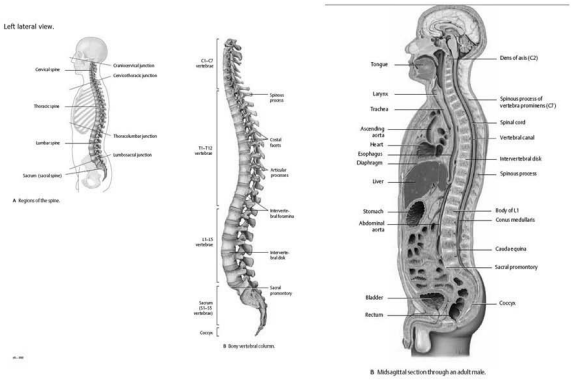
Session VI. (전공의/전문간호사)

Preoperative Radiologic Evaluation of Spinal Diseases

조 대 철
경북의대

Normal anatomy of spine



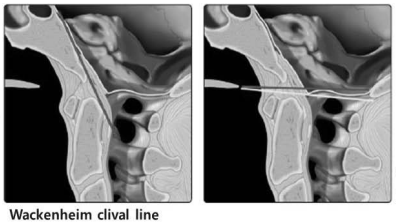
Anatomy of Cervical Spine

Radiologic Assessment

Nasion, Basion, Opisthion

Harris ring: composite shadow of C2 body, lateral mass and facet

Anatomy of Cervical Spine



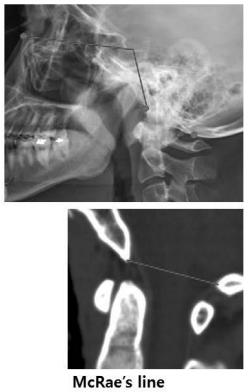
Wackenheim clival line

Chamberlain line
McGregor line

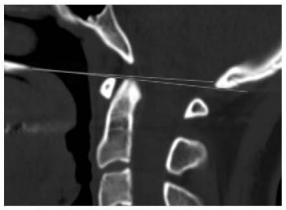
Common CV Junction Measurements

Measurement	Definition	Normal	Abnormal
Chamberlain (palatooccipital) line	Posterior hard palate to opisthion	< 2.5 mm of dens above line	Dens > 2.5 mm above line
McGregor (basal) line	Posterior hard palate to lowest point of occipital bone	Tip of dens < 4.5 mm above line	Tip of dens > 4.5 mm above line
McRae line	Basion to opisthion	Entire dens below line	< 19 mm
Wackenheim clival line	Dorsum sellae to tip of clivus	Entire dens ventral to line	Dens bisects line

Anatomy of Cervical Spine



Basal angle (n: 125°~143°)
- >144°: platybasia
- <125°: basilar kyphosis



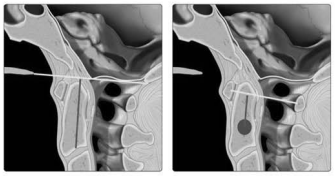
Chamberlain's line
McGregor's line

McRae's line

Anatomy of Cervical Spine

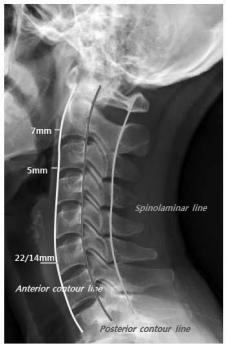
Anterior atlantodental interval	Posterior aspect of anterior C1 arch to anterior margin odontoid process	Plain films in children: < 4-5 mm; plain film in adults: Males < 3.0 mm, females < 2.5 mm; sagittal CT reformats in children: < 2.6 mm; sagittal CT in adults: Both males and females < 2.0 mm	Plain Films in children: > 4-5 mm; plain film in adults: Males > 3.0 mm, females > 2.5 mm; sagittal CT reformats in children: > 2.6 mm; sagittal CT in adults: Both males and females > 2.0 mm
Posterior atlantodental interval (PADI)	Horizontal distance from posterior dens to anterior aspect of C1 lamina or ring		Smaller is worse and relates to potential neurologic deficit
Basion dental interval (BDI)	Basion to superior aspect of odontoid process	< 12-12.5 mm in children on plain films, < 10.5 mm in children by sagittal CT, < 8.5 mm in adults	> 12 mm (Harris measurement)
Basion axial interval (BAI)	Distance between basion and a line drawn along posterior cortical margin of C2	0-12 mm on plain films	Highly variable and not recommended as primary diagnostic method
Powers ratio	Ratio of distance between basion and C1 posterior arch divided by distance between opisthion and midpoint of posterior aspect of anterior C1 arch (BC/OA)	< 1.0	> 1.0 (anterior dislocation only) posterior dissociation or vertical distraction could be missed with normal value

