Lumbar Spondylolisthesis

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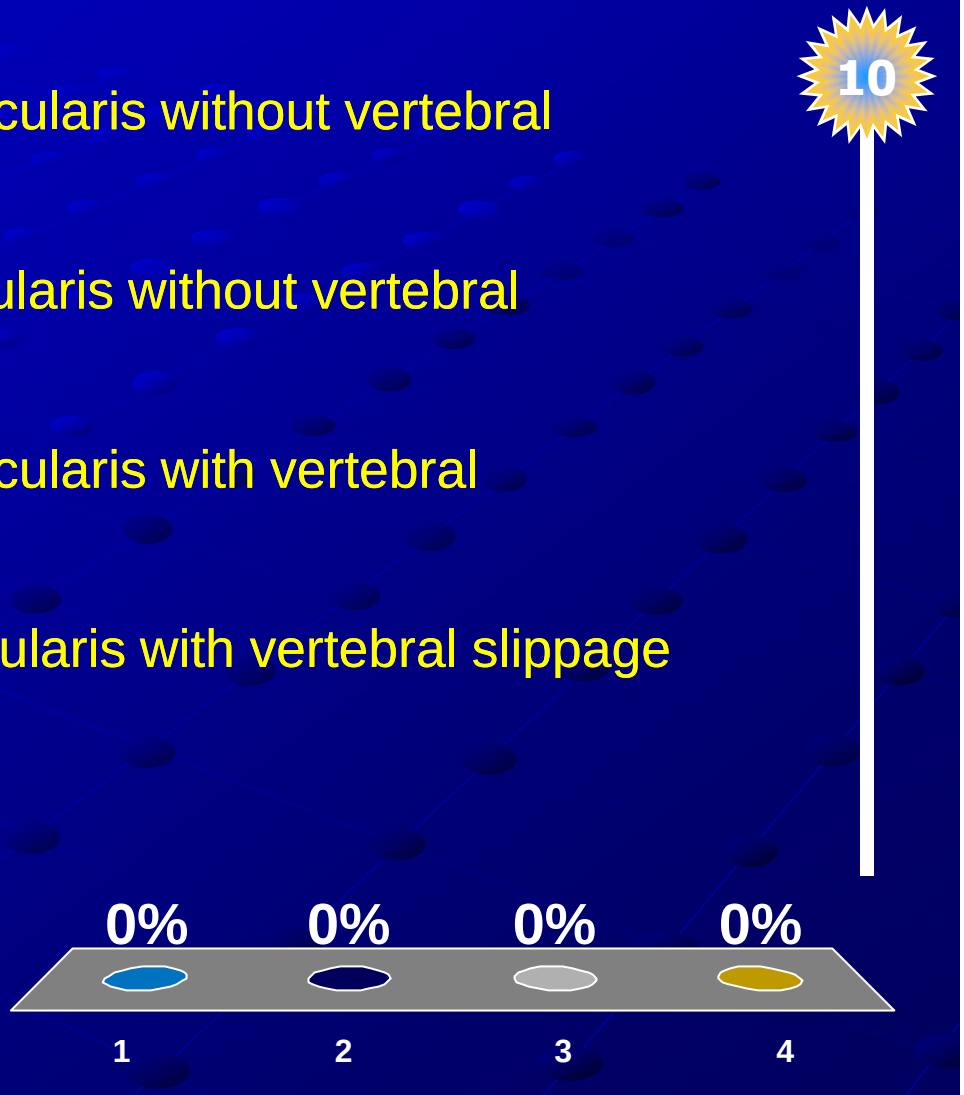
Dr Deepak Agrawal

Presentation by – Dr Vipin K. Gupta

Q1. Spondylolysis is

1. Unilateral defect in pars interarticularis without vertebral slippage
2. Bilateral defect in pars interarticularis without vertebral slippage
3. Unilateral defect in pars interarticularis with vertebral slippage
4. Biilateral defect in pars interarticularis with vertebral slippage



Q2. Spondyloptosis is

1. **Slippage of the L5 vertebra in which the entire vertebral body of L5 is located below the top of S1**
2. **Slippage of the L5 vertebra in which 75% of the vertebral body of L5 is located below the top of S1**
3. **Slippage of the L5 vertebra in which 50% of the vertebral body of L5 is located below the top of S1**
4. **Slippage of the L5 vertebra in which 25% of the vertebral body of L5 is located below the top of S1**

