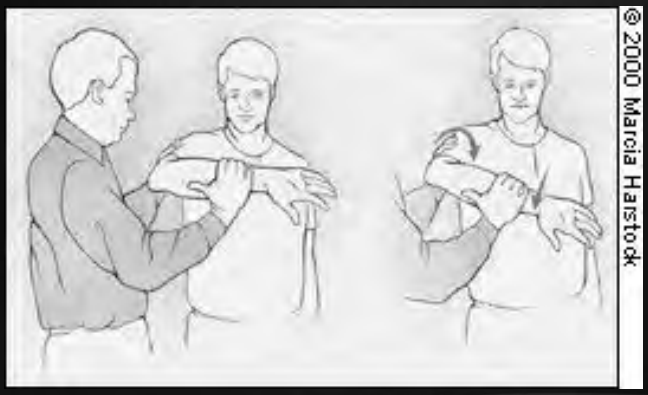

Hawkins' Test

The Hawkins' test is another commonly performed assessment of impingement.[5] It is performed by elevating the patient's arm forward to 90 degrees while forcibly internally rotating the shoulder *(Figure 6)*. Pain with this maneuver suggests subacromial impingement or rotator cuff tendonitis. One study[6] found Hawkins' test more sensitive for impingement than Neer's test.

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Full-Thickness Tears (Supraspinatus, Infraspinatus)

- The best physical examination signs for rotator cuff disease include weakness in external rotation, a positive drop-arm sign, and a painful arc of motion.
- If a patient is more than sixty years old and has these three signs, then there is a 91% chance of a full-thickness rotator cuff tear.
- Another study suggested that if a patient was older than sixty years and had a positive Neer or Hawkins-Kennedy impingement sign with weakness in abduction, there was a 98% chance that the patient had a full-thickness rotator cuff tear.

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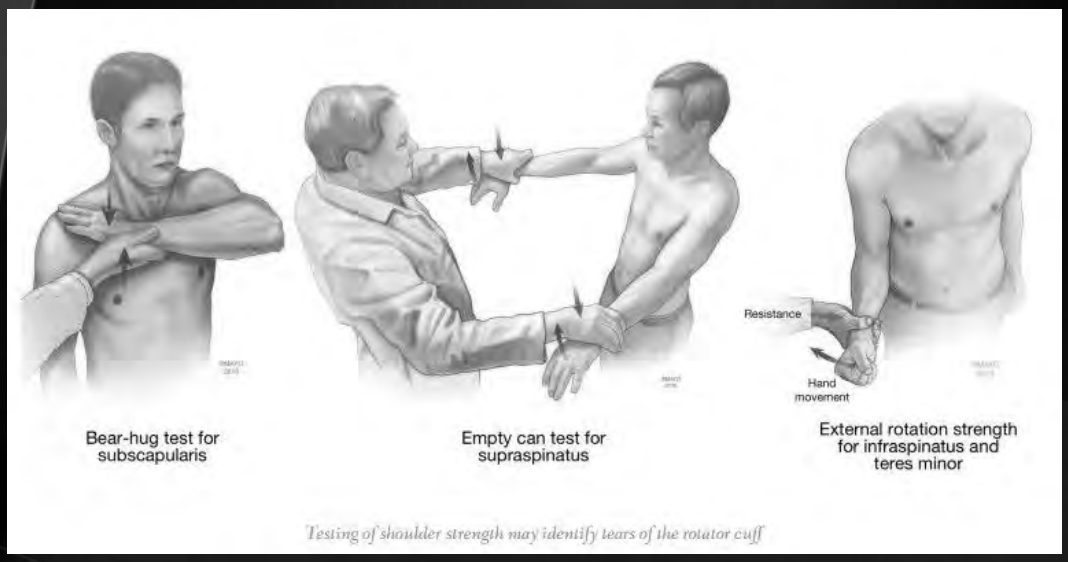

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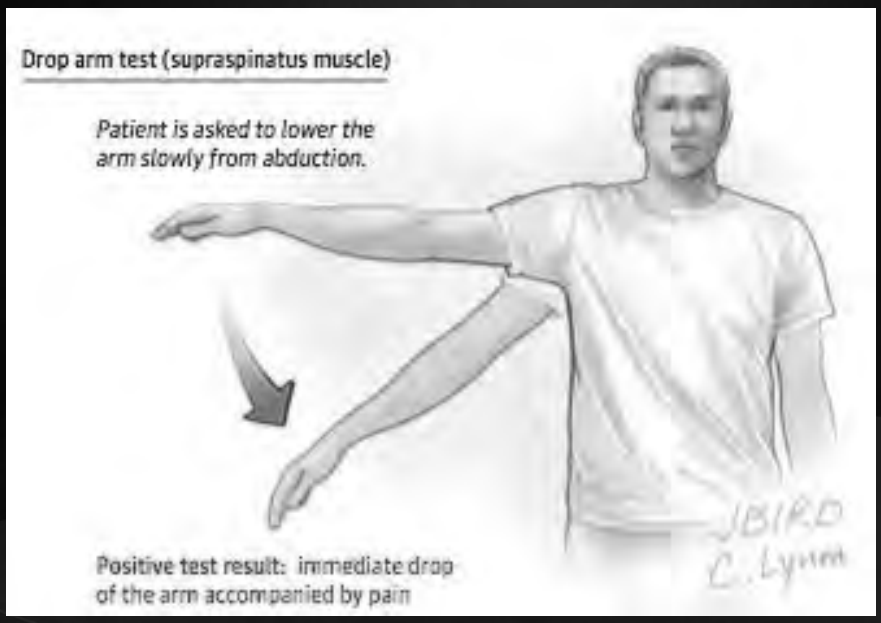

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Subscapularis Tendon Tears

- Described tests for the subscapularis muscle and tendon are the lift-off test, the belly-press test, and the bear-hug test.
- All of these tests have been reported to be beneficial in diagnosing subscapularis dysfunction; however, they are of limited usefulness for patients who have stiff shoulders that do not allow independent movement of the glenohumeral joint (e.g., frozen shoulders or shoulders with severe arthritis).

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Figure 1 – Magnetic resonance image. The arrow shows a dislocated tendon of biceps long head, as well as a subscapularis rupture.

Maximal internal rotation lift-off test. Left: Dorssum of hand is placed on midline of posterior thorax at level of inferior aspect of the scapula. Right: Subject is asked to lift hand away from the thorax. Reprinted with permission from Stefko JM, et al., Electromyographic and Nerve Block Analysis of the Subscapularis Liftoff Test. Journal of Shoulder and Elbow Surgery;6(4):349. Copyright Mosby Year Book, Inc.

Lift-Off Test

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Belly Press Test

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Bear Hug Test

Patients perform the bear-hug test by placing the palm of the affected side on the opposite shoulder with the fingers extended and the elbow positioned anteriorly.

The patient then holds the position while the physician tries to pull the patient's hand from the shoulder by applying an external rotation force perpendicular to the forearm, according to the study.

The test was considered positive if the patient could not hold the hand against the shoulder, or if he or she showed weakness of resisted internal rotation of greater than 20% compared with that of the opposite side. If the strength was comparable to that of the opposite side, without any pain, the test was negative.

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Acromioclavicular Joint Abnormalities

- Physical examination can help the clinician accurately diagnose abnormalities of the acromioclavicular joint.
- It is well known that degenerative changes of the acromioclavicular joint are extremely common in patients who are older than thirty years. Therefore, the acromioclavicular joint should not be presumed to be the source of pain in the shoulder unless it can be confirmed on physical examination.

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- Local tenderness is considered by most physicians to be the sine qua non for making the diagnosis of acromioclavicular joint disorders.
- In most patients, pain relief resulting from an injection of local anesthetic into the joint can confirm that the acromioclavicular joint is the cause of the symptoms.
- Although the classic cross-body adduction test is helpful diagnostically, the acromioclavicular resisted extension test and the active compression test are more specific (but not more sensitive) for the presence of acromioclavicular abnormalities.

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Fig. 1: Active compression test, maximal internal rotation

Fig. 2: Active compression test, maximal external rotation

The active compression test involved the client standing with the affected arm straight and forward flexed to 90 degrees The arm was then horizontally adducted 10-15 degrees and maximally internally rotated. The patient then resisted a downward force applied by the examiner to the distal arm.

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- The test was then repeated in the same position with the arm maximally externally rotated (Figure 2).
- The authors provided no data on the amount of force used.
- This test was considered positive for ACJ dysfunction if the pain was localized to the ACJ on the first position and relieved or eliminated on the second position.
- Pain "deep inside the shoulder," with or without a click, in the first position and eliminated or reduced in the second position was considered indicative of a glenoid labrum tear.

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Fig. 3: Cross-body adduction stress test

Fig. 4: Acromioclavicular resisted extension test

- The cross-body adduction stress test was described as a test where the client's arm is forward flexed to 90 degrees and then horizontally adducted across the body (Figure 3).
- The acromioclavicular resisted extension test was performed with the client's shoulder flexed to 90 degrees of combined with maximal internal rotation and 90 degrees of elbow flexion. The client was then asked to horizontally abduct the arm against resistance (Figure 4).
- These tests are considered positive if it caused pain at the ACJ.

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Shoulder Instability

Anterior Instability

- Studies have shown that physical examination for anterior shoulder instability is clinically helpful if the criterion for a positive test is the reproduction of a symptom of instability.
- Specificity of the anterior apprehension test, the relocation test, and the surprise test exceeds 95%.

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Posterior Instability

- To our knowledge, there have only been a few studies of the accuracy of physical examination in the diagnosis of posterior instability.

Multidirectional Instability

- To our knowledge, no study has evaluated the accuracy, validity, or clinical usefulness of current tests for diagnosing multidirectional instability. Multidirectional instability of the shoulder has been traditionally defined55 as symptomatic instability in two or more directions (anterior, posterior, or inferior).

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Anterior and Posterior Lesions of the Superior Labrum

- The diagnosis of anterior and posterior lesions of the superior labrum on the basis of physical examination alone remains elusive.
- There is as yet no one universally accepted modality for making the diagnosis.

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Glenoid labrum tears

Bankart lesions are a common complication of anterior shoulder dislocation and are frequently seen in association with a Hill-Sachs lesion.

Perthes lesion of the shoulder is one of the types of the anterior glenohumeral injury in which the anterior inferior labrum is torn and lifted from the edge of the glenoid [1] but still attached to the intact lifted periosteum from the anterior aspect of the glenoid.

Glenolabral articular disruption (GLAD) lesions result from a forced adduction injury. There is a superficial anterior inferior labral tear associated with an anterior inferior glenoid articular cartilage injury. These lesions do not tend to be associated with shoulder instability.

An anterior labroligamentous periosteal sleeve avulsion (ALPSA) lesion is similar to a Bankart lesion, in that it too is usually due to anterior shoulder dislocation and involves th anterior inferior labrum.

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Biceps Tendon Tears (Other than Anterior and Posterior Lesions of the Superior Labrum)

- Biceps tendon abnormalities other than anterior and posterior lesions of the superior labrum include biceps tenosynovitis, partial biceps tendon tears, biceps tendon subluxations, and biceps entrapment in the joint.
- Diagnosing any of these lesions with use of physical examination is difficult because an isolated biceps tendon abnormality is relatively rare.
- A partial tear of the biceps tendon, subluxation of the biceps tendon, or biceps tenosynovitis often coexists with rotator cuff tears or other intra-articular abnormalities.
- Therefore, pain in the anterior or lateral aspect of the shoulder during testing of the biceps tendon cannot be reliably ascribed to the biceps tendon alone.

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CURRENT CONCEPTS

Physical Examination of the Shoulder

Joseph J. King, MD, Thomas W. Wright, MD

This article summarizes the overall assessment of the shoulder joint and seeks to help direct clinicians to diagnose shoulder pathology using standard and specific physical examinations. The history and standard examination can prompt the examiner to focus on specific tests to further evaluate the shoulder and limit the differential diagnoses. An appropriate and directed shoulder physical examination allows the clinician to focus on further diagnostic strategies and treatment options for the patient. *(J Hand Surg Am. 2014;39(10):2103–2112. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Physical examination, shoulder.

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- Pain referral patterns are important to understand for clinicians treating patients with shoulder pain to reach the definitive diagnosis:
  - Pain from rotator cuff or subacromial pathology is often referred to the lateral arm.
  - Intra-articular glenohumeral joint pathology is often referred to the posterior shoulder or periscapular region. This can be partially explained by periscapular muscle fatigue or strain resulting from a compensatory increase in scapular motion with glenohumeral joint pathology.
  - Acromioclavicular joint pathology can cause referred pain medially, often to the superomedial scapula, base of the neck or medial clavicle.

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TABLE 1. Shoulder Physical Examination Tests and Pathology They Assess

Test	Pertinent Diagnosis Being Tested	Positive Test If:
Jobe supraspinatus test	Supraspinatus strength	Weakness or pain, or both
External rotation lag test	Infraspinatus integrity	Drift back
Liftoff test	Subscapularis tear	Unable to perform
Belly press test	Subscapularis pathology	Weakness or anterior shoulder pain, or both
Bear hug test	Subscapularis pathology	Weakness
Neer test	Impingement syndrome	Pain
Hawkin test	Impingement syndrome	Pain
Apprehension test	Anterior shoulder instability	Anterior shoulder pain or instability sensation, or both
Jobe relocation test	Anterior shoulder instability	Reduction in pain or instability sensation, or both
Surprise test	Anterior shoulder instability	Pain or instability sensation, or both
Anterior drawer test	Anterior shoulder instability	Abnormal translation AND pain
Posterior drawer test	Posterior shoulder instability	Abnormal translation AND pain
Posterior apprehension test	Posterior shoulder instability	Posterior shoulder pain or instability sensation, or both
Load and shift test	Posterior shoulder instability	Posterior shoulder pain or painful clunk
Jerk test	Posterior shoulder instability	Palpable clunk or painful click
Sulcus test	Inferior shoulder instability	Abnormal motion AND pain
Yergason test	Bicipital groove pathology	Anterior shoulder or arm pain
Speed test	Bicipital groove pathology	Anterior shoulder or arm pain
Uppercut test	Bicipital groove pathology	Anterior shoulder or arm pain
O'Brien test	Superior labral pathology	Increased pain with internal rotation
Anterior slide test	Superior labral pathology	Deep shoulder pain or a click, or both
Crank test	Superior labral pathology	Deep shoulder pain or a click, or both
Cross shoulder adduction test	Acromioclavicular joint pathology	Pain localized to the acromioclavicular joint

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e154 Original Article

THIEME OPEN ACCESS

Clinical Assessment of Physical Examination Maneuvers for Superior Labral Anterior to Posterior Lesions

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Surg J 2017;3:e154–e162.

Conclusion Our study demonstrates that the physical examination tests for SLAP lesions are poor diagnostic indicators of disease. Performing a combination of tests will likely help, although the magnitude of the improvement is minimal. These authors caution clinicians placing confidence in the physical examination tests for SLAP lesions rather we suggest that clinicians rely on diagnostic imaging to confirm this diagnosis.