Anatomy of Cervical Spine



Ranawat	Distance between center of C2 pedicle and transverse axis of atlas measured along axis of odontoid process	< 15 mm in males, < 13 mm in females	≥ 15 mm in males, ≥ 13 mm in females
Redlund-Johnell line	Distance between McGregor line and midpoint of caudal margin C2	< 34 mm in males, < 29 mm in females	≥ 34 mm in males, ≥ 29 mm in females

Anatomy of Cervical Spine

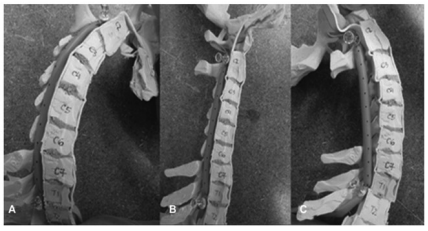


♥ Prevertebral soft tissue
- C2: 7mm in adult
- C3: 6mm in children
- 1/2-2/3 of VB AP distance

Kyphosis, Myelo-Radiculopathy

An increase in cervical malalignment

→ greater cord tension, flattening, and an increase in intramedullary pressure



Shimizu K et al, Spine, 2005

Ames CP et al, Spine, 2013

Assessment of Cervical alignment

Assessment of Cervical alignment

Cervical lordosis

C2-7 Sagittal Vertical Axis (SVA)

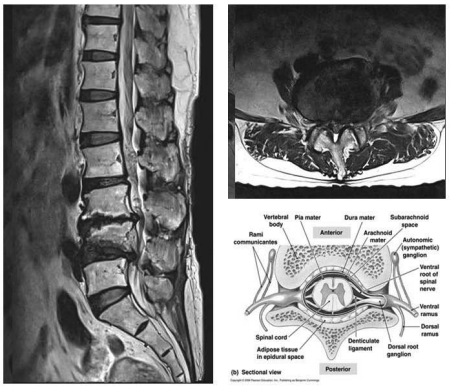
TABLE 1. Normal Segmental Cervical Angles in Asymptomatic Adults From Literature*

Level	Angle (°)
C0-C1	2.1 ± 5.0
C1-C2	−32.2 ± 7.0
C2-C3	−1.9 ± 5.2
C3-C4	−1.5 ± 5.0
C4-C5	−0.6 ± 4.4
C5-C6	−1.1 ± 5.1
C6-C7	−4.5 ± 4.3
C2-C7	−9.6
Total (C1-C7)	−41.8

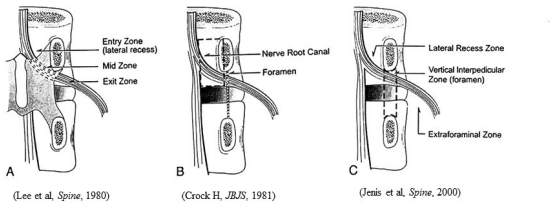
Values presented as means ± SDs, and the negative sign indicates lordosis in the segmental values.
**Adopted from Hardacker et al.[8]*
SD indicates standard deviation.

