

Spodylolyis, Spodylolisthesis

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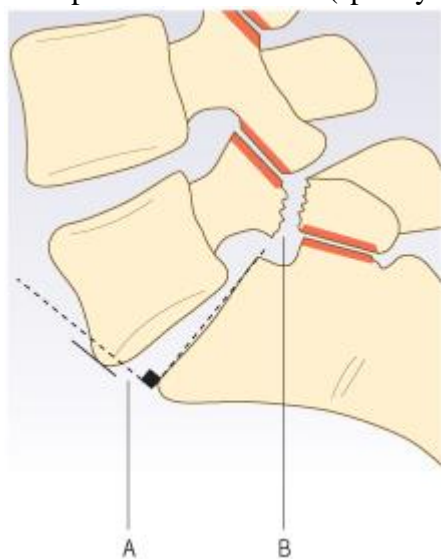
SPONDYLOLYSIS

SPONDYLOLYSIS (“vertebral loosening”) - **bony cleft in *pars interarticularis*** (segment between superior and inferior articular processes, near junction of pedicle with lamina).

- usually bilateral.
- most frequently in **L5** (occasionally, L4); rarely in cervical spine (C2), usually in association with spina bifida occulta at same level.
- relatively common (PREVALENCE ≈ 7%); frequent in young patients! (50% of chronic back pain in adolescents)
- vertebral body, pedicles, and superior articular facets may slip anteriorly and leave posterior elements behind – **spondylolytic (s. isthmic) spondylolisthesis**.

Lumbosacral junction:

- A. Anterior translation of L5 on S1 (spondylolisthesis).
- B. Defect in pars interarticularis (spondylolysis).



ETIOLOGY

- 1) **repeated minor injuries (fatigue fracture)** – esp. in sports which require spine hyperextension (such as gymnastics!).
- 2) **single injury**
- 3) **congenitally failed fusion** of posterior arch ossification centers (rare)
 - often associated with other defects: absent pedicles, absent superior articular facet, hypoplastic laminae with spinous process deviation, hypertrophy of contralateral pedicle.

CLINICAL FEATURES

- **back pain** not associated with neurological symptoms* (unless severe subluxation is present).
 *according to other sources, > 50% of patients develop **radiculopathy**

“Stork test” – ask adolescent to stand on one leg and hyperextend back; reproduction of pain is suggestive of spondylolysis:

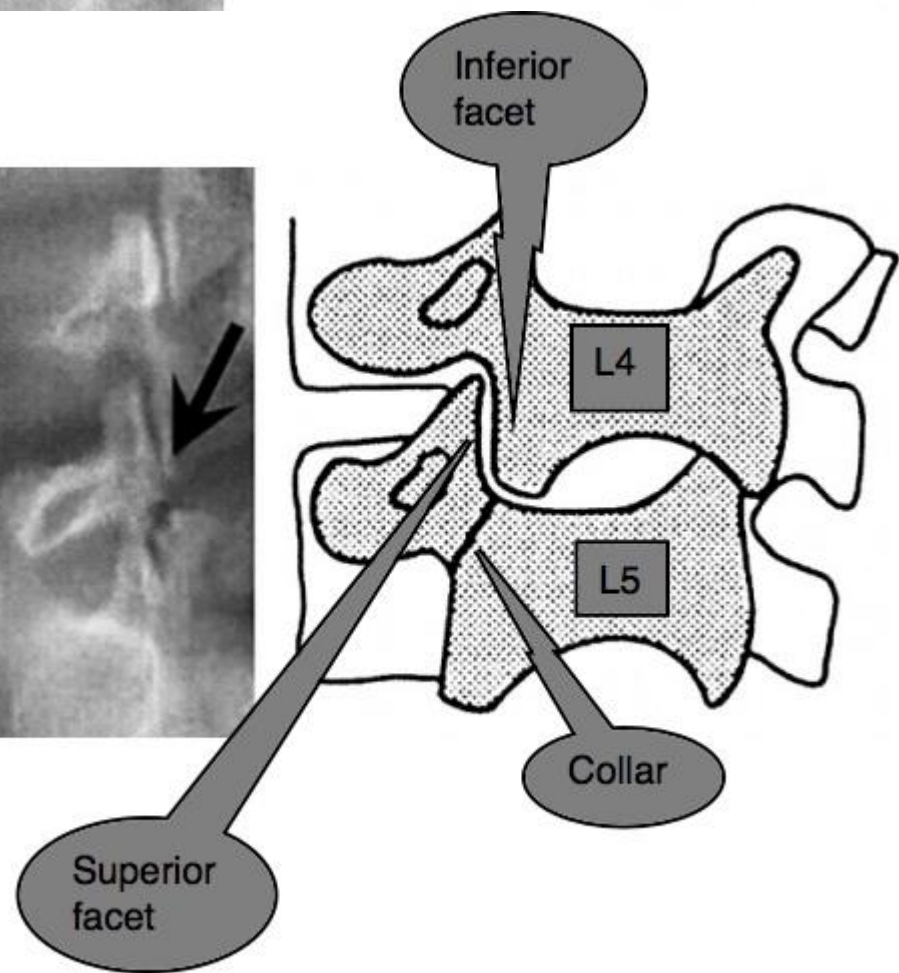
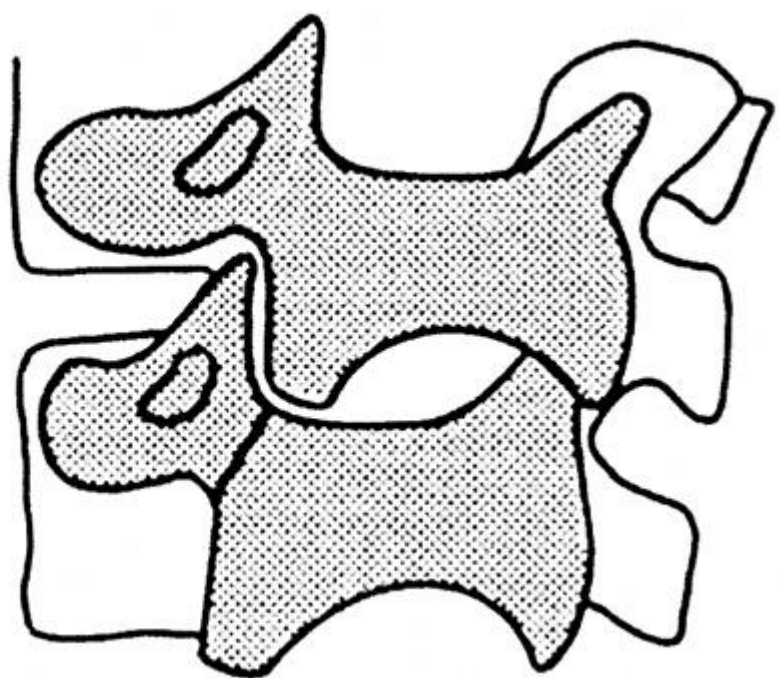