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DELANEY RADIOLOGISTS GROUP - Radiology Report

Patient:	Demetrious, James	Ordering Physician:	Demetrious, James, S
ID:	633228/269.119096	Phone, Pager:	Phone: (910)790-8020 Pager:
DOB:	7/11/1961		
Age/Gender:	55Y, M	Primary Location:	DELANEY BLDG A
Procedure:	SHOULDER COMPLETE MINIMUM TWO VIEWS	Study Date:	11/1/2016 11:03:05 AM
Accession #:	02721119	Order #:	02721119
Report Status:	Finalized		
Reason:	SHOULDER PAIN		

DELANEY RADIOLOGISTS GROUP
1925 MEDICAL CENTER DRIVE
WILMINGTON, NC 28401
(910) 762-5662

NAME: DEMETRIOUS, JAMES REF PHYS: JAMES DEMETRIOUS; DOB: [illegible] AGE: 55 YR PHONE: 9106243 DATE OF EXAM: 11/01/2016
ACCESSION #: 02721119
MD #: 633228

EXAM(S): RIGHT SHOULDER MINIMUM TWO VIEWS
REASON FOR EXAM: SHOULDER PAIN

Three-view right shoulder

Mild degenerative change acromioclavicular joint. No fracture or dislocation

Conclusion

Mild degenerative change without fracture or dislocation

Dictated by: L. Patrick Warren, MD 11/1/2016 11:12 AM
Electronically Signed by: L. Patrick Warren, MD 11/1/2016 11:12 AM

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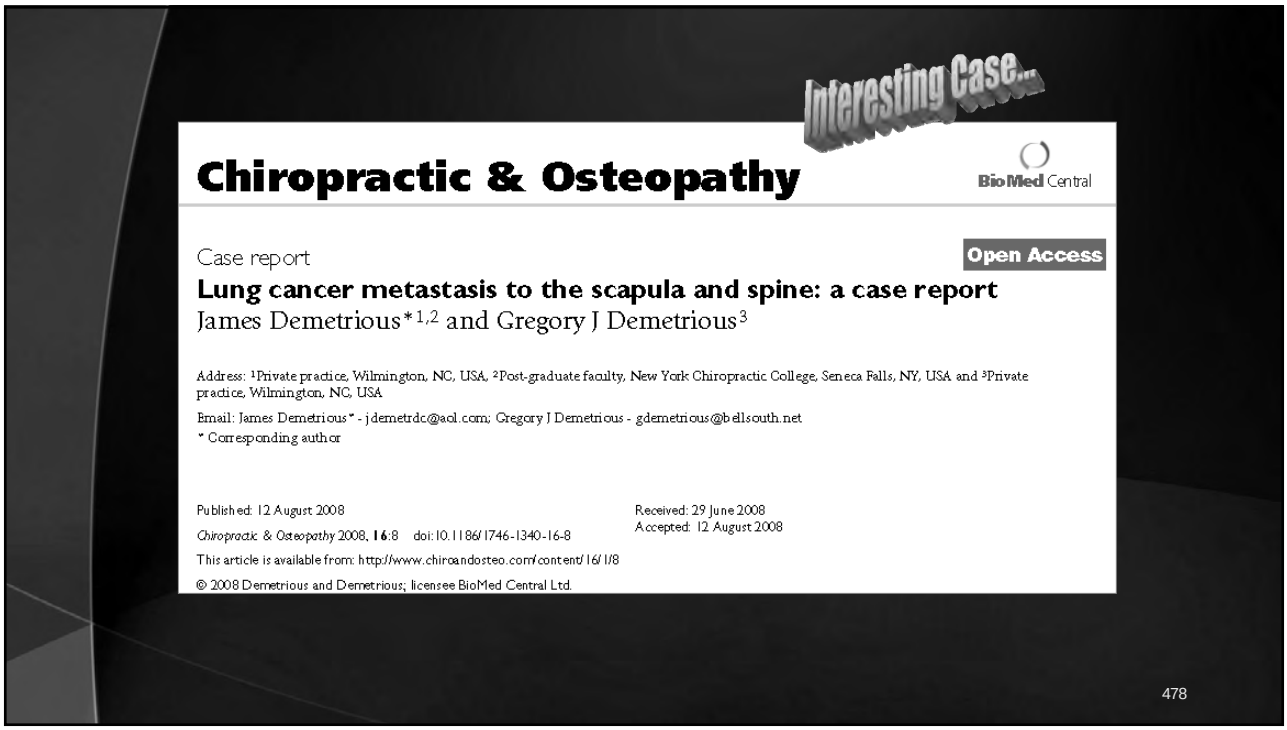

Interesting Case...

Chiropractic & Osteopathy

BioMed Central

Case report

Open Access

Lung cancer metastasis to the scapula and spine: a case report

James Demetrious*[1,2] and Gregory J Demetrious[3]

Address: [1]Private practice, Wilmington, NC, USA, [2]Post-graduate faculty, New York Chiropractic College, Seneca Falls, NY, USA and [3]Private practice, Wilmington, NC, USA

Email: James Demetrious* - jdemetrdc@aol.com; Gregory J Demetrious - gdemetrious@bellsouth.net

* Corresponding author

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Accepted: 12 August 2008

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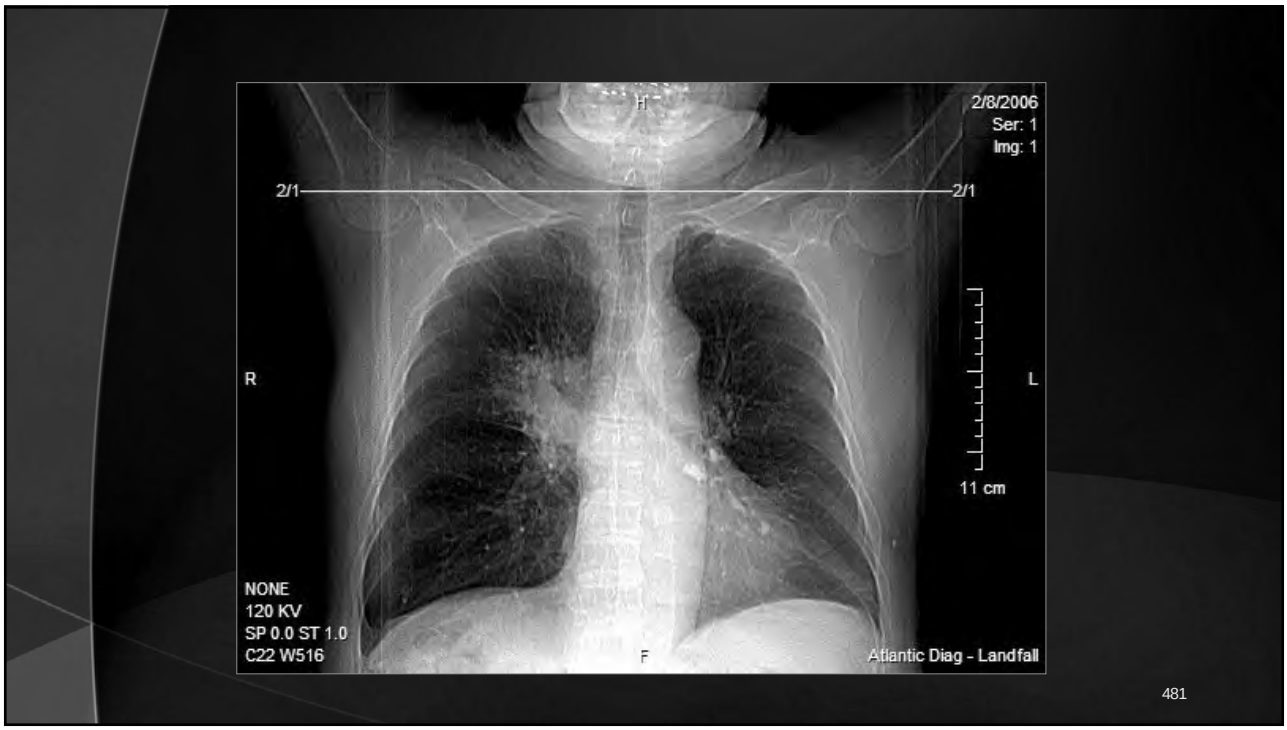
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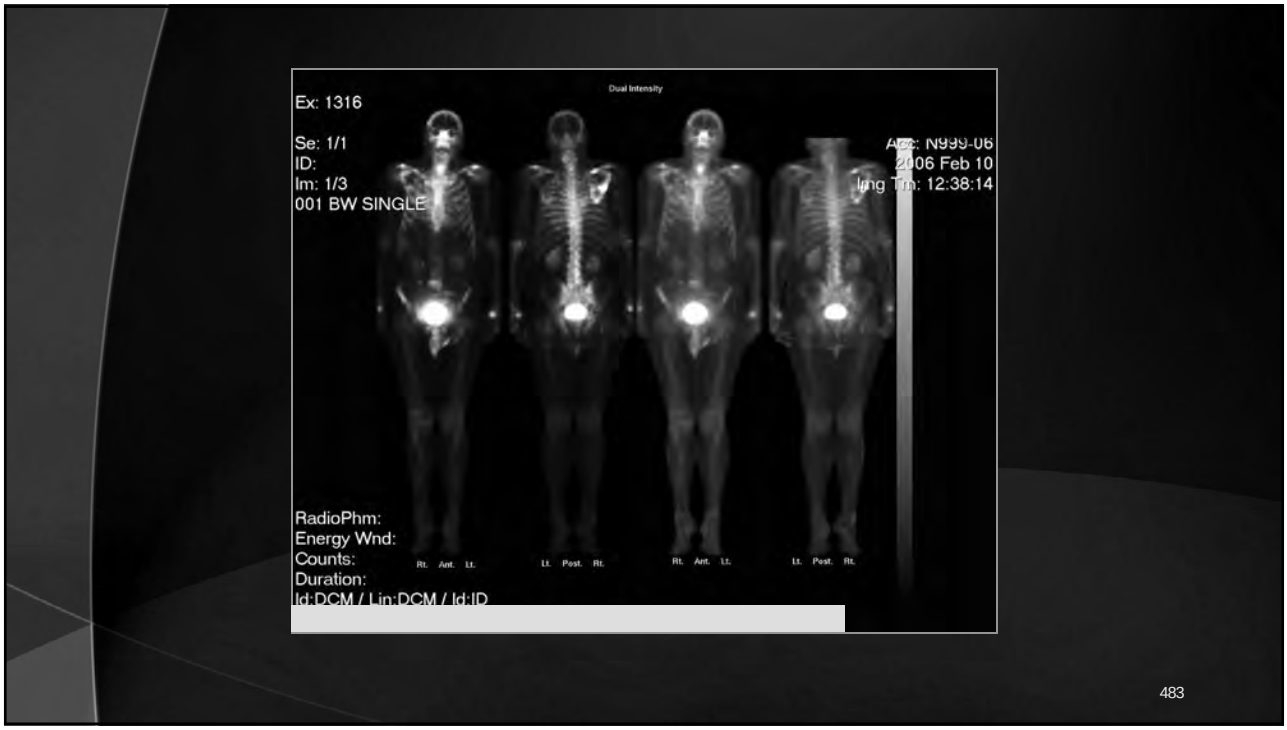
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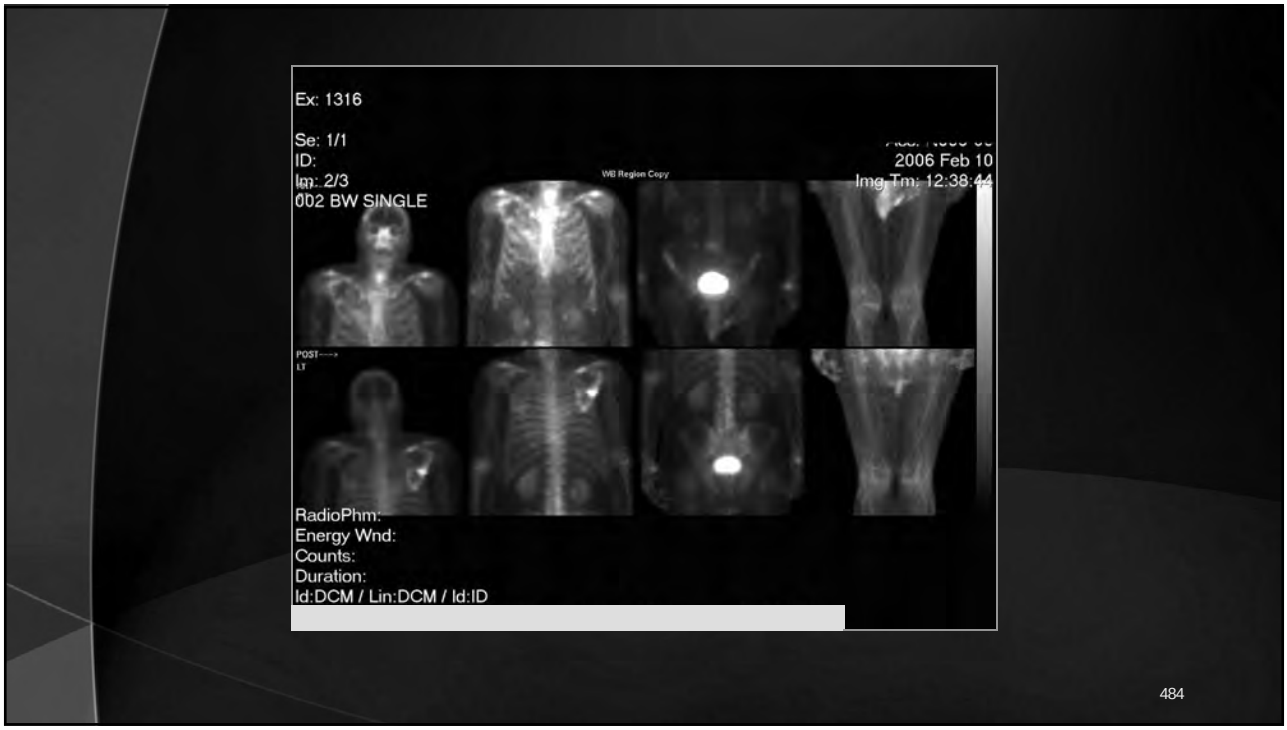
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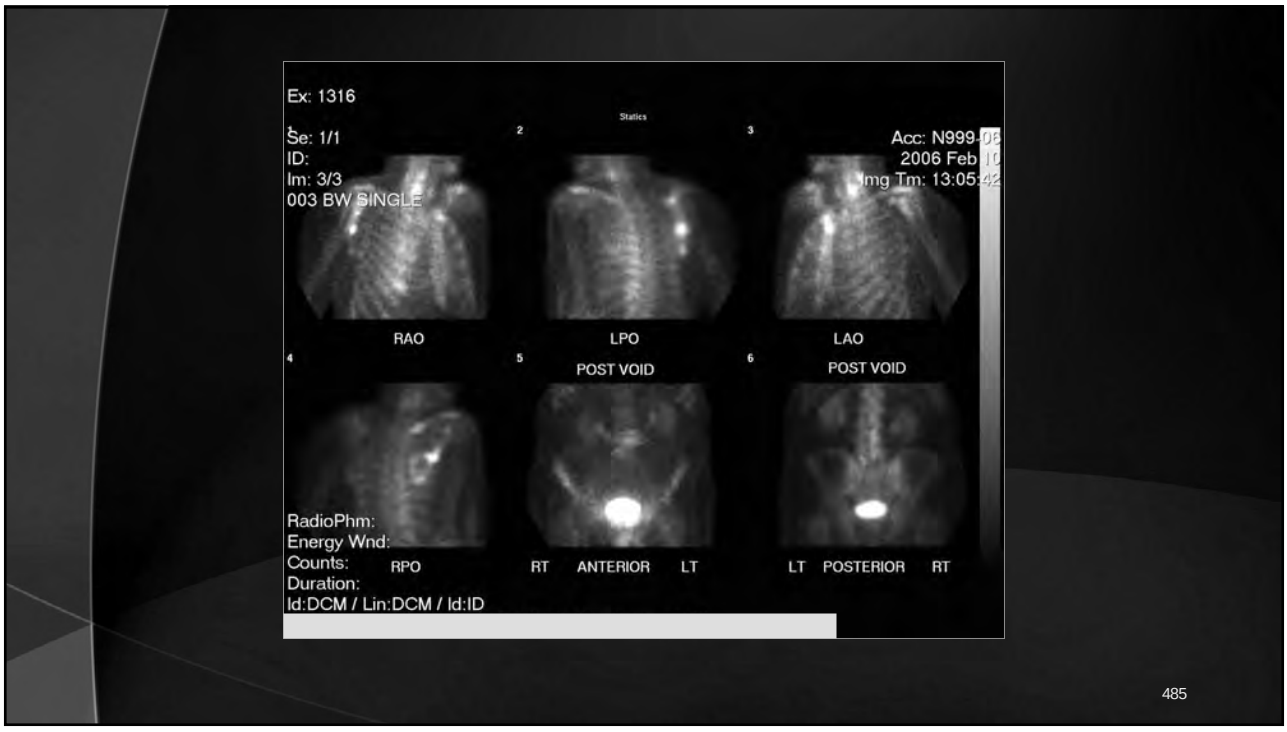
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Interesting Case...
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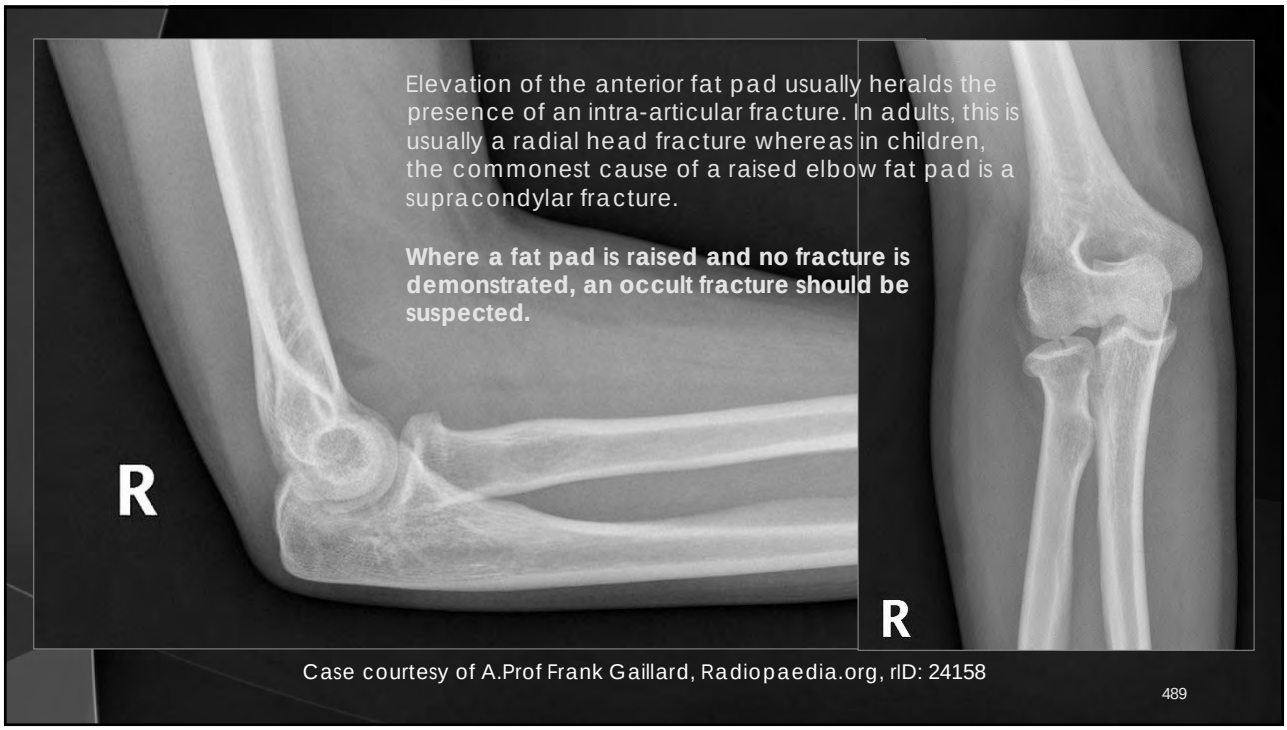
Elevation of the anterior fat pad usually heralds the presence of an intra-articular fracture. In adults, this is usually a radial head fracture whereas in children, the commonest cause of a raised elbow fat pad is a supracondylar fracture.
Where a fat pad is raised and no fracture is demonstrated, an occult fracture should be suspected.
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Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 24158
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Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 24158
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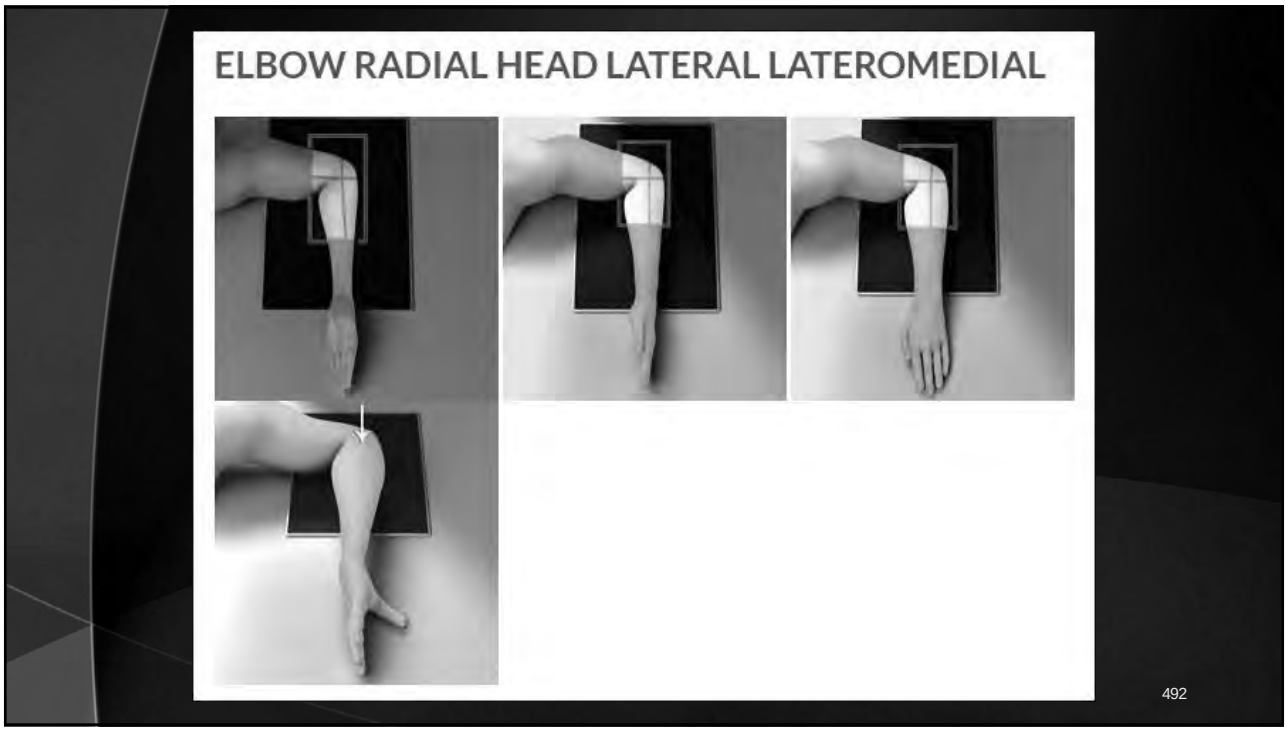

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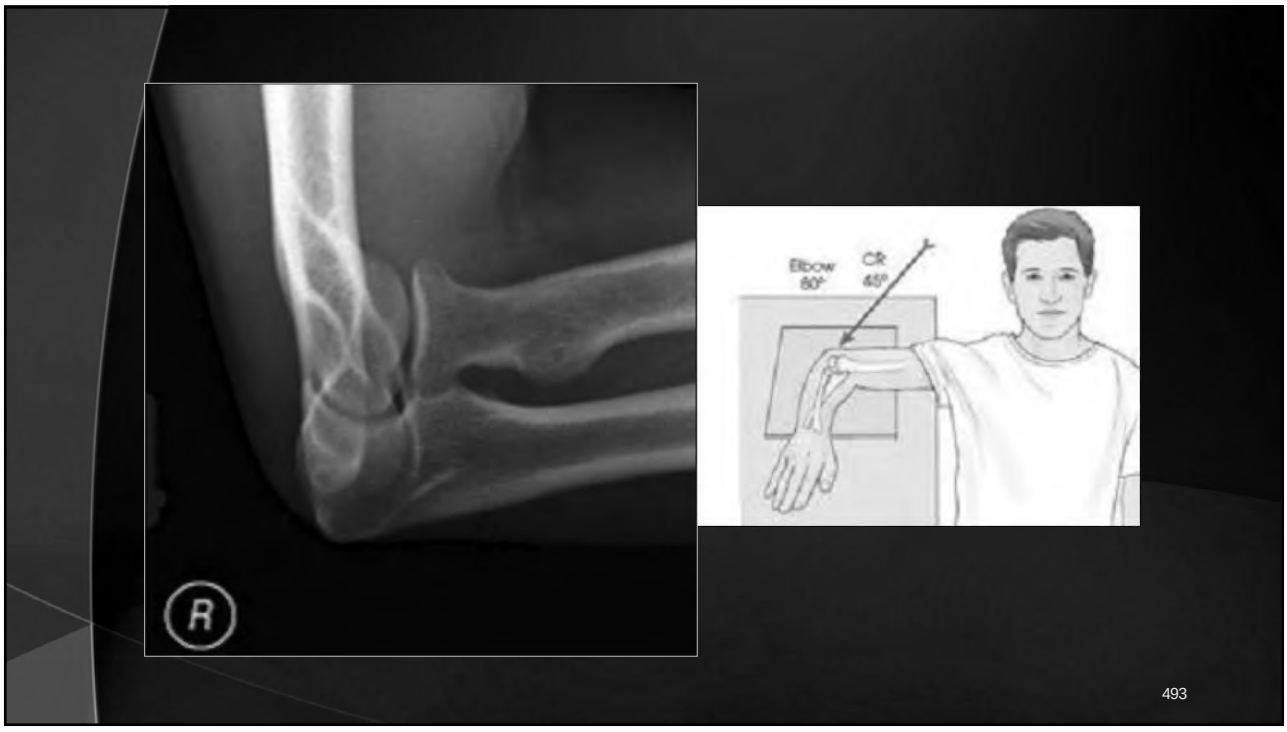
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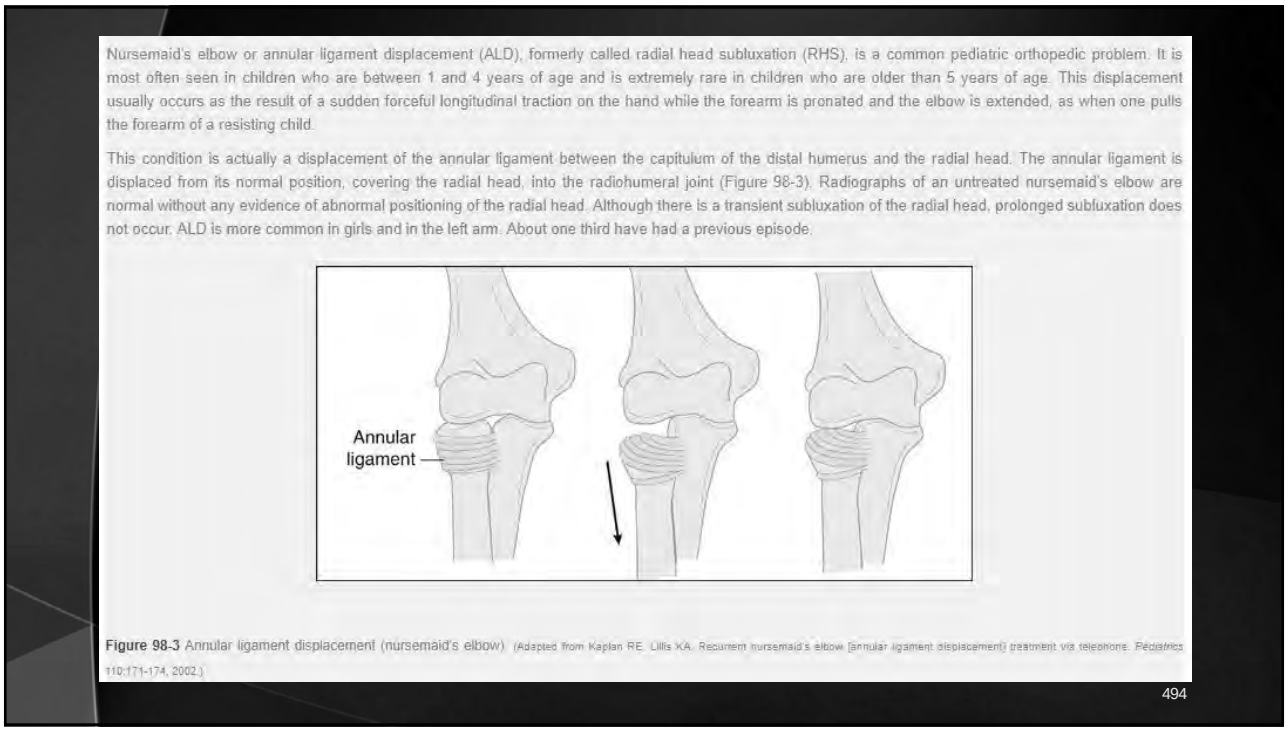
Nursemaid's elbow or annular ligament displacement (ALD), formerly called radial head subluxation (RHS), is a common pediatric orthopedic problem. It is most often seen in children who are between 1 and 4 years of age and is extremely rare in children who are older than 5 years of age. This displacement usually occurs as the result of a sudden forceful longitudinal traction on the hand while the forearm is pronated and the elbow is extended, as when one pulls the forearm of a resisting child.
This condition is actually a displacement of the annular ligament between the capitulum of the distal humerus and the radial head. The annular ligament is displaced from its normal position, covering the radial head, into the radiohumeral joint (Figure 98-3). Radiographs of an untreated nursemaid's elbow are normal without any evidence of abnormal positioning of the radial head. Although there is a transient subluxation of the radial head, prolonged subluxation does not occur. ALD is more common in girls and in the left arm. About one third have had a previous episode.
Annular ligament
Figure 98-3 Annular ligament displacement (nursemaid's elbow). (Adapted from Kaplan RE, Lillis KA. Recurrent nursemaid's elbow [annular ligament displacement] treatment via telephone. Pediatrics 110:171-174, 2002.)
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Put your thumb over the head of the radius with your fingers supporting the elbow and press down with your thumb while you smoothly and fully supinate the forearm and extend the elbow. Complete the procedure by fully flexing the elbow while your thumb remains pressing against the radial head and the forearm remains supinated (Figure 98-1). At some point, you should feel a click beneath your thumb. The patient will usually scream for a while at this point. **Leave for about 10 minutes, then return and reexamine the elbow to see that the child has fully recovered.** This recovery may take as much as 30 minutes. Postreduction immobilization is unnecessary.