Ames CP et al, Spine, 2013

Classification of spinal stenosis

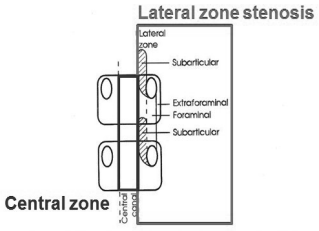


Classification of spinal stenosis



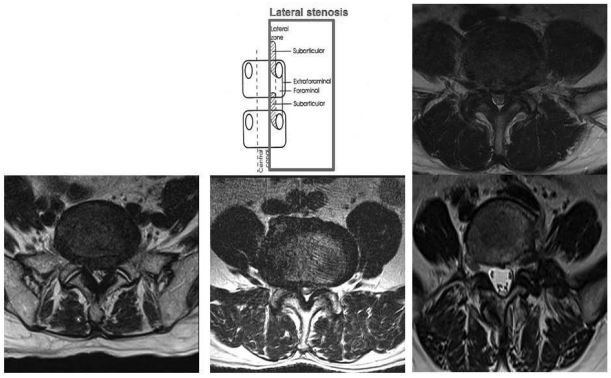
(Lee et al, *Spine*, 1980) (Crock H, *JBJS*, 1981) (Jenis et al, *Spine*, 2000)

Classification of spinal stenosis

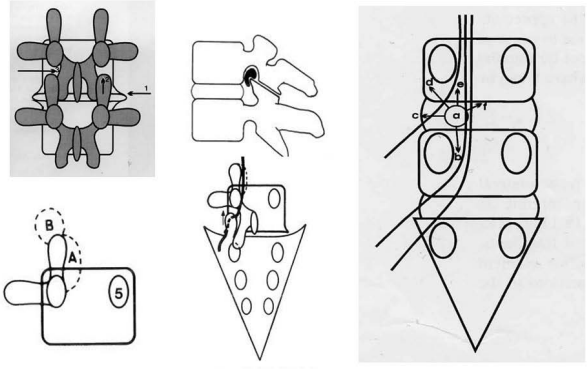


(Textbook: Essentials of Spinal Microneurosurgery)

Classification of spinal stenosis



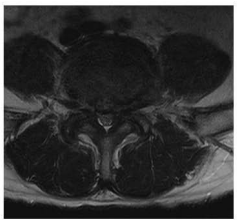
Classification of spinal stenosis



2D radiologic image vs 3D structure

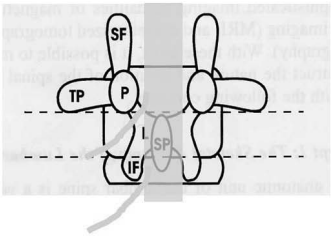
Where is the pathology?

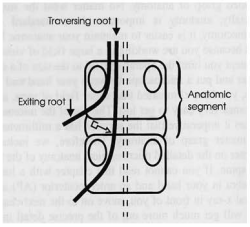
2D radiologic image vs 3D structure



Where is the pathology?

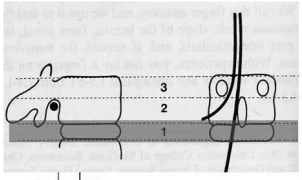
Anatomic segment

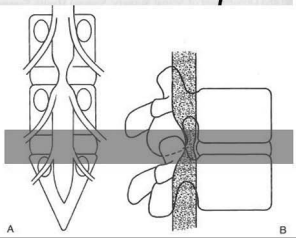




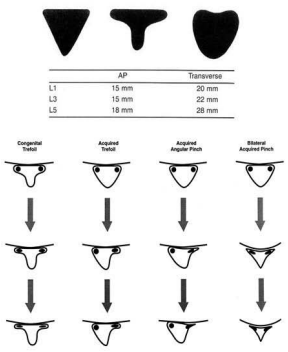
Where is the pathology?

