



Lumbar Spine CT: Assessing Imaging Scan Protocol

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Disclosures

- ▶ Nothing to disclose.

Canadian Association of Radiologists Referral Guidelines for Lower Back Pain

Clinical/Diagnostic Problem	Investigation	Recommendation (Grade)	Dose	Comment
C06. Lower back pain <i>(continued)</i>	CT	Indicated in special circumstances [B]	☼☼	<p>Imaging is only indicated if there are "red flag" indications:</p> <p>If there is clinical concern about an epidural abscess or hematoma which may present with acute pain but no neurological symptoms, urgent imaging is required.</p> <ul style="list-style-type: none"> • Suspected cancer • Suspected infection. • Cauda equina syndrome • Severe/progressive neurologic deficit • Suspected compression fracture <p>In patients with suspected uncomplicated herniated disc or spinal stenosis imaging is only indicated after an unsuccessful 4- 6 week trial of conservative management.</p> <p>CT is only indicated if MRI is contraindicated or unavailable. CT can provide excellent imaging. In very large patients, image noise can be a problem. The radiation dose is also a consideration.</p>

Herniated Lumbar Disc Location(s)

Over 95 percent of clinically important lumbar disc herniation occur at L4-5 and L5-S1. Whereas high lumbar disc herniation is so rare they are reported in the literature as case reports demonstrated below.

[L1-2 lumbar disc herniation: a case report].

[Article in Japanese]

[Monobe T](#)¹, [Fujita T](#), [Nakaue Y](#), [Nishi N](#).

Spine (Phila Pa 1976). 1990 Jul;15(7):679-82.

High lumbar disc degeneration. Incidence and etiology.

[Hsu K](#)¹, [Zucherman J](#), [Shea W](#), [Kaiser J](#), [White A](#), [Schofferman J](#), [Amelon C](#).

Question?

- ▶ If high lumbar disc herniation is so rare then why do we initially image L1-3 intervertebral levels in outpatients presenting with low back/leg pain and no red flags?

Purpose

- ▶ Audit CT lumbar spines to determine if our institutions are using appropriate guidelines and to suggest a standard protocol for optimizing radiation dose and range of scan.

Hypothesis

- ▶ CT imaging of the upper lumbar spine levels in this patient population is low yield while needlessly exposing the patient to radiation.

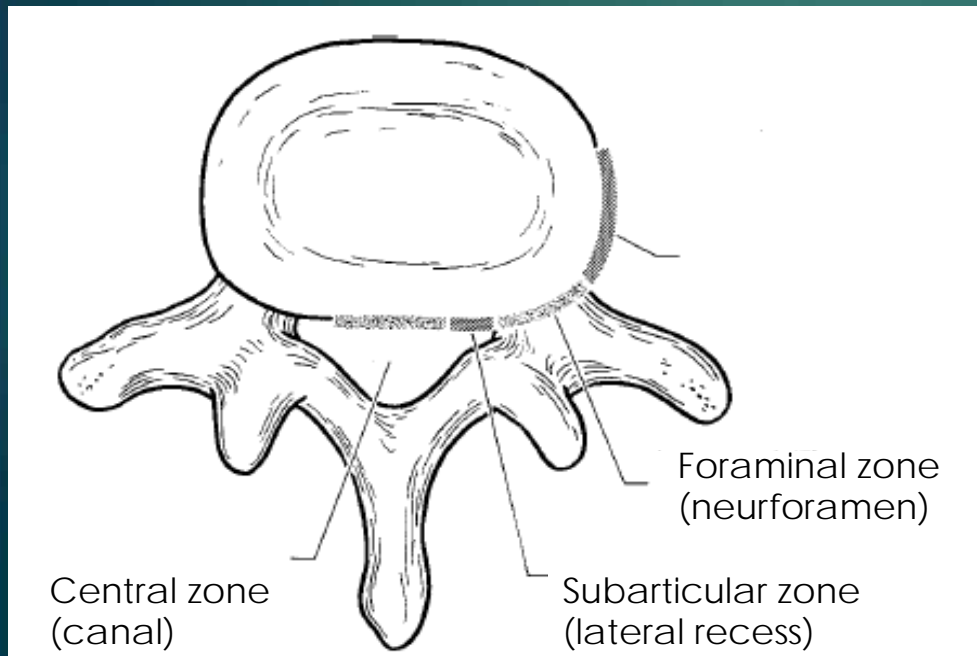
Methods

- ▶ Retrospective case audit of CT L1-S1 studies for neuroforamen/lateral recess or central canal stenosis.
- ▶ 3 Hospital Sites in St. John's
- ▶ N= 56 adults with low back/leg pain and no red flags
- ▶ N= 9 exclusions

Nomenclature and Classification of Lumbar Disc Pathology

Recommendations of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology

David F. Fardon, MD,* and Pierre C. Milette, MD†



NEUROFORAMEN\LATERAL RECESS

subarticular zone The zone, within the vertebral canal, sagittally between the plane of the medial edges of the pedicles and the plane of the medial edges of the facets, and coronally between the planes of the posterior surfaces of the vertebral bodies and the under anterior surfaces of the superior facets. Syn: lateral recess, posterolateral zone Note: The subarticular zone cannot be

foraminal zone The zone between planes passing through the medial and lateral edges of the pedicles.