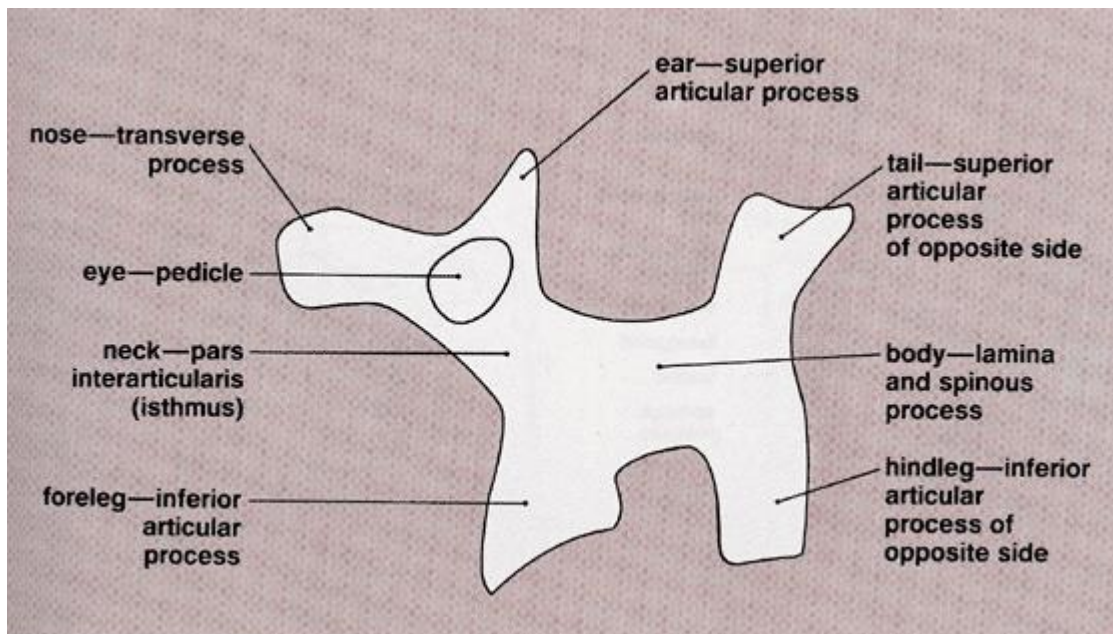


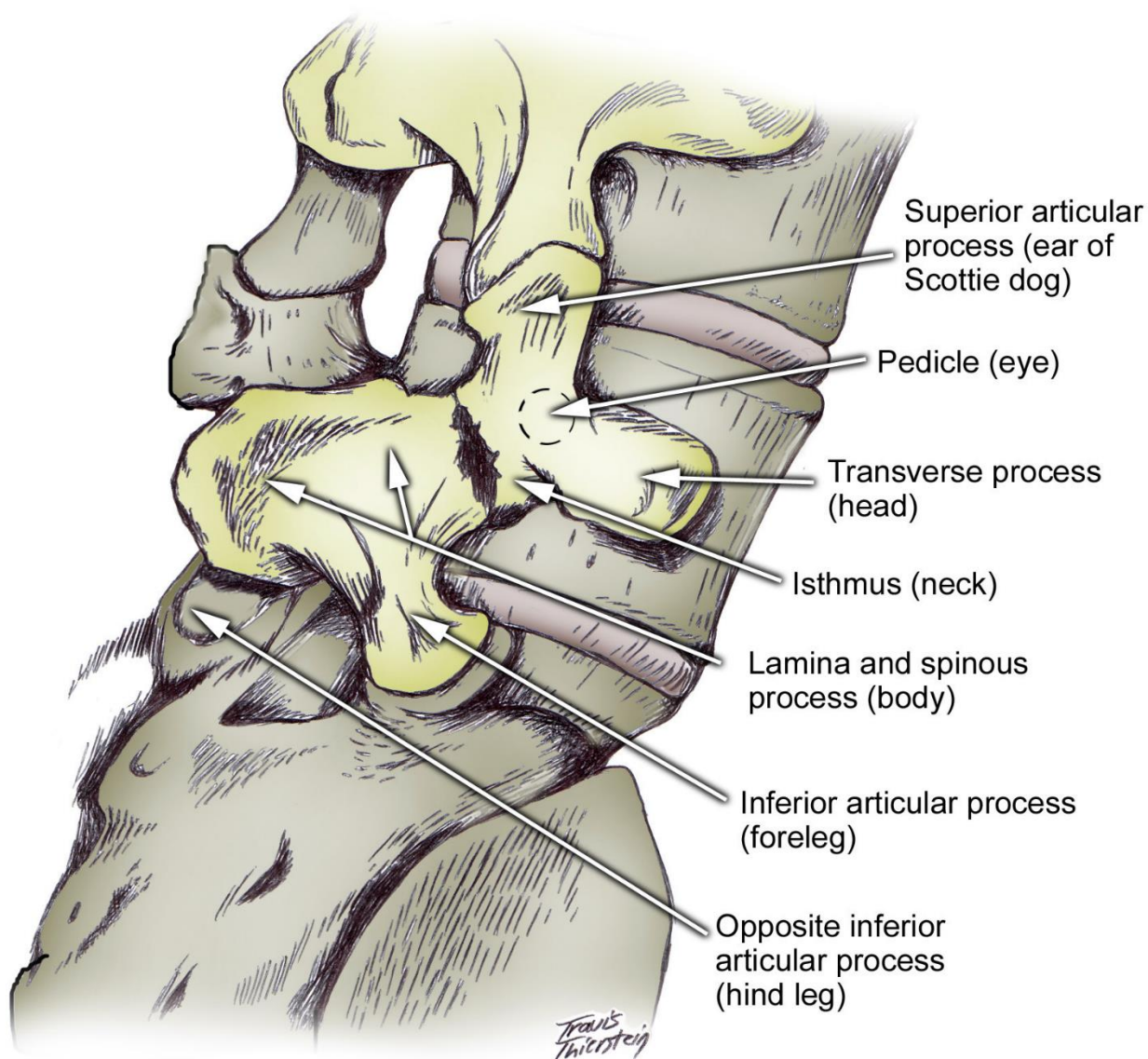
Source of picture: Edward J. Shahady “Primary Care of Musculoskeletal Problems in the Outpatient Setting” (2006); Springer; ISBN-13: 978-0387306469 >>

DIAGNOSIS

- 1) **axial CT with sagittal reformatted images** - best single test!
- 2) **standing plain X-ray (oblique* projection!)** - **irregular lucency** traversing pars interarticularis** in oblique or horizontal fashion.
 - *chronic defect often has *thick, sclerotic borders* with reactive hypertrophic bone (hypertrophic pseudarthrosis) - because of bony superimposition, AP and lateral views may not reveal defect!
 - **described as lucency across "neck of Scottie dog" (referring to appearance of posterior elements in oblique projection).

Pars defect is radiolucent “collar” on “Scottie dog” that is seen on oblique X-ray of lumbar spine:



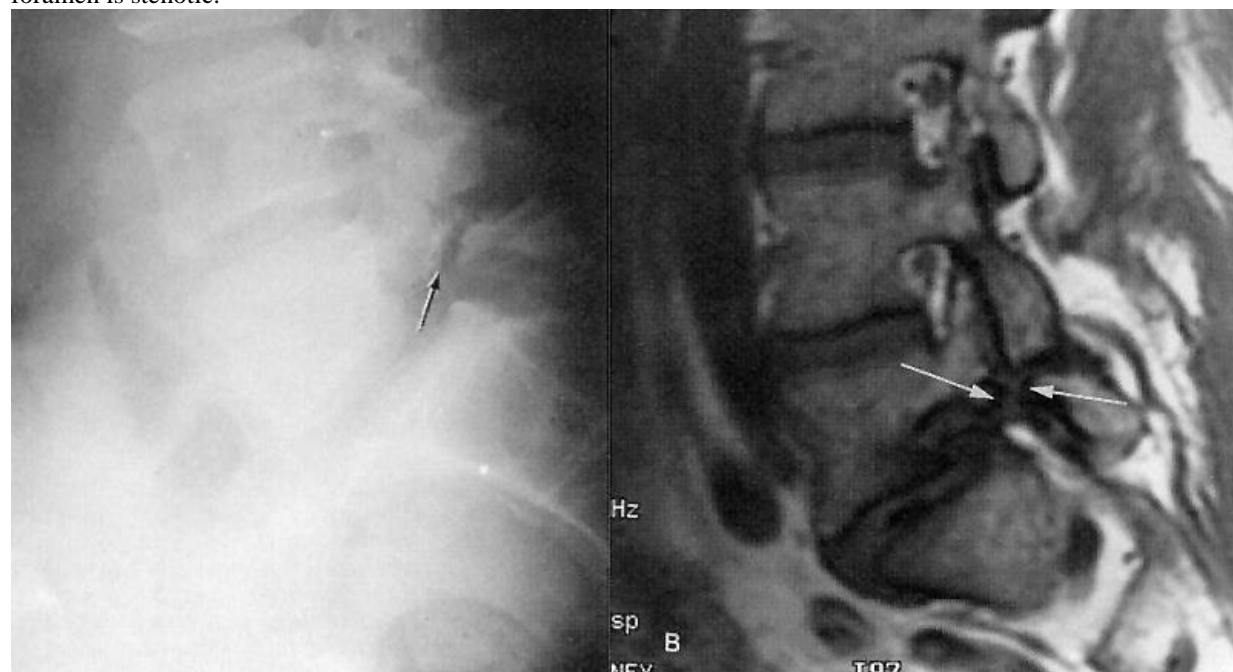


“Scottie dog” with pars interarticularis defect of L5 compared to intact L4 pars interarticularis:



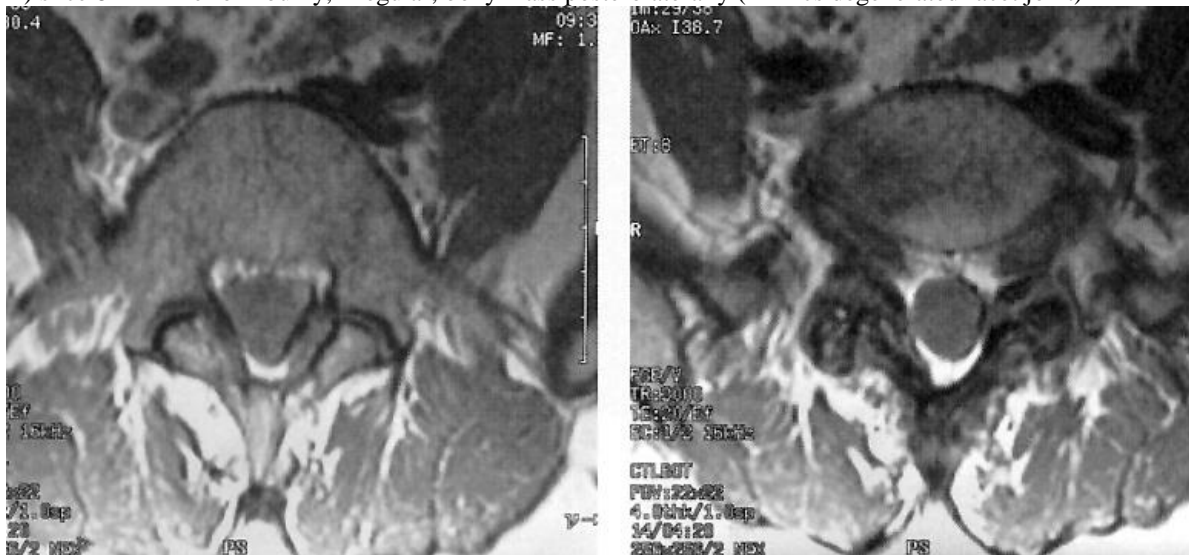
L5 spondylolytic spondylolisthesis:

- A) gap in bony isthmus (pars interarticularis) between superior and inferior articular processes; grade 2 spondylolisthesis.
- B) note hypointense borders on both sides of gap in pars interarticularis (arrows), indicating chronic spondylolysis; L5-S1 foramen is stenotic.

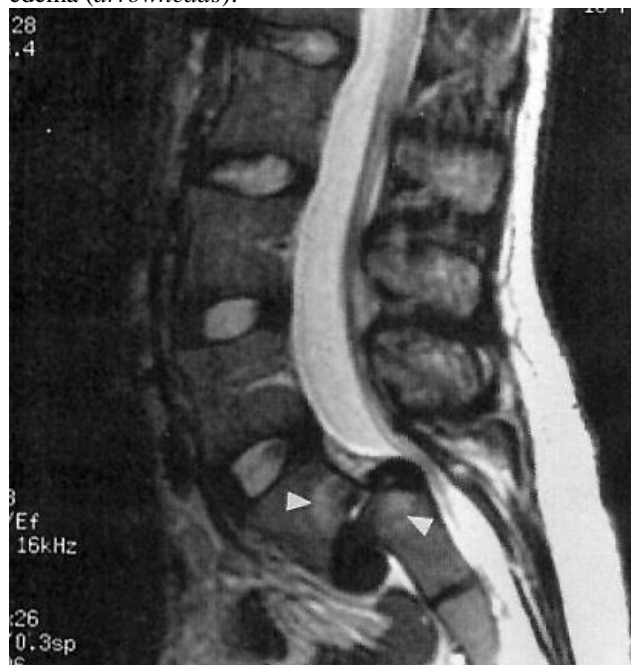


L5 spondylolysis:

- A) normal L4-5 facet joints.
- B) slice 8 mm inferior - bulky, irregular, bony mass posterolaterally (mimics degenerated facet joint)



L5 spondylolytic spondylolisthesis (grade 3) and disc degeneration in 18-year-old gymnast (T2-MRI): central canal stenosis at L5-S1 level; compare normally hydrated upper lumbar discs with involved level and with sub-end-plate marrow edema (arrowheads):



TREATMENT

Congenital, stress fractures - relative rest from hyperextension, oral pain medications, ± nonrigid brace.

- if spondylolisthesis slips to grades III and IV, pain does not respond to conservative measures, or neurological symptoms appear → fusion surgery.

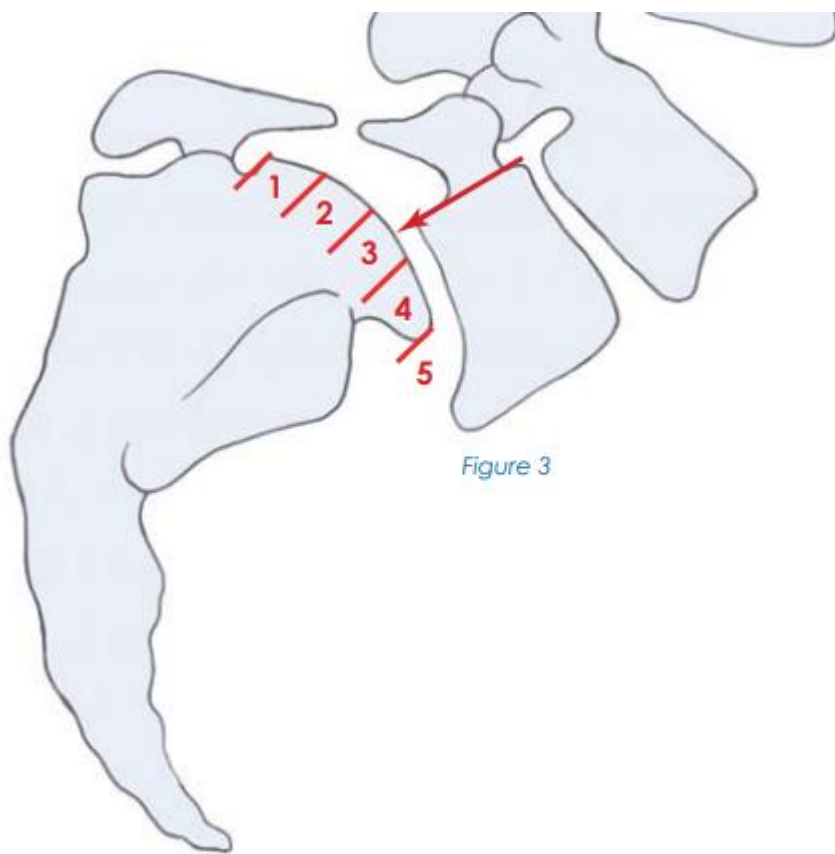
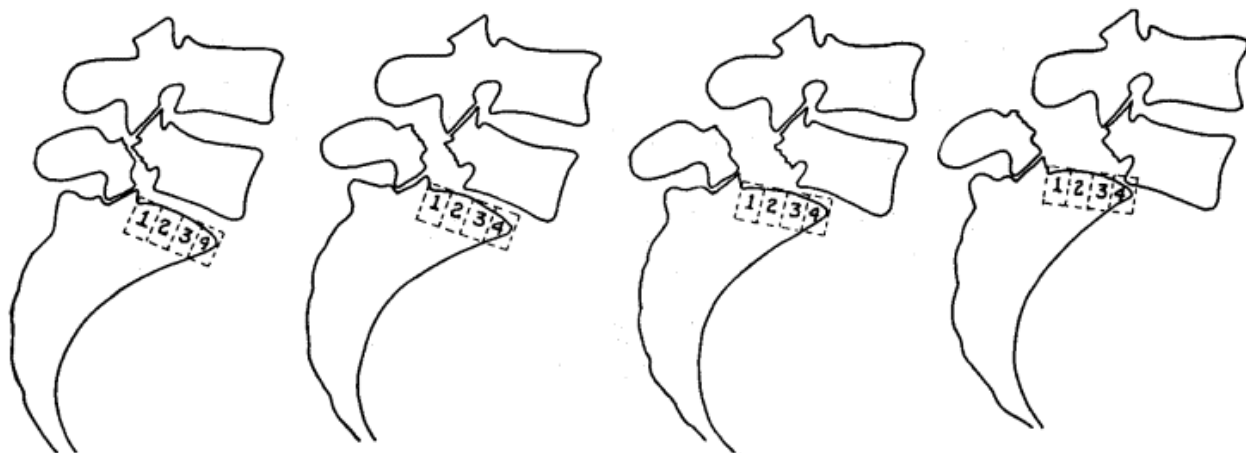
Traumatic spondylolysis – brace (TLSO often does not work; need SPICA brace).