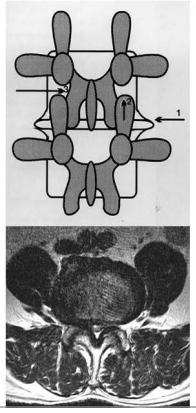
Anatomic segment



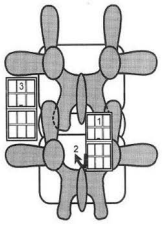


Subarticular stenosis





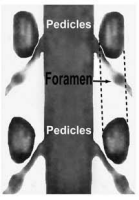
Imagine 3D anatomic segment



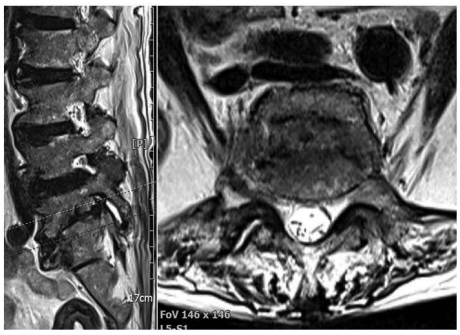
Foraminal and extraforaminal stenosis

TABLE 1. Wildermuth's MRI Grading System for Grading Lumbar Spine Foraminal Stenosis

Grade 0	Normal foramina [normal dorsolateral border of the intervertebral disk and normal form at the foraminal epidural fat (oval or inverted pear shape)]
Grade 1	Slight foraminal stenosis and deformity of the epidural fat, with the remaining fat still completely surrounding the exiting nerve root
Grade 2	Marked foraminal stenosis, with epidural fat only partially surrounding the nerve root
Grade 3	Advanced stenosis with obliteration of the epidural fat



Foraminal and extraforaminal stenosis



Foraminal and extraforaminal stenosis

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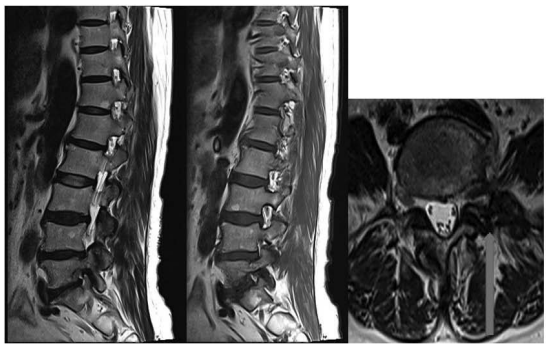
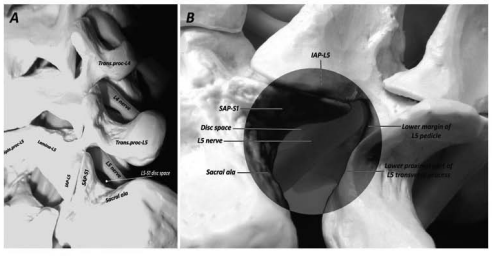
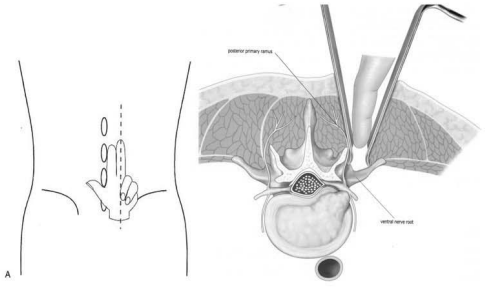


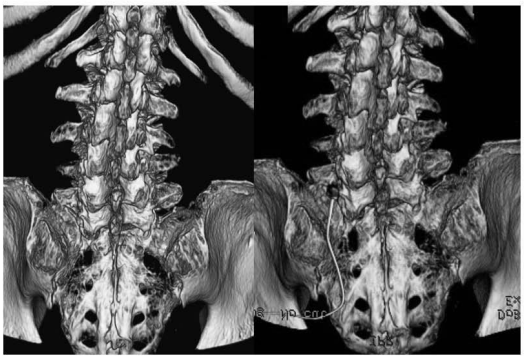
Foraminal and extraforaminal stenosis



Paramedian approach



Paramedian approach



Paramedian approach