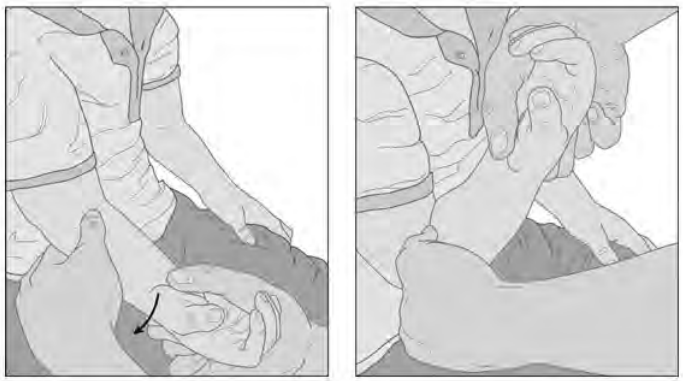

Figure 98-1 Supination technique for annular ligament displacement (ALD) reduction.

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An alternative maneuver that some believe is more effective is the "handshake" or hyperpronation maneuver. Grasp the hand of the patient's affected arm as if to shake it, place your other hand under the affected elbow with your thumb over the radial head, and slowly pronate the wrist. This can be done alone or while simultaneously extending the elbow, followed by fully flexing the elbow while still maintaining pronation of the forearm (Figure 98-2).

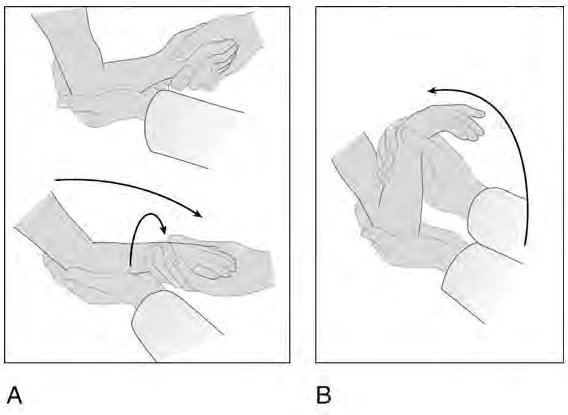

Figure 98-2 "Handshake" or hyperpronation maneuver. Simultaneous pronation of the wrist and extension of the elbow (**A**), followed by flexion of the elbow with the forearm maintained in pronation (**B**). (Adapted from Kaplan RE, Lillis KA. Recurrent nursemaid's elbow [annular ligament displacement] treatment via telephone. *Pediatrics* 110:171-174, 2002.)

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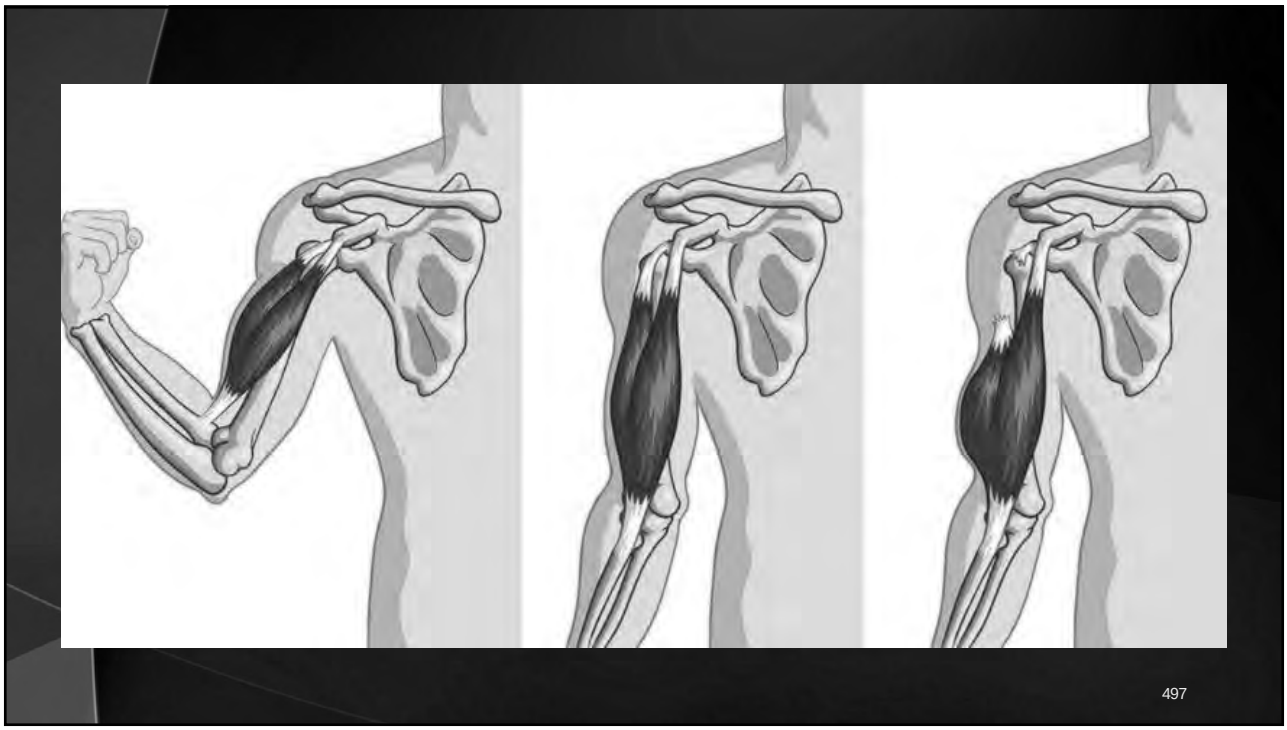
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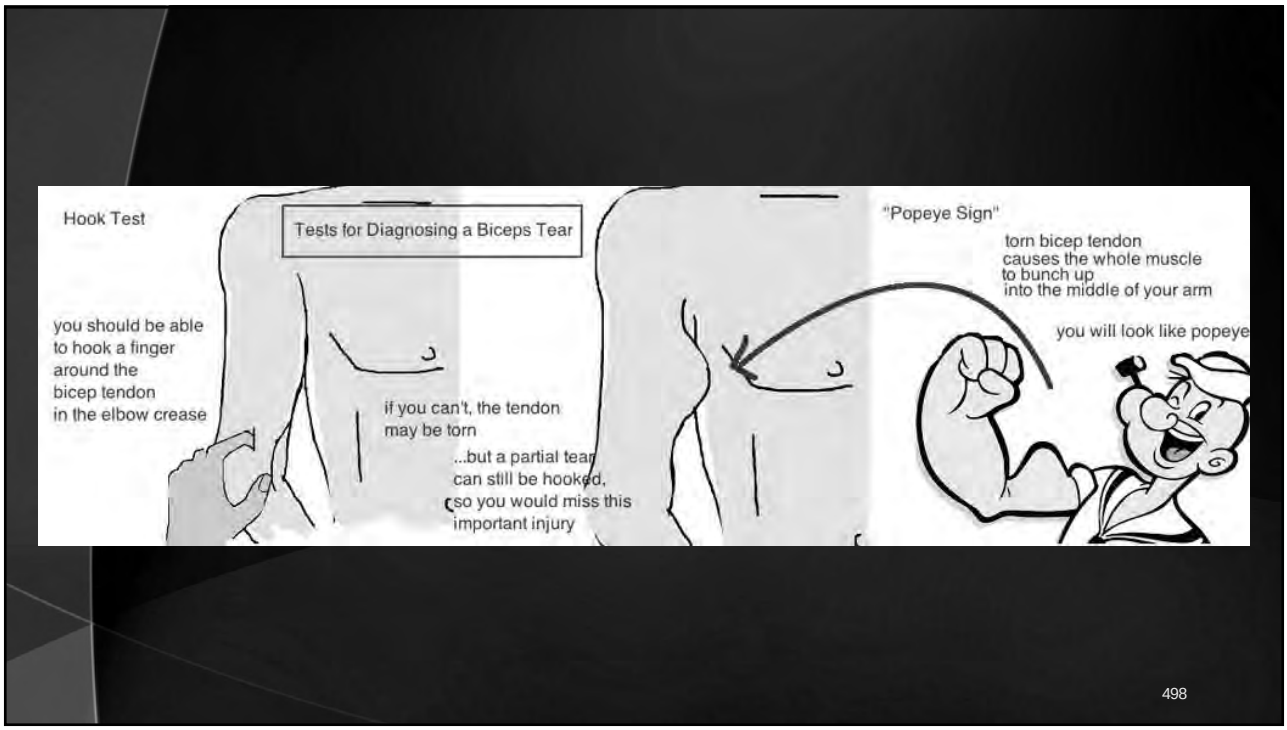
Hook Test
Tests for Diagnosing a Biceps Tear
you should be able to hook a finger around the bicep tendon in the elbow crease
if you can't, the tendon may be torn
...but a partial tear can still be hooked, so you would miss this important injury
"Popeye Sign"
torn bicep tendon causes the whole muscle to bunch up into the middle of your arm
you will look like popeye
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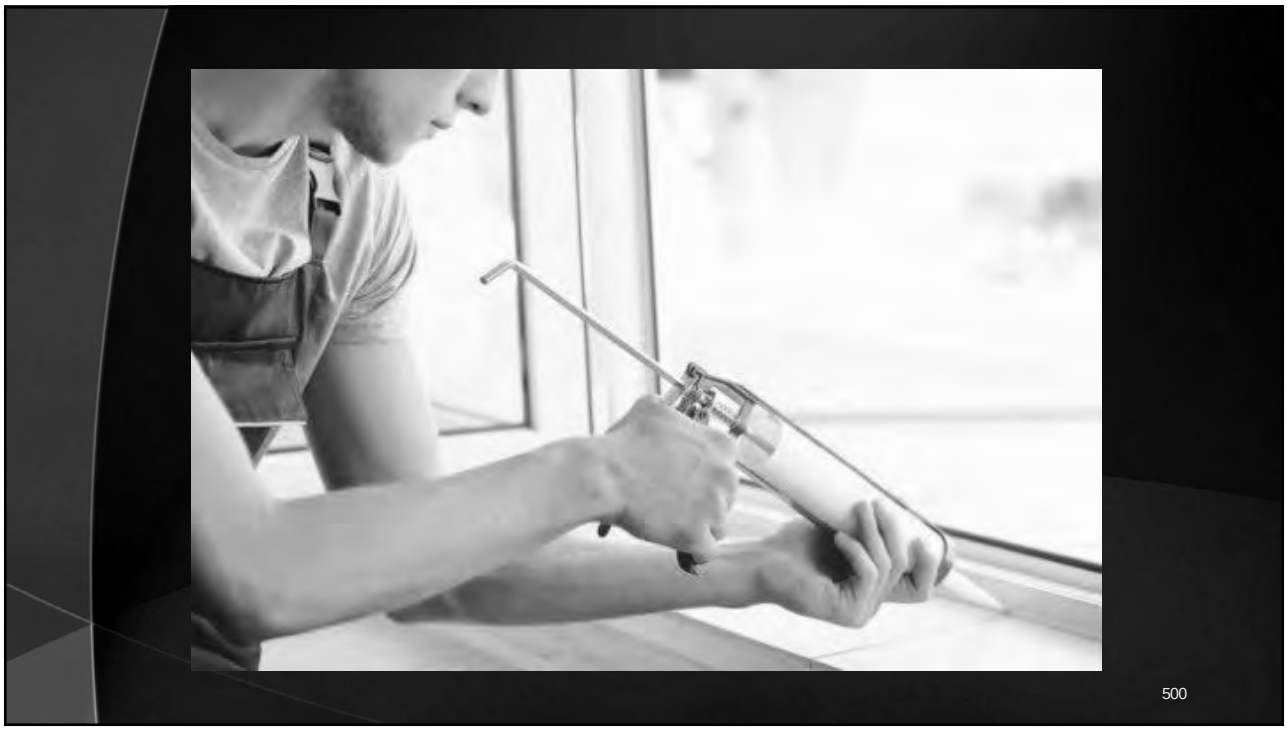

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Posterior interosseous nerve syndrome

- Patients with posterior interosseous nerve syndrome present with weakness or paralysis of the wrist and digital extensors.
- Pain may be present, but it usually is not a primary symptom.
- Attempts at active wrist extension often result in weak dorsoradial deviation due to preservation of the radial wrist extensors but involvement of the extensor carpi ulnaris and extensor digitorum communis.
- These patients do not have a sensory deficit.

http://www.emedicine.com/orthoped/topic549.htm

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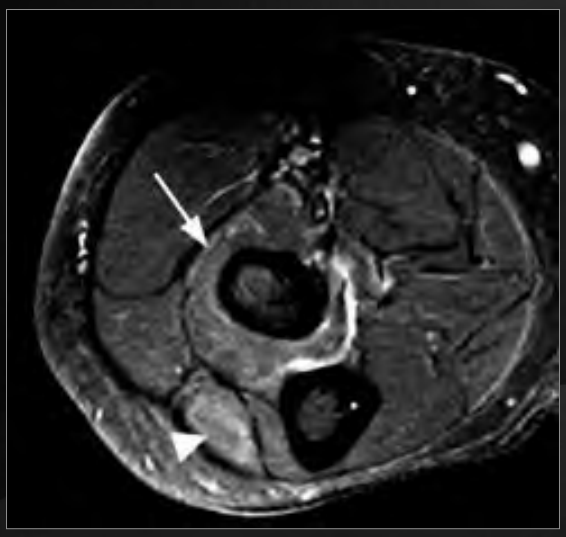

An axial fat-suppressed T2-weighted image in the proximal forearm demonstrates edema of the supinator (arrow) and extensor carpi ulnaris (arrowhead) in this patient with proximal posterior interosseous nerve entrapment.

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Rofo. 2020 Sep 3. doi: 10.1055/a-1219-8158. Online ahead of print.

Imaging of Carpal Instabilities

Jan-Peter Grunz [1], Carsten Herbert Gietzen [1], Katharina Grunz [1], Thorsten Bley [1], Rainer Schmitt [1]

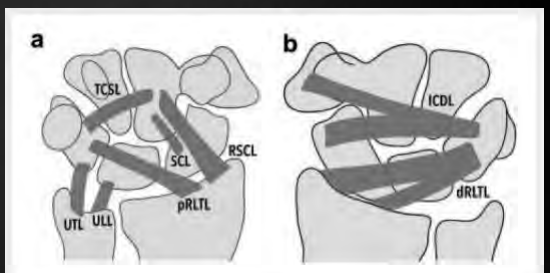
Affiliations – collapse

Affiliation

1 Department of Diagnostic and Interventional Radiology, University Hospital Würzburg, Germany.

PMID: 32882727 DOI: 10.1055/a-1219-8158

Rofo. 2020 Sep 3. doi: 10.1055/a-1219-8158.



▸ **Fig. 3** Schematic display of intracapsular carpal ligaments. **a** Palmar "V" ligaments. The proximal palmar "V" consists of the palmar radiolunotriquetral ligament (pRLTL) on the radial side and the ulnolunate (ULL) and ulnotriquetral ligaments (UTL) on the ulnar side. The radial leg of the distal palmar "V" is formed by the radioscaphocapitate (RSCL) and scaphocapitate ligament (SCL), while the triquetrocapitoscaphoid ligament (TCSL = arcuate ligament) constitutes its ulnar leg. **b** Dorsal "V" ligaments. In contrast to the palmar side, the ligamentous anatomy of the dorsal carpus resembles a horizontal "V" with the dorsal radiolunotriquetral ligament (dRLTL) as the proximal leg and the intercarpal dorsal ligament (ICDL) as the distal leg.