CENTRAL CANAL

central zone Zone within the vertebral canal between sagittal planes through the medial edges of each facet.

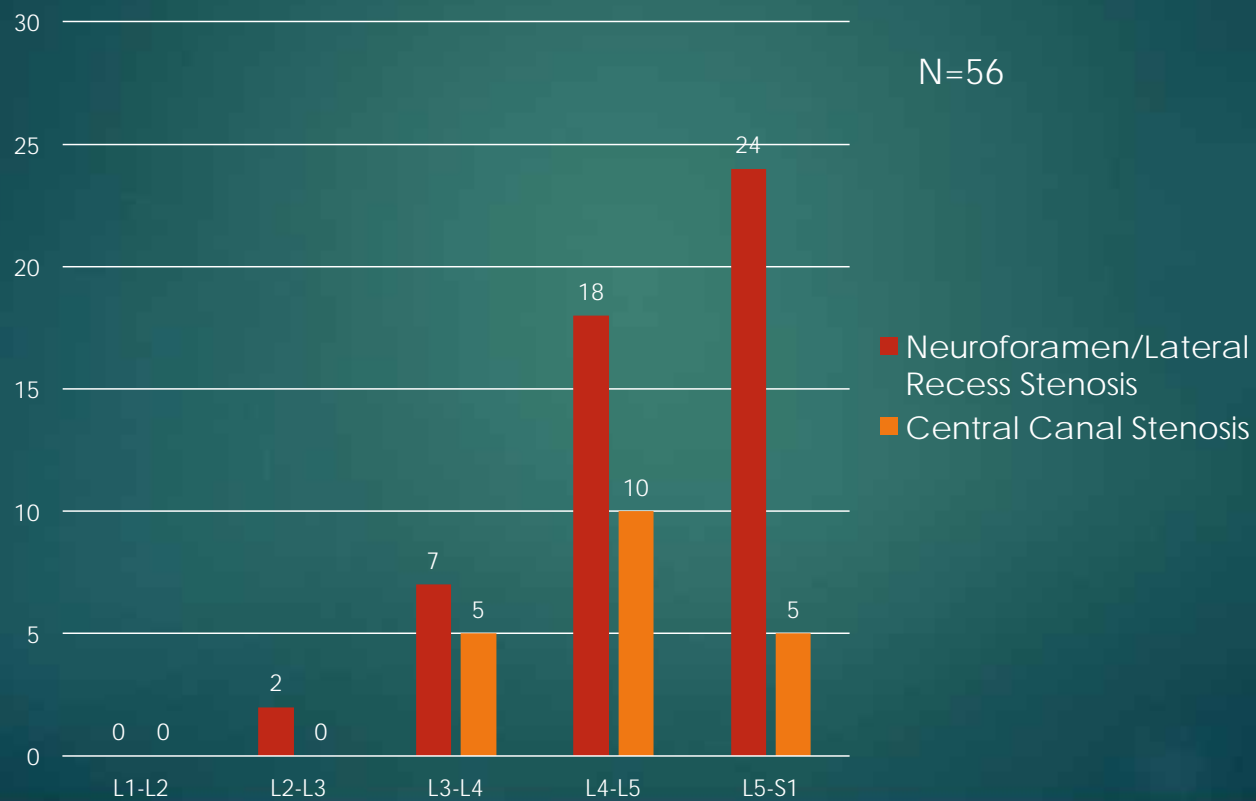
Patients Included

PATIENT IDENTIFIER	N=56
AVERAGE AGE	51
FEMALE	27
MALE	29
LOW BACK/LEG PAIN DURATION	
ACUTE	9
CHRONIC	11
UNKNOWN	36

Patients Excluded

PATIENT IDENTIFIER	N=9
< L1-S1	6
Red Flags	3

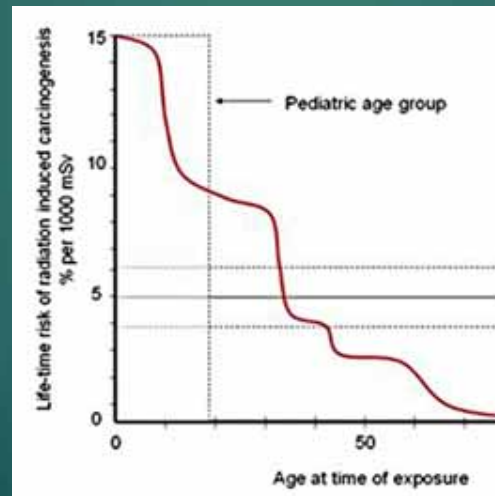
The vast majority of Radiologic Findings were at the L3-S1 Intervertebral Levels



Patients with Findings at L2/L3 had Findings at Multiple Levels

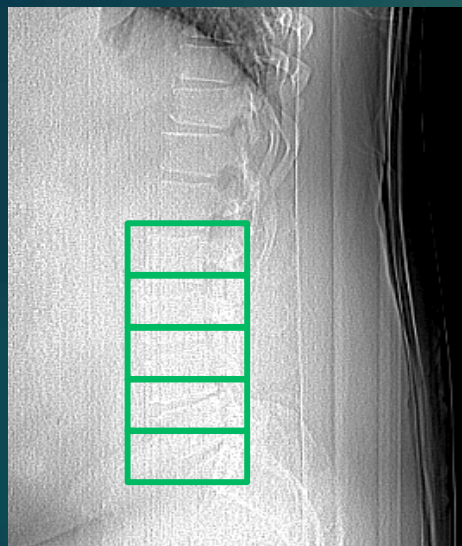
PATIENT NUMBER	Clinical Hx Given	Findings	Report
2	Acute LBP	L2 - L5	"Broad based posterior disc bulge eccentric to left appears to touch exiting left L2 nerve root. Are symptoms referable to this?"
46	"Increasing back pain"	L2 - S1	"At L2-L3 as on prior exam there is a small lateral disc protrusion just anterior to the right lateral recess which abuts the exiting L2 nerve root. This is unchanged since 2013."

If we did not scan L1/2 and L2/L3 intervertebral levels how much radiation dose would be eliminated? Is this clinically significant?



Adapted from ICRP Publication 60 (1990) <http://www.imagewisely.org/imaging-modalities/computed-tomography/medical-physicists/articles/how-to-understand-and-communicate-radiation-risk>

Calculating Effective Radiation Dose Reduction



1. Average scan uses 4-7 wide volume boxes
2. Assume 1 wide volume box/ intervertebral level
3. Average DLP $\text{mGy} \cdot \text{cm}/\text{patient} \times \text{Wt} = \text{Average mSv}/\text{patient}$
4. $1026.4 \text{ mGy} \cdot \text{cm} \times 18 = 18.5 \text{ mSv}$