SPONDYLOLISTHESIS

SPONDYLOLISTHESIS - displacement (slippage) of vertebra with respect to subjacent vertebra:

- in anterior direction (**anterolisthesis**) – most commonly!
- in posterior direction (**retrolisthesis**) – at level above lumbar anterolisthesis.

- most often L5 on S1 (occasionally L4 on L5).
- **MEYERDING'S classification** - *degree* of lumbar spondylolisthesis – in lateral X-ray superior surface of sacrum is divided into four equal parts:



- spondylolisthesis can be **stable (fixed)** or **unstable (dynamic)** – only relevant for surgical indications. see p. Op220 >>

ETIOLOGY

- Degenerative** - degenerative changes of facet joints and intervertebral disc.
 - additional cause in neck – inflammatory softening of transverse ligament of atlas (e.g. RA).
 - posterior elements are intact – subluxation degree is low (I or II).
 - prevalence in USA – 11.5%.
 - women : men = 6 : 1.
 - patients > 40 yrs.
- Spondylolytic (s. isthmic)** – spondylolisthesis (most commonly in C6) can be of *high degree*.
 - patients – young adults.
 - radiographic incidence in general population 3.8-8.0%
 - spondylolisthesis occurs in 40-66% of patients with **bilateral** spondylolysis; spondylolisthesis is unlikely to occur in patients with **unilateral** spondylolysis.
- Iatrogenic** (e.g. post-laminectomy if surgeon removed too much of pars or facet*)
 - *it is safe to remove up to 50% of medial facet
- Traumatic** – with fractures in structures other than pars interarticularis (e.g. posterior vertebral arch fracture, odontoid fracture); dislocation occurs gradually.

5. **Congenital (s. dysplastic)** - rare (strong hereditary component) - caused by thin, elongated pars interarticularis.
- patients – children.

CLINICAL FEATURES

May be asymptomatic!

- chronic **pain & tenderness** in low back, with or without positional variance.
- radiculopathy** may develop (70% sciatica, 30% intermittent neurogenic claudication).
 - in severe degrees of spondylolisthesis, **cauda equina syndrome** may occur.
- "**step**" on deep palpation of posterior elements.
- in severe degrees of spondylolisthesis, trunk may be shortened and abdomen protuberant.

DIAGNOSIS

Standing lateral X-ray is the best test to detect spondylolisthesis! – grade often more severe than on MRI

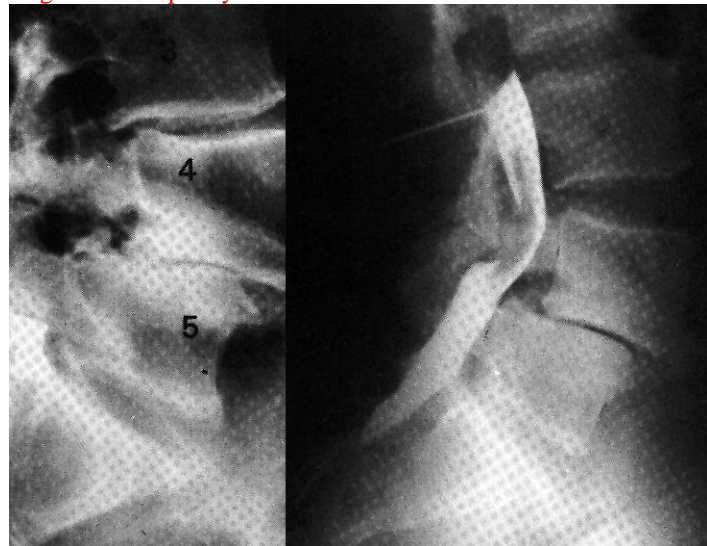
The best test to detect the associated stenosis – **MRI** (second best test – **myelography**, plain or CT).

- facet joint effusion** > 1.5 mm on supine MRI is suggestive of degenerative lumbar spondylolisthesis.
- insufficient evidence for or against the upright **seated** MRI (in the diagnosis of degenerative lumbar spondylolisthesis) or **axial loaded** MRI (to evaluate the dural sac cross sectional area).

Degenerative spondylolisthesis (T1-MRI) - anterior slip of L4 on L5 and degeneration in posterior joints at this level:



Degenerative spondylolisthesis L4-L5:



TREATMENT

SURGERY

Indications for therapy: debilitating pain, 3-4 degree, neurologic symptoms.

Decompression ± reduction → fusion ± PLIF*

see p. Op220 >>

*PLIF restores disc height (improved sagittal balance, opens foramina) but prevents reduction of spondylolisthesis

- decompression without fusion** is a treatment option for **lumbar stenosis associated with stable low-grade degenerative spondylolisthesis**;
 - concern for **destabilizing effect of laminectomy**; minimally invasive **unilateral laminotomy** for “over the top” decompression might be a less destabilizing alternative to traditional open laminectomy.

K. Schöller et al. Lumbar Spinal Stenosis Associated With Degenerative Lumbar Spondylolisthesis: A Systematic Review and Meta-analysis of Secondary Fusion Rates Following Open vs Minimally Invasive Decompression. Neurosurgery, Volume 80, Issue 3, 1 March 2017, Pages 355–367.

OBESITY

A. Chan et al. Obese Patients Benefit, but do not Fare asWell as Nonobese Patients, Following Lumbar Spondylolisthesis Surgery: An Analysis of the Quality Outcomes Database. Obese Patients Benefit, but do not Fare asWell as Nonobese Patients, Following Lumbar Spondylolisthesis Surgery: An Analysis of the Quality Outcomes Database

- obesity (BMI > 30) was associated with inferior perioperative outcomes: higher blood loss, longer operative times, longer hospitalizations, and fewer routine discharges.
- obese patients achieve significant improvements in all PRO metrics at 12 mo.
- obesity is associated with inferior **leg pain** and **quality of life**, but similar **back pain, disability, and satisfaction** —12 mo postoperatively; for **increasing severity of obesity**—via analysis of the continuous variable BMI—outcomes are progressively worse for leg pain and EQ-5D.

CONSERVATIVE

NASS Clinical Guidelines for Degenerative Lumbar Spondylolisthesis (2nd ed., 2014): Work Group Consensus Statement: medical/interventional treatment when the radicular symptoms of stenosis predominate, most logically **should be similar to** treatment for degenerative lumbar **stenosis**.

BIBLIOGRAPHY for ch. “Spinal Disorders” → follow this [LINK](#) >>