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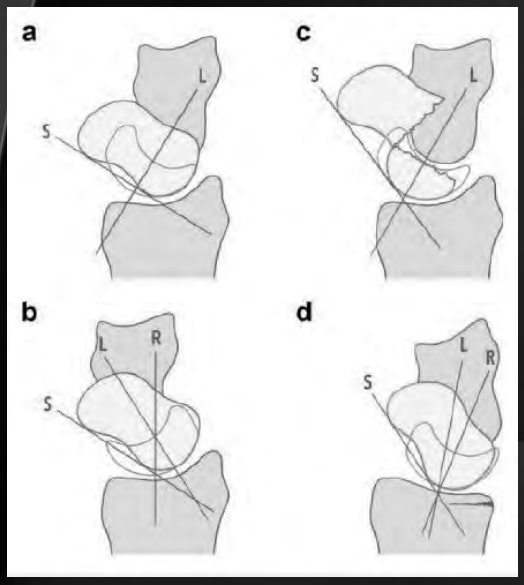

Rofo. 2020 Sep 3. doi: 10.1055/a-1219-8158.

▸ **Fig. 1** For angle measurements in lateral radiographs, the longitudinal axes of the radius (R) and lunate (L) as well as the palmar tangent of the scaphoid (S) are required. **a** Scapholunate dissociation. Palmar flexion of the scaphoid and dorsal extension of the lunate result in pathologic widening of the scapholunate angle (above 60–70°). **b** Lunotriquetral dissociation. Simultaneous flexion of the scaphoid and lunate results in widening of the radiolunate (above 15°) and radioscaphoid (above 60°) angles, while the scapholunate angle remains within the normal range or decreases (below 30°). **c** Unstable scaphoid nonunion. The proximal scaphoid fragment and lunate bone extend dorsally, while the distal scaphoid fragment rotates to palmar. The scapholunate angle is subsequently increased (above 60–70°). **d** Radiocarpal structural disorder. Pathological inclination of the radial articular surface after fracture leads to combined dorsal extension of the scaphoid and lunate. Therefore, the radiolunate angle decreases (below −15°), while the radioscaphoid angle remains normal or decreases (below 30°).

▸ **Table 1** Reference values for carpal angulations in lateral radiographs.

▸ **Tab. 1** Referenzwerte für karpale Winkelbestimmungen im seitlichen Röntgenbild.

angle	reference (range)
radiolunate angle	0° (−15° to 15°)
radioscaphoid angle	45° (30° to 60°)
capitolunate angle	0° (−15° to 15°)
scapholunate angle	45° (30° to 60°)

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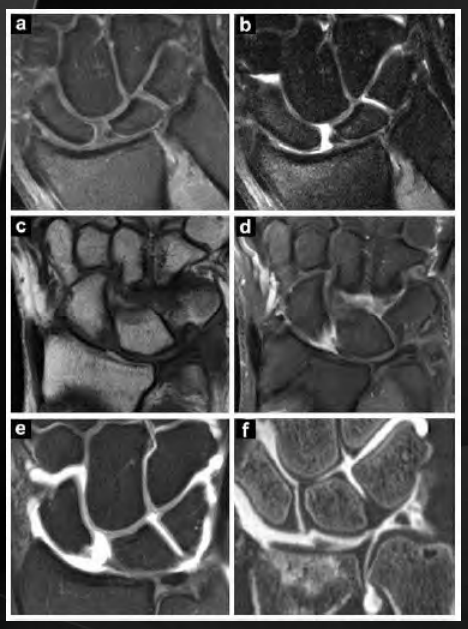

► **Fig. 2** Imaging of scapholunate ligament injury using fat-saturated (fs) fast spin echo (FSE) sequences and MR/CT arthrography. **a** T1 FSE fs **b** PD-weighted FSE fs **c** T1 FSE **d** T1 FSE fs after intravenous application of gadolinium **e** T1 FSE fs after multicompartment wrist arthrography **f** Multidetector CT after multicompartment wrist arthrography

Therapy

Depending on the severity and acuteness of the instability, treatment options include immobilization, scapholunate transfixation, ligament suture, plasty of the extrinsic ligaments (dorsal capsulodesis), stabilization of the scaphoid with a tendon strip or partial arthrodesis, implantation of bone-ligament-bone grafts, as well as salvage procedures in late stages with advanced osteoarthritis [27, 35, 38, 39].

Rofo. 2020 Sep 3. doi: 10.1055/a-1219-8158.

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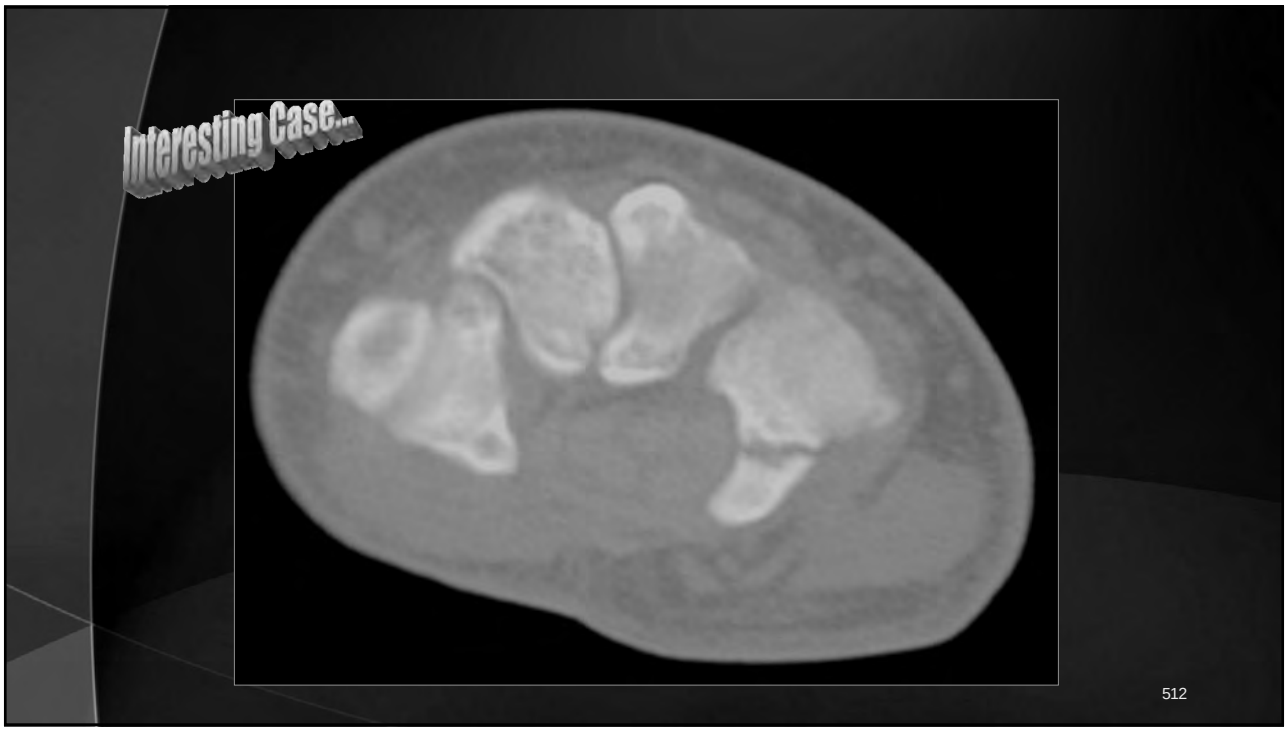

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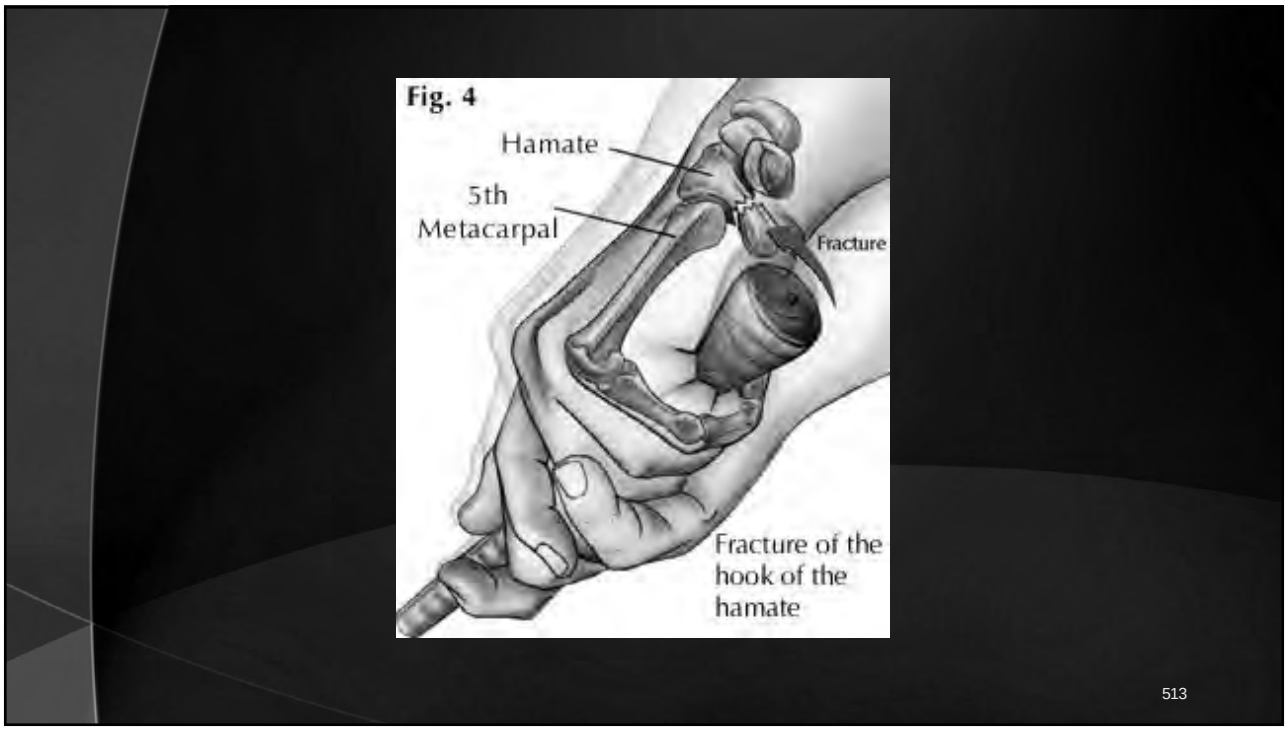
Fig. 4
Hamate
5th
Metacarpal
Fracture
Fracture of the
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Interesting Case...
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Upper Extremities

- **T or F** Chronic tears of the supraspinatus may produce a decreased acromiohumeral interval.
- **T or F** On MRI, Grade III represents a partial or full thickness tear.

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Lower Extremities

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review article

Wien Klin Wochenschr (2017) 129:81–95
DOI 10.1007/s00508-016-1096-4

Wiener klinische Wochenschrift
The Central European Journal of Medicine

CrossMark

Gait disorders in adults and the elderly

A clinical guide

Walter Pirker · Regina Katzenschlager

Wien Klin Wochenschr (2017) 129:81–95

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- Gait disorders lead to a **loss of personal freedom,** falls and injuries and resultant marked reduction of quality of life.
- The prevalence of gait disorders increases from 10% in patients aged 60-69 years to more than 60% in community dwelling subjects over 80 years.
- With advancing age, the proportion of patients with multiple causes or combinations of neurologic and non-neurological gate disorders increases.

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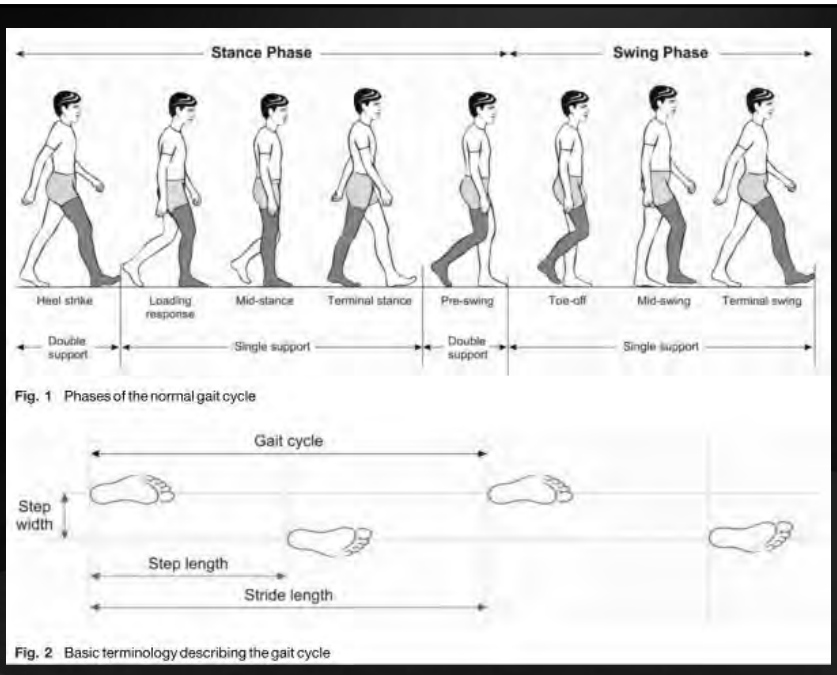

Wien Klin Wochenschr (2017) 129:81–95

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Table 5 Phenomenological classification of gait disorders (modified from Ružička and Jankovic [9])

Gait disorder	Characteristics
Hemispastic gait	Unilateral extension and circumduction
Paraspastic gait	Bilateral extension and adduction, stiff
Ataxic gait	Broad base, lack of coordination
Sensory ataxic gait	Cautious, worsening without visual input
Cautious gait	Broad based, cautious, slow, anxious
Freezing gait	Blockage, e.g. on turning
Propulsive gait	Centre of gravity in front of body, festination
Astasia	Primary impairment of stance/balance
Dystonic gait	Abnormal posture of foot/leg
Choreatic gait	Irregular, dance-like, broad-based
Steppage gait	Weakness of foot extensors
Waddling gait	Broad-based, swaying, drop of swinging leg
Antalgic gait	Shortened stance phase on affected side
Vertiginous gait	Insecure, tendency to fall to one side
Psychogenic gait disorder	Bizarre, rarely falls

Wien Klin Wochenschr (2017) 129:81–95

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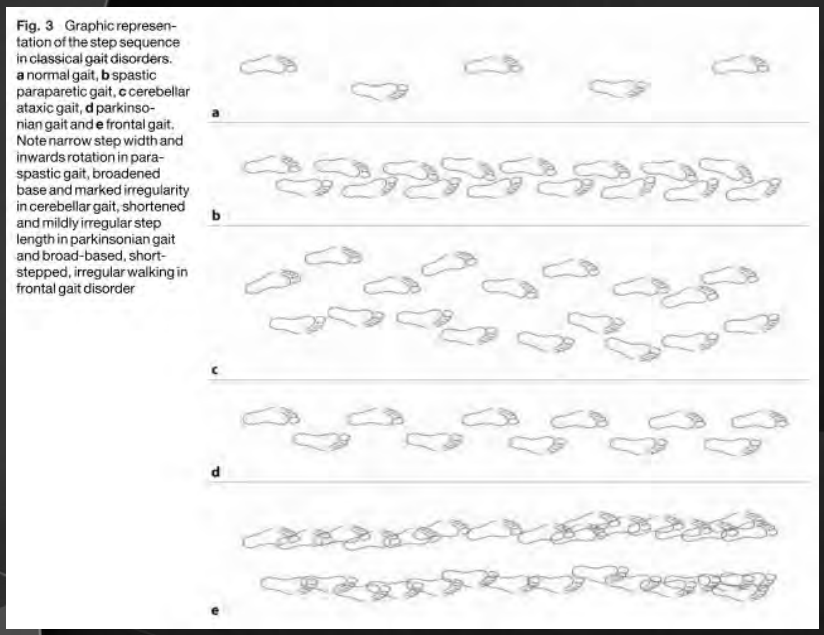

Fig. 3 Graphic representation of the step sequence in classical gait disorders. **a** normal gait, **b** spastic paraparetic gait, **c** cerebellar ataxic gait, **d** parkinsonian gait and **e** frontal gait. Note narrow step width and inwards rotation in paraspastic gait, broadened base and marked irregularity in cerebellar gait, shortened and mildly irregular step length in parkinsonian gait and broad-based, short-stepped, irregular walking in frontal gait disorder

Normal Gait

Spastic Paraplegic Gait

Cerebellar Ataxic Gait

Parkinsonian Gait

Frontal Gait

Wien Klin Wochenschr (2017) 129:81–95

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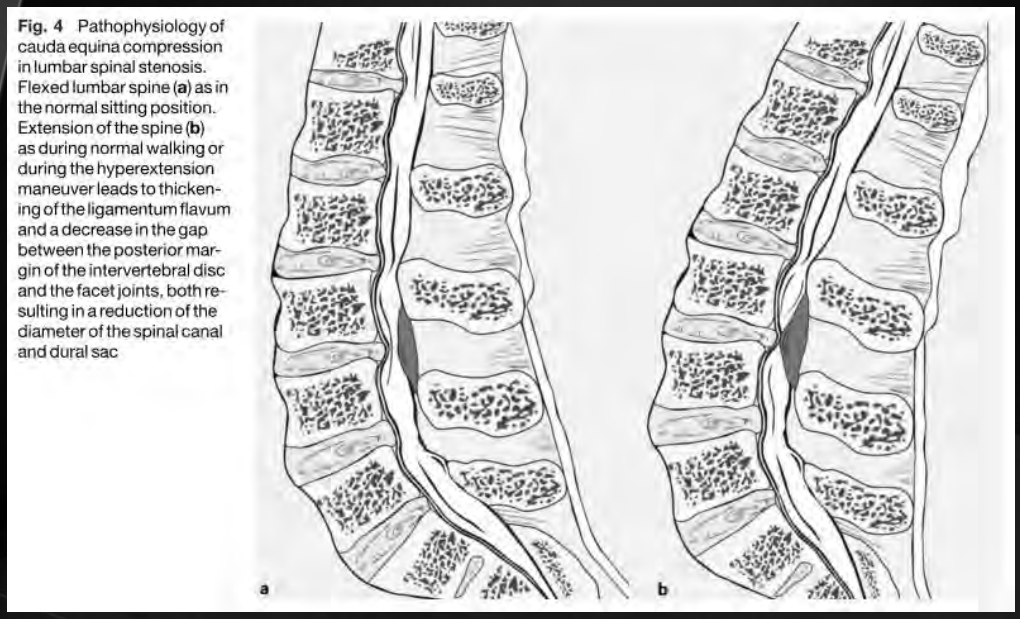

Fig. 4 Pathophysiology of cauda equina compression in lumbar spinal stenosis. Flexed lumbar spine (**a**) as in the normal sitting position. Extension of the spine (**b**) as during normal walking or during the hyperextension maneuver leads to thickening of the ligamentum flavum and a decrease in the gap between the posterior margin of the intervertebral disc and the facet joints, both resulting in a reduction of the diameter of the spinal canal and dural sac

Wien Klin Wochenschr (2017) 129:81–95

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Table 4 General measures to prevent falls and fall-related injuries

Check entire list of medication
Avoid sedatives, particularly with long half-life
Avoid (classical) neuroleptics and tricyclic antidepressants
Check the indications for and dose of atypical neuroleptics
Increase physical activity
Healthy diet, avoid malnutrition and overweight
Muscle training
Balance training
Anxiolytic and antidepressant therapy
Behavioral therapy for anxiety, depression and dementia
Therapy of orthostatic hypotension
Treatment for osteoporosis
Adequate footwear
Protective devices such as hip protectors
Remove risks at home and adjust personal environment
Electronic warning systems

Wien Klin Wochenschr (2017) 129:81–95

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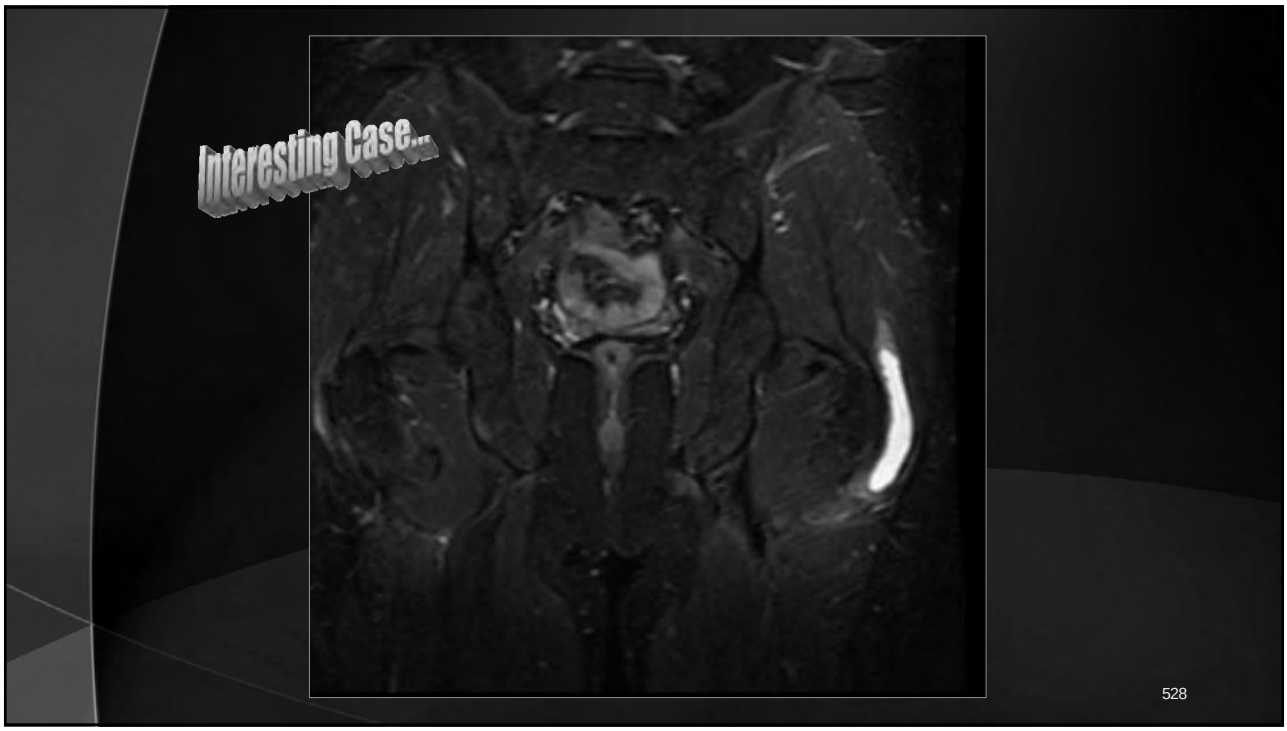

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GSPS
Cor FSE T2 FS PELVIS
Se: 4/6
Im: 13 (ASC)
Cor: A31.5
Mag: 1.6
(BSpline)
1951 January 15 F 423522
Acc: 02495362
2015 July 24
Acq Tm: 18:47:23
320 x 224
Interesting Case...
A: 1,967.28mm²
P: 168.09mm
M: 90.60
SD: 37.32
RAI
LPS
ETL: 18
TR: 3,050.0
TE: 101.7
5.0thk
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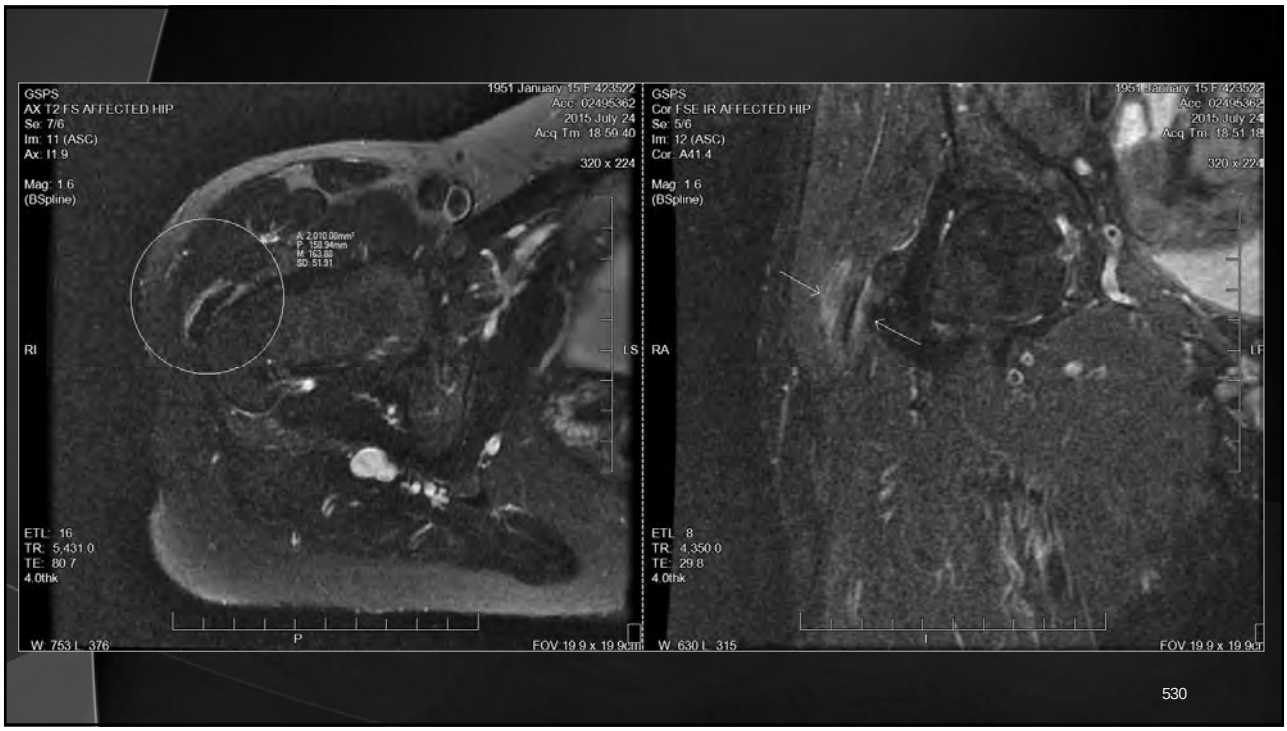
GSPS
AX T2 FS AFFECTED HIP
Se: 7/6
Im: 11 (ASC)
Ax: I1.9
Mag: 1.6
(BSpline)
1951 January 15 F 423522
Acc: 02495362
2015 July 24
Acq Tm: 18:59:40
320 x 224
A: 2,010.06mm²
P: 158.94mm
M: 163.82
SD: 51.91
RI
LS
ETL: 16
TR: 5,431.0
TE: 80.7
4.0thk
W: 753 L: 376
FOV 19.9 x 19.9cm
GSPS
Cor FSE IR AFFECTED HIP
Se: 5/6
Im: 12 (ASC)
Cor: A41.4
Mag: 1.6
(BSpline)
RA
ETL: 8
TR: 4,350.0
TE: 29.8
4.0thk
W: 630 L: 315
FOV 19.9 x 19.9cm
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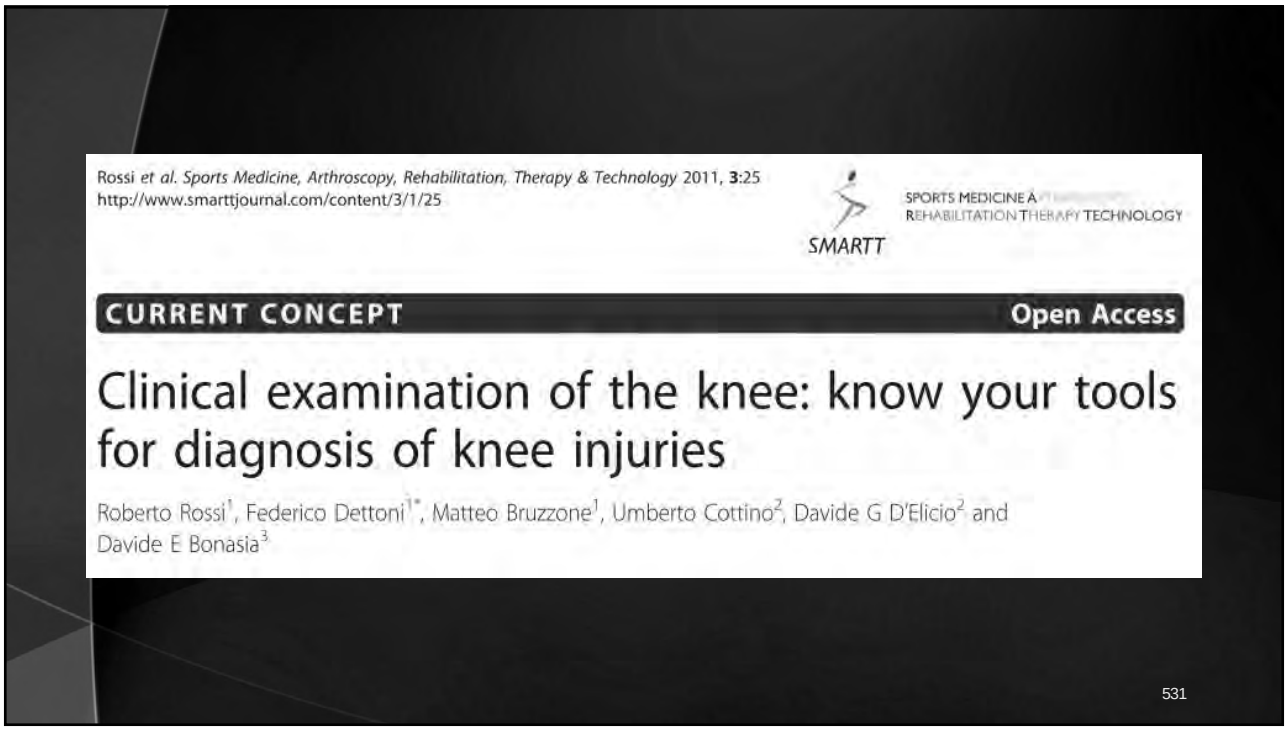

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- The clinical examination of the knee is addressed to evaluate three aspects:
  - Patellofemoral joint/extensor mechanism
  - Articular (meniscal and chondral) lesions
  - Knee instability

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25

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Figure 1 Patellar Glide (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.3]

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Figure 2 MPFL palpation test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.4]

534

Figure 3 McMurray Test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

Meniscal Palpation Tests

In *McMurray test* the knee is flexed while the leg is externally rotated, palpating the joint line with a finger. Then, the knee is slowly extended. The test for lateral meniscus is carried out by internally rotating the leg. Pain or a crackling sound is felt when the condyle engages in the meniscal lesion (Figure 3).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.5]

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Figure 4 The figure of four meniscal stress maneouver (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

In the *figure of four meniscal stress manoeuvre*, the knee is held in a "figure of 4" (Cabot's) position, then the knee swings rapidly from a varus to a valgus stress, while a finger is pushed in the joint line. This brings the meniscus toward the periphery of the joint while the finger pushes it toward the centre of the joint: the combination of these two opposite forces stresses the meniscus, raising a sharp pain in case of meniscal tear (Figure 4).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.6]

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Figure 5 Apley grinding test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010)

Meniscal Rotation Tests

Apley's (grinding) test is carried out with the patient prone and the knee flexed to 90°. Then the leg is twisted and pulled, then pushed. If pain is felt only while pushing, a meniscal lesion is diagnosed, while if no difference between distraction and compression is detected, a chondral lesion is more likely (Figure 5).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.7]

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Figure 6 Valgus and varus stress tests (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010)

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.8]

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Figure 8 Anterior Drawer test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[53.9]

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Figure 9 Lachman Test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010).

The *Lachman test* is the test for ACL evaluation easier to be performed in all settings: it can be particularly useful in those cases when the knee is examined in the first days after injury, with the knee swollen and highly painful. The test is performed holding the knee in full extension and at 30° flexion, and slightly externally rotated. As in the drawer test, besides the amount of anterior dislocation it is important the quality of the endpoint: a soft stop is highly predictive for ACL rupture, while a hard stop can indicate an intact ACL, even in case of a sensible amount of tibial traslation (Figure 9).

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25[54.0]

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Figure 12 Pivot Shift (Jerk) Test (Adapted with permission from: Rossi R, Bruzzone M, Dettoni F, Margheritini F: Clinical examination of the knee. In: Orthopedic Sports Medicine, Principles and Practice. Edited by Margheritini F, Rossi R. Milan: Springer; 2010)

Pivot Shift (jerk) Tests

These tests evaluate the rotatory instability that affects ACL deficient patients: this determines discomfort or frank pain with a shift or jerk of the knee joint, usually felt when squatting or changing direction.

An isolated ACL rupture produces a slight shift, often highly uncomfortable for the patients, while a postero-lateral corner lesion is required to determine a huge, visible and sometimes audible jerk.

Rossi et al. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:25$_{54.1}$

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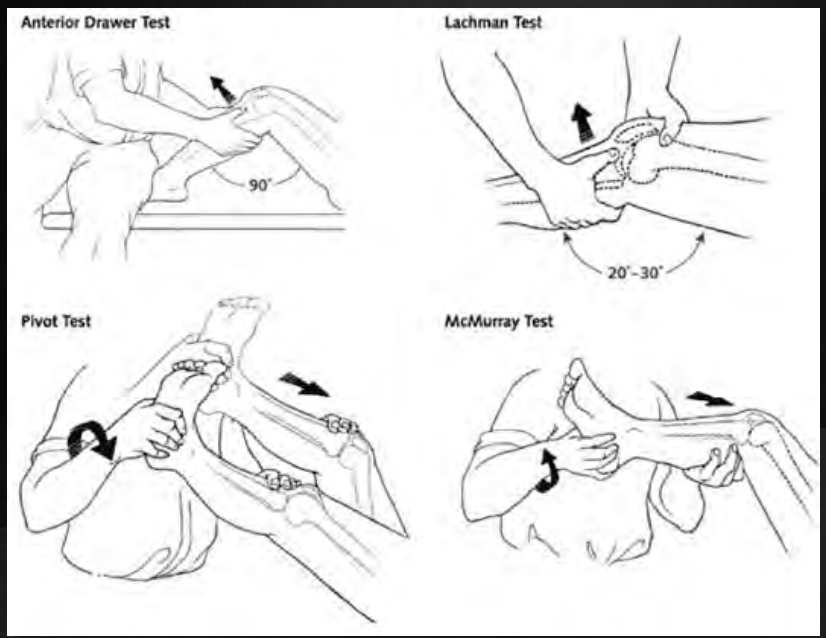

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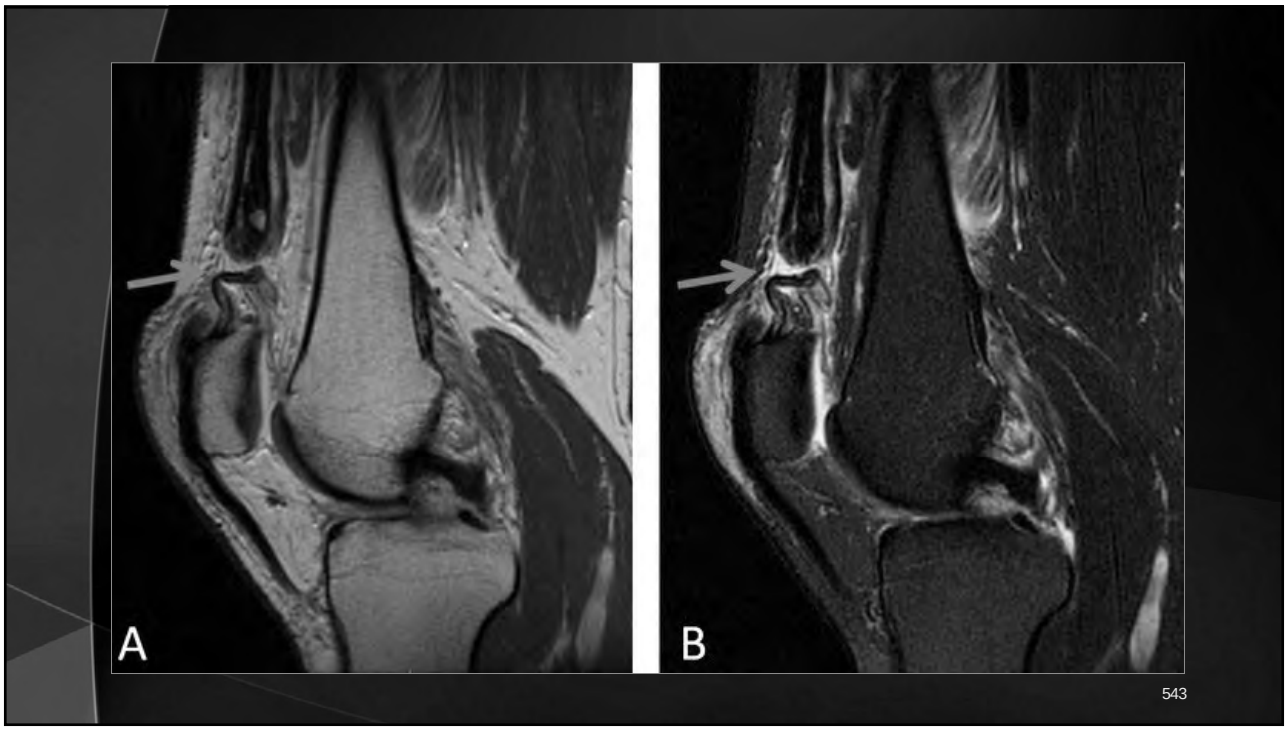

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Table 1 – Classification of quadriceps strains

Grade	Description
1 (mild)	Involve tearing of a few muscle fibers with mild pain and minimal loss of strength; pain is elicited with resisted active contraction and passive stretching; the patient may be able to continue with the activity after the injury
2 (moderate)	Involve partial tearing of muscle fibers with some strength loss; significant pain is elicited with unopposed active contraction and with passive stretching
3 (severe)	Include tearing of the entire muscle with significant loss of strength

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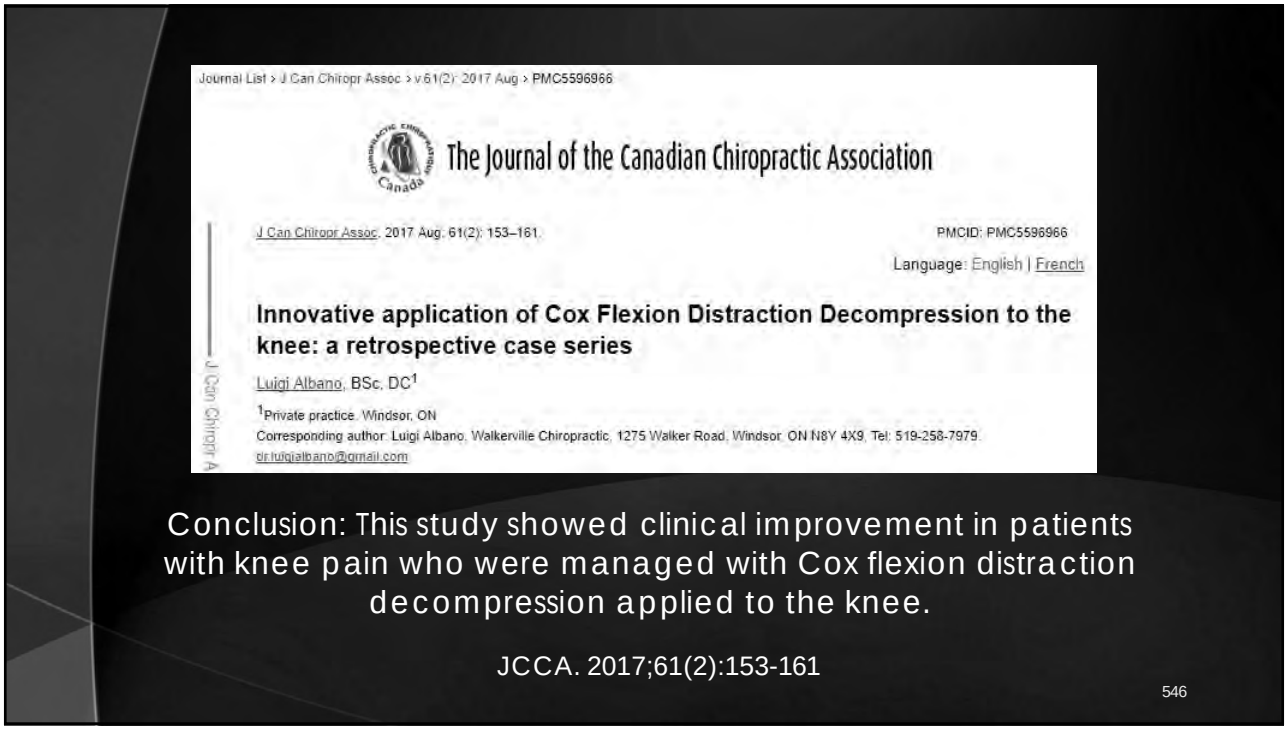

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- The dorsal section of the table was placed at an angle between 0-15 degrees below horizontal.
- The chiropractor applied downward forces above the knee and at the superior aspect of the distal tibiofibular joint.
- The table was axially distracted to the "taut point" to the point of the barrier of elasticity using a foot switch, applied according to patient tolerance.
- The knee was then distracted and brought to flexion and extension as tolerated by the patient in an oscillatory manner that was smooth and rhythmical for a minimum of 10-15 repetitions.
- Each repetition lasted 2-4 seconds. Total treatment time with Cox FDD was approximately 1 minute.

JCCA. 2017;61(2):153-161

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Figure 1.
Initial setup.

JCCA. 2017;61(2):153-161

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ORIGINAL ARTICLE

Myofascial pain in patients waitlisted for total knee arthroplasty

Richard Henry MD[1], Catherine M Cahill PhD[1,2,3], Gavin Wood MD[4], Jennifer Hroch[1], Rosemary Wilson RN(EC) PhD[1,3], Tracy Cupido DO[1], Elizabeth VanDenKerkhof RN DrPH[1,3]

R Henry, CM Cahill, G Wood, et al. Myofascial pain in patients waitlisted for total knee arthroplasty. Pain Res Manage 2012;17(5):321-327.

La douleur myoaponévrotique chez les patients en attente d'une arthroplastie totale du genou

CONCLUSION: All patients had trigger points in the vastus and gastrocnemius muscles, and 92% of patients experienced significant pain relief with trigger point injections at the first visit, indicating that a significant proportion of the OA knee pain was myofascial in origin. Further investigation is warranted to determine the prevalence of myofascial pain and whether treatment delays or prevents TKA.

Pain Res Manage Vol 17 No 5 September/October 2012

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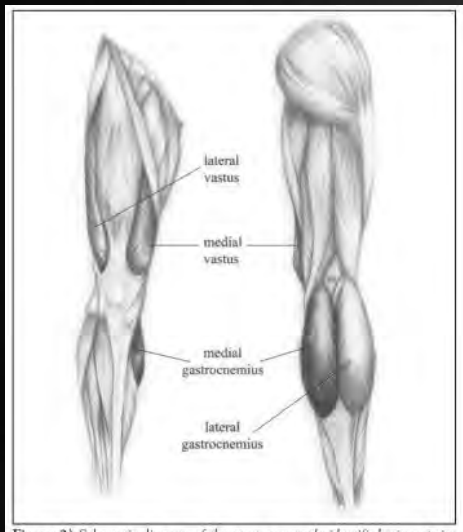

Figure 2) *Schematic diagram of the most commonly identified trigger point locations in the present study. Muscles coloured in red presented with the most common active trigger points that accounted for knee pain. The intensity of the colour shading indicates the most common muscle affected, with the deep red colour indicating the muscle with the most prominent active trigger points*

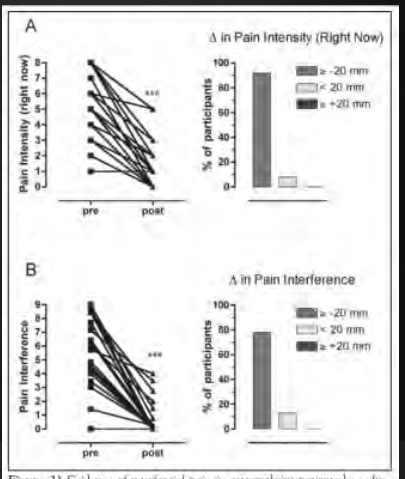

Figure 3) *Evidence of myofascial pain in osteoarthritis patients by reductions in pain scores before (pre) and following (post) intervention at the first interview (week 0) as measured by the brief pain inventory questionnaire. A Pain intensity right now was significantly attenuated, with 92% of participants reporting a reduction of more than 20 mm on a 100 mm scale (right column). B Pain interference was significantly attenuated, with 78% of participants reporting a reduction of more than 20 mm on a 100 mm scale. Statistical analysis were performed with a Wilcoxon signed-rank test comparing pre- and post-trigger point injection values. ***P<0.001*

Pain Res Manage Vol 17 No 5 September/October 2012

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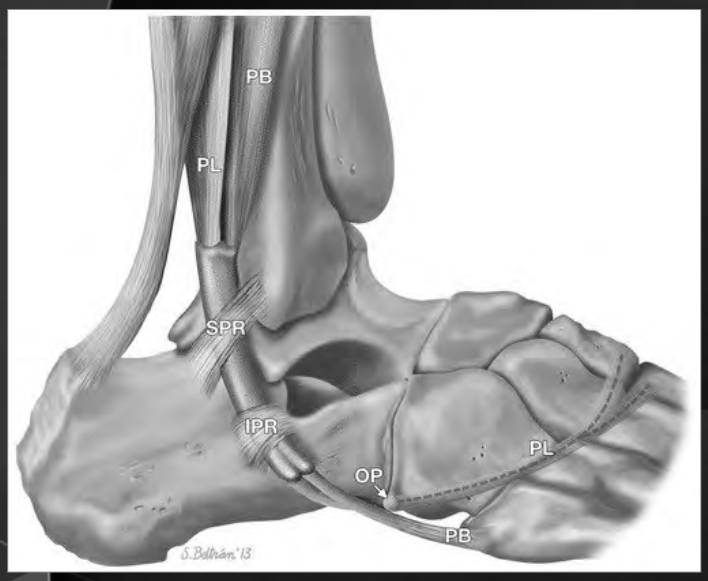

PB = peroneus brevis

PL = peroneus longus

SPR = superior peroneal retinaculum

IPR = inferior peroneal retinaculum

RadioGraphics 2015; 35:179–199

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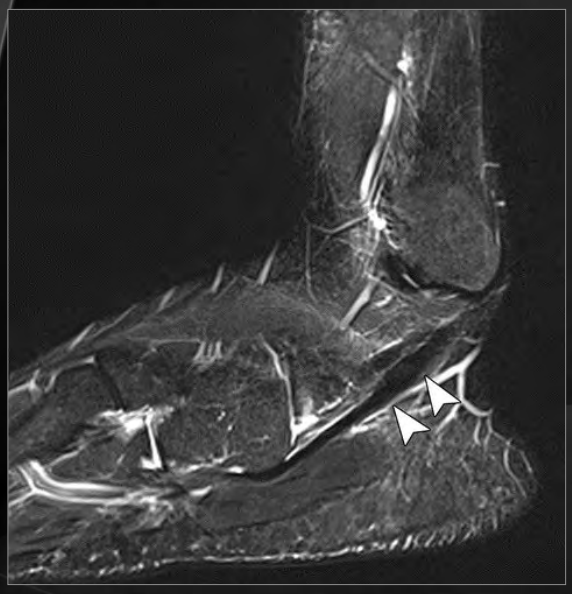

Severe tendonopathy of the PL tendon.

RadioGraphics 2015; 35:179–199

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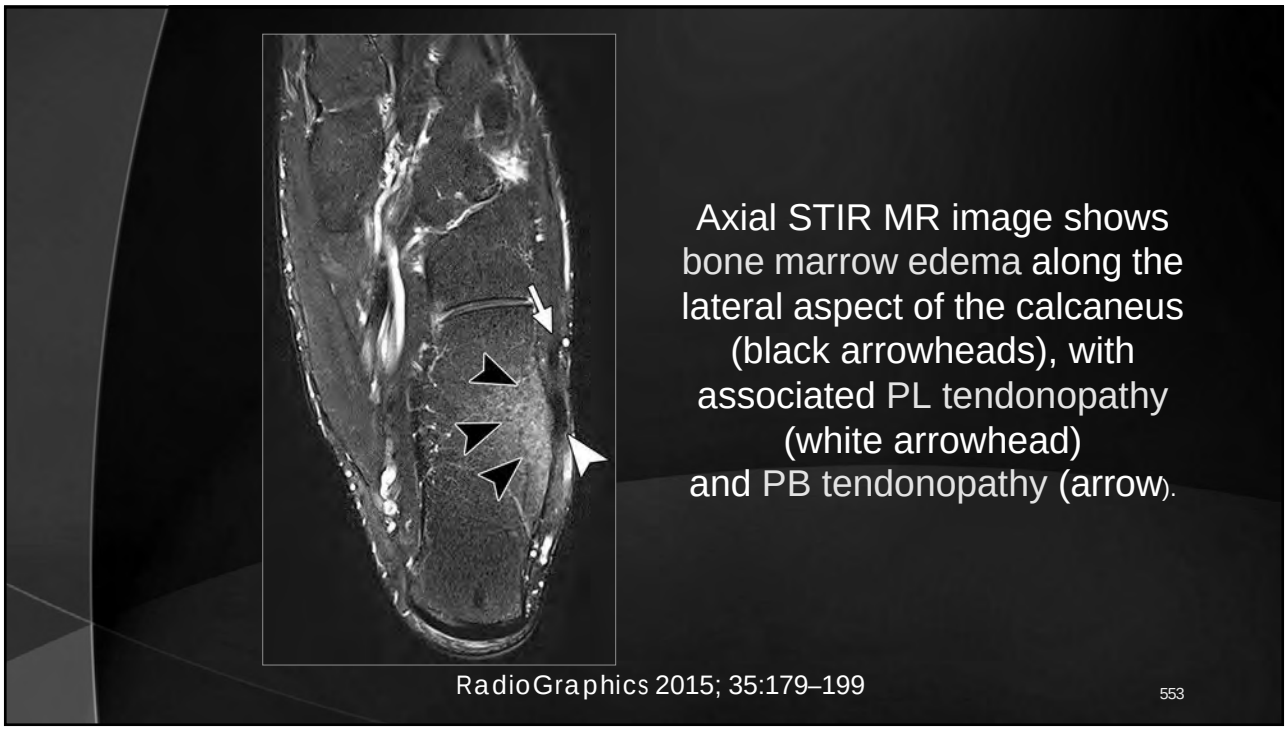
Axial STIR MR image shows bone marrow edema along the lateral aspect of the calcaneus (black arrowheads), with associated PL tendonopathy (white arrowhead) and PB tendonopathy (arrow).
RadioGraphics 2015; 35:179–199
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Interesting Case...
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Retrocalcaneal Bursitis

- Refers to inflammation of the retrocalcaneal bursa, which lies between the antero-inferior calcaneal tendon and posterosuperior calcaneus. It forms part of Haglund syndrome.
- **Clinical presentation**
  - Patients present with posterior ankle pain made worse by passive dorsiflexion of the ankle with swelling/erythema in the region of the distal calcaneal tendon [3,4].
- **Pathology**
  - Retrocalcaneal bursitis rarely occurs in isolation and is almost always associated with calcaneal tendinitis and/or Haglund deformity (bony enlargement formed at posterosuperior aspect of calcaneum).
- **Aetiology**
  - Causes includes
  - calcaneal tendon injury: rupture or tendinitis
  - inflammatory arthropathies: Reiter syndrome, ankylosing spondylitis, rheumatoid arthritis
  - calcaneal fractures
  - infectious bursitis

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Surgical and Radiologic Anatomy
https://doi.org/10.1007/s00276-018-2124-z

ORIGINAL ARTICLE

Clinical-anatomic mapping of the tarsal tunnel with regard to Baxter's neuropathy in recalcitrant heel pain syndrome: part I

Simone Moroni[1,2] · Marit Zwierzina[3] · Vasco Starke[4] · Bernhard Moriggl[4] · Ferruccio Montesi[5] · Marko Konschake[4]

Received: 17 September 2018 / Accepted: 21 October 2018

- First branch of lateral plantar nerve, also known as Baxter's nerve (BN).
- The BN might be the most common cause of chronic heel pain syndrome of neurological origin
- BN provides a motor branch for the abductor digiti minimi muscle and sensory afferent through the calcaneal branch of the inferior calcaneal nerve from the periosteum of the medial calcaneal tuberosity.

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© Med Sci Monit, 2010; 16(4): CS50-53
PMID: 20357723

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Published: 2010.04.01

Bilateral Baxter's neuropathy secondary to plantar fasciitis

Authors' Contribution:
A Study Design

Berna Dirim[1,3,B,G], Donald Resnick[2,3D], Nesibe Kurt Özenler[1,B]

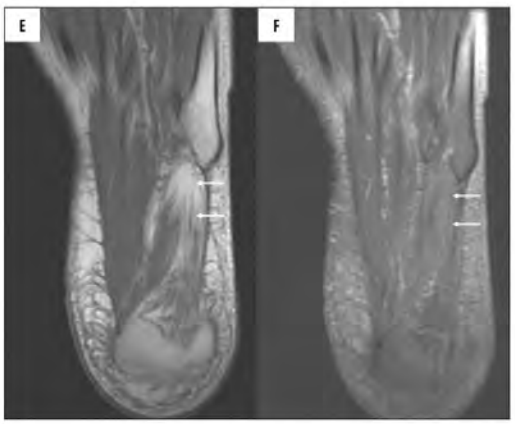

Figure 1E,F. SE T1-weighted axial (**E**) and fat suppressed FSE T2-weighted axial (**F**) images of left foot show the atrophy of the abductor digiti minimi muscle (arrows) attached to the base of the 5th metatarsus.

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Skeletal Radiol (2008) 37:505–510
DOI 10.1007/s00256-008-0455-2

SCIENTIFIC ARTICLE

Plantar fasciitis and calcaneal spur formation are associated with abductor digiti minimi atrophy on MRI of the foot

Usha Chundru · Amy Liebeskind · Frank Seidelmann · Joshua Fogel · Peter Franklin · Javier Beltran

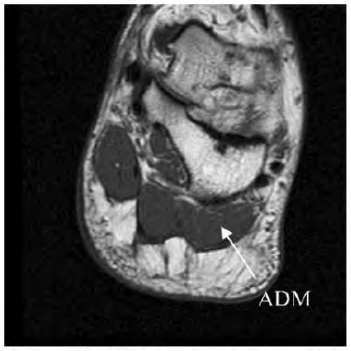

Fig. 1 Coronal T1-weighted image demonstrating normal abductor digiti minimi (*ADM*) muscle

Fig. 2 Coronal T1-weighted image demonstrating fatty replacement of the abductor digiti minimi muscle (*ADM*), indicating atrophy

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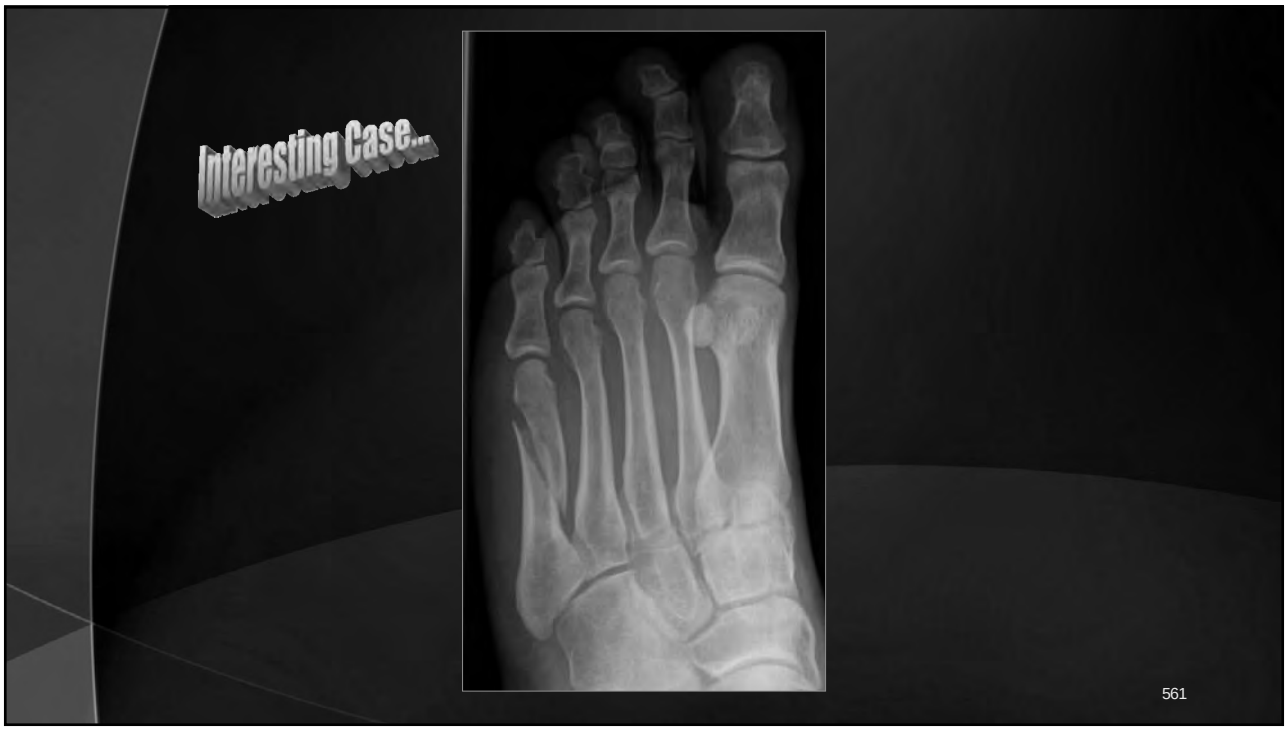

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Lower Extremities

1. **T or F** Acute trochanteric bursitis should appear as increased signal intensity on T2-weighted images and decreased signal intensity on T1-weighted images

2. **T or F** Haglund deformity is a bony enlargement formed at posterosuperior aspect of calcaneum that is often associated with retrocalcaneal bursitis.

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Quiz

Name:_____

- **Introduction:**
  1. T or F
  2. T or F
- **Trauma/Biology/CT:**
  1. T or F
  2. T or F
- **Myositis:**
  1. T or F
  2. T or F
- **Capsulitis:**
  1. T or F
  2. T or F
- **Discogenic issues:**
  1. T or F
  2. T or F
- **CNS/Radiculitis:**
  1. T or F
  2. *T or F*
- ***Spine/trunk:***
  1. *T or F*
  2. *T or F*
- ***Upper extremities:***
  1. *T or F*
  2. *T or F*
- ***Lower extremities:***
  1. *T or F*
  2. *T or F*

Thank you for attending our class!

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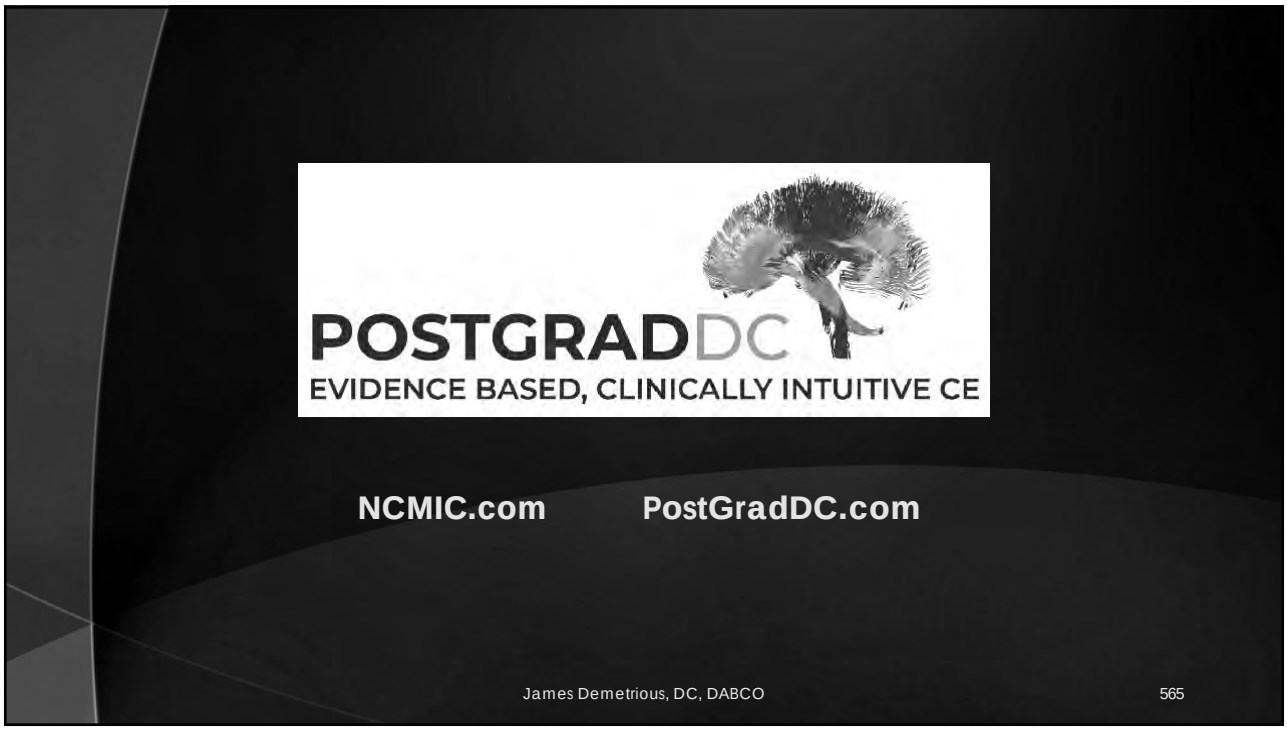

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