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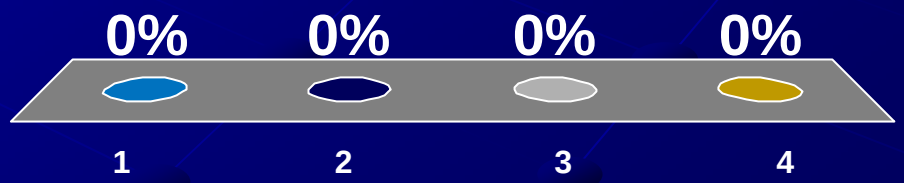
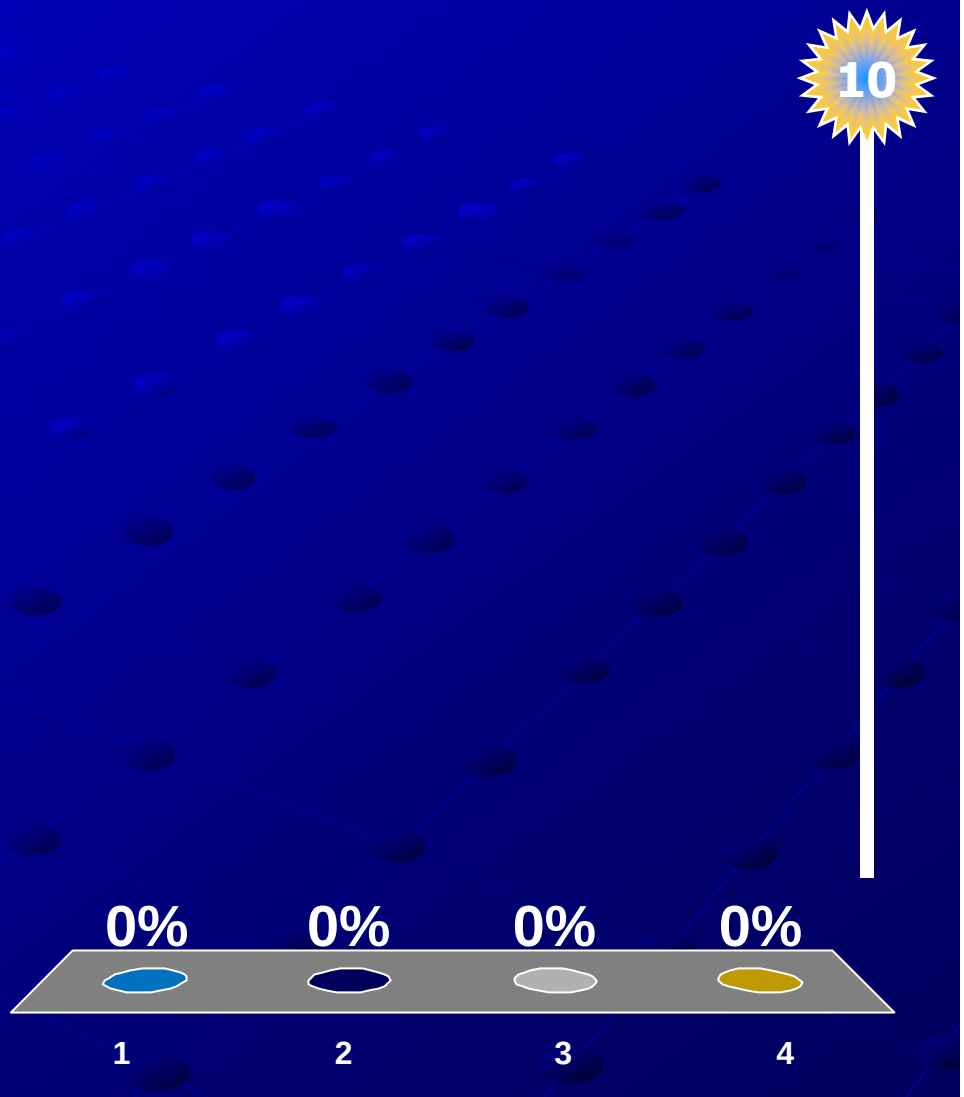


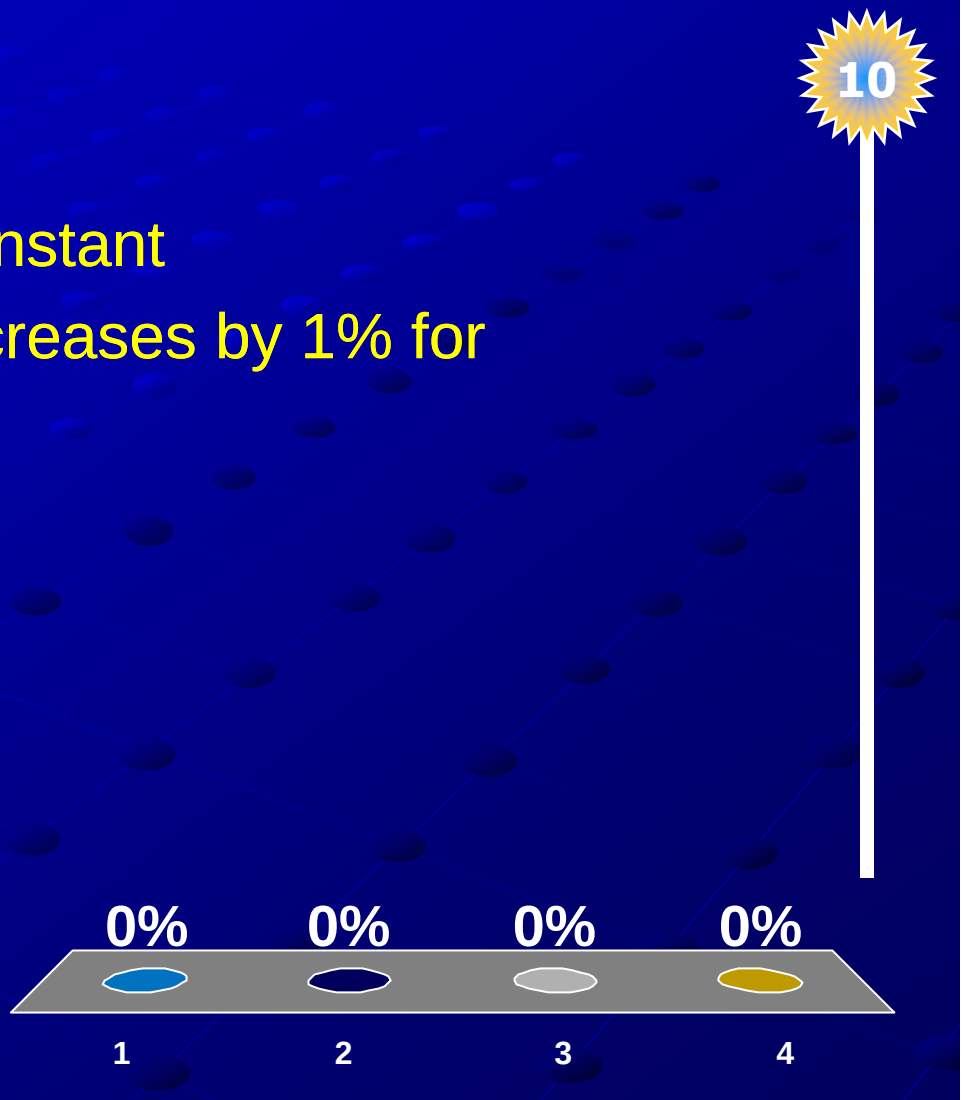
Q3. Dysplastic type of Spondylolisthesis is

1. Acquired
2. Traumatic
3. Pathologic
4. Developmental



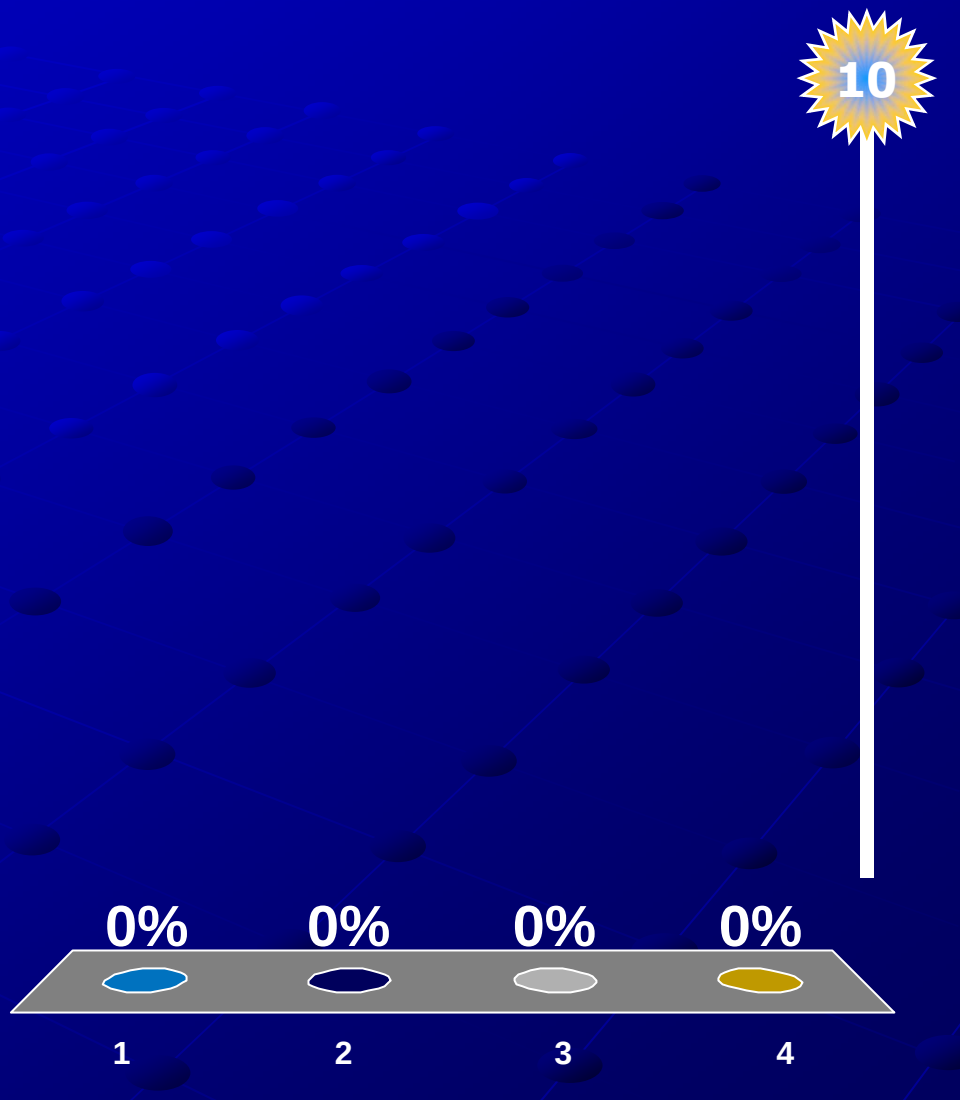
Q4. The incidence of Spondylolisthesis is approximately

1. 1% in all adults
2. 3% in all adults
3. 6% in all adults and constant
4. 8% in all adults and increases by 1% for every decade of life



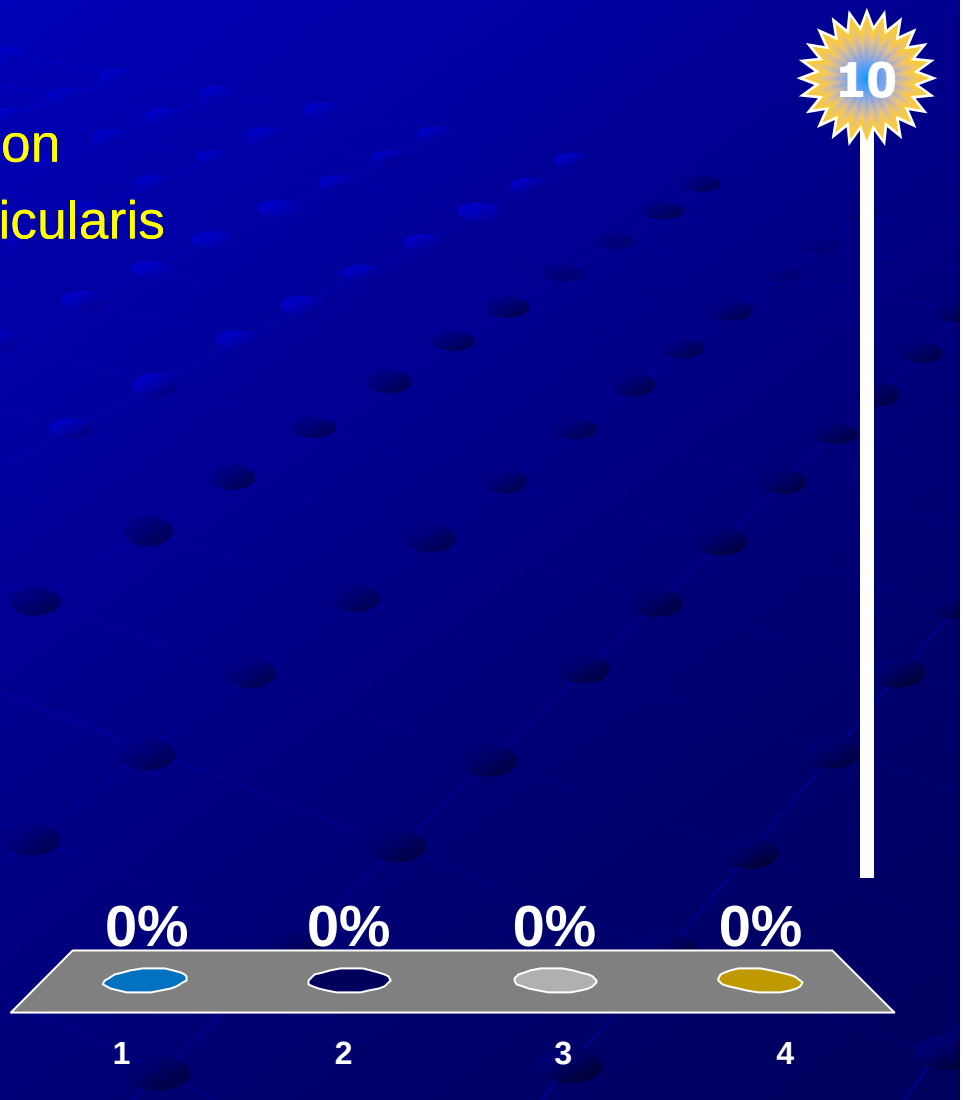
Q5. The “Scottie dog” appearance of posterior spinal elements on X-ray in Spondylolysis is best seen in

1. AP view
2. Lateral view standing
3. Oblique view
4. Lateral view supine



Q6. The options for treatment of Spondylolysis in children are

1. Intertransverse(Lateral) fusion
2. Direct repair of pars interarticularis
3. Non-operative treatment
4. All of the above



Q7. Best fusion rates are achieved in listhesis with

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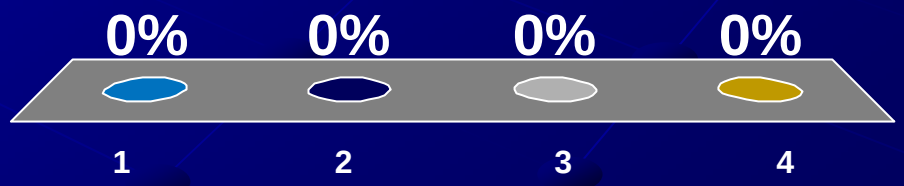
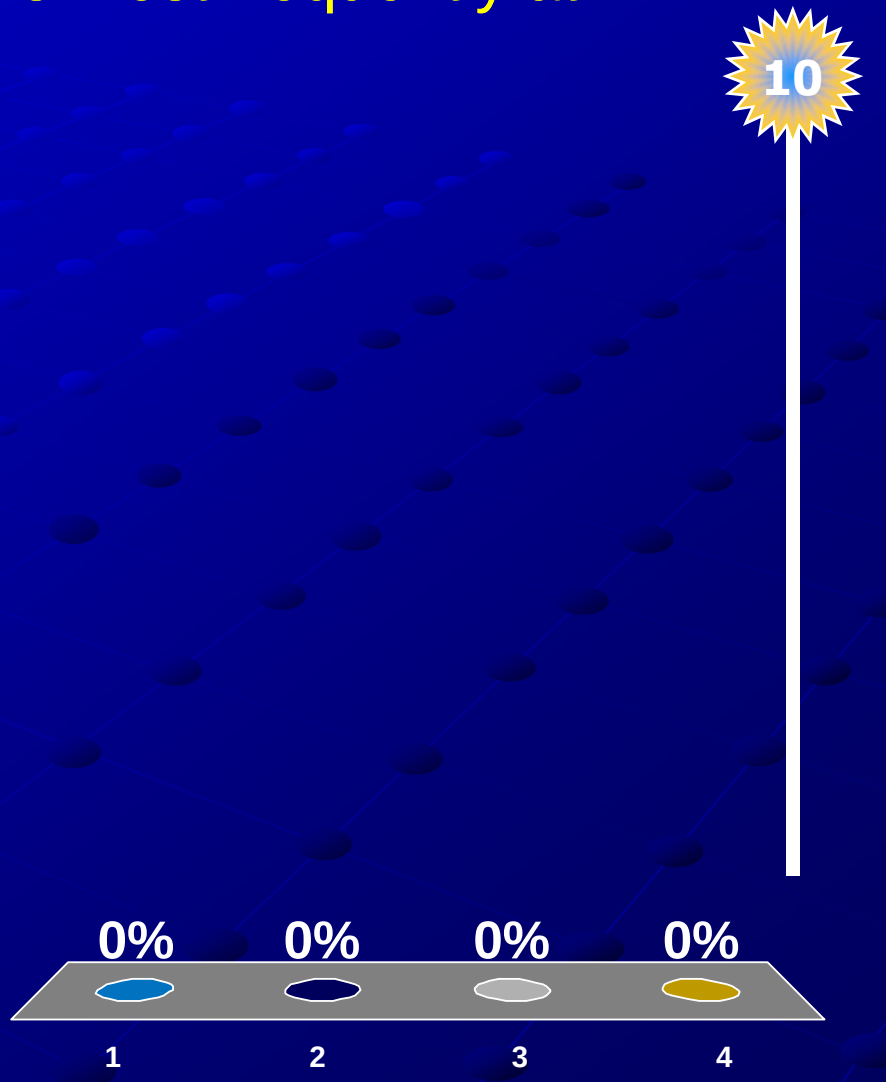
1. Posterior-lateral fusion without implants
2. Posterior-lateral fusion with implants
3. Circumferential fusions(including Interbody fusions)
4. No difference in fusion rates in all procedures



Q8. Degenerative listhesis occurs most frequently at

1. L5-S1
2. L4-L5
3. L3-L4
4. L4-L5 and L5-S1 occur with the same frequency



Q9. Non-spinal disorders which can mimic the signs and symptoms of degenerative listhesis are all except

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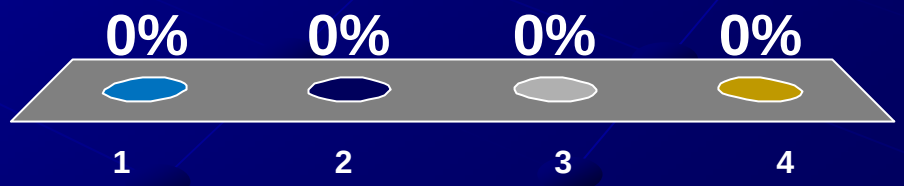
1. Degenerative arthritis of Unilateral Hip joint
2. Degenerative arthritis of Bilateral Hip joint
3. Peripheral vascular disease
4. All of the above



Q10. In a patient with degenerative Grade II L4/L5 listhesis with persistent leg pain, progressive neurological deficit, and significant reduction in quality of life, the treatment of choice is

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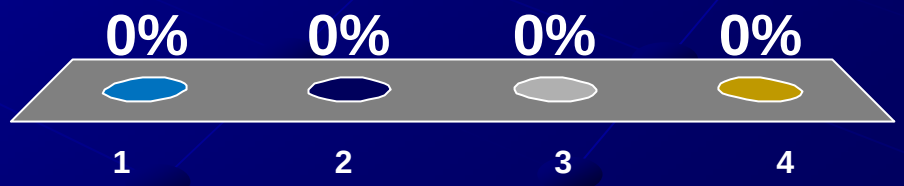