5. $18.5 \text{ mSv} \times 2/5 \text{ intervertebral levels} = \underline{7.4 \text{ mSv}}$



The JW Hospital site demonstrated longer scans and a higher Effective Radiation Dose secondary to their protocol

Hospital Site	N	Average length (cm/scan)	Average (mSv/scan)	Protocol
HSC	4	19.7	11.1	L2-S1 Inclusive
SCM	2	18.8	15.8	L2-S1 Inclusive
JW	50	27.0	19.1	Half T12-S5

Summary of Results



1. Imaging guidelines were not being followed in some cases as at least 9 patients were scanned contradictory to CAR guidelines.
2. The vast majority of radiologic findings of the lumbar spine in our study occurred at L3-S1 intervertebral levels.
3. Protocols for lumbar spine imaging across hospital sites are not standardized.
4. Estimate for effective radiation dose reduction if L1-3 intervertebral levels were eliminated was 7.4 mSv.

Recommendations



1. Hospital sites should follow CAR guidelines and not image outpatients presenting with acute back/leg pain without red flags.
2. Outpatients presenting with chronic back/leg pain without red flags should begin with an L3-S1 CT Lumbar Spine Protocol unless otherwise stated.
3. Standardization of protocols across sites.

Limitations

1. The study had low power as only 65 patients were audited.
2. The effective radiation dose saved per patient assumed 1 wide volume box/intervertebral level and site standardization.
3. Unknown clinical significance of reported radiologic findings.

References

Full references available on request.

1. Fardon et al., 2014.
2. Monobe et al., 1996.
3. Hsu et al., 1990.
4. 2012 CAR Diagnostic Imaging Referral Guidelines.
5. Image Wisely, <http://www.imagewisely.org/>
6. Hude et al., 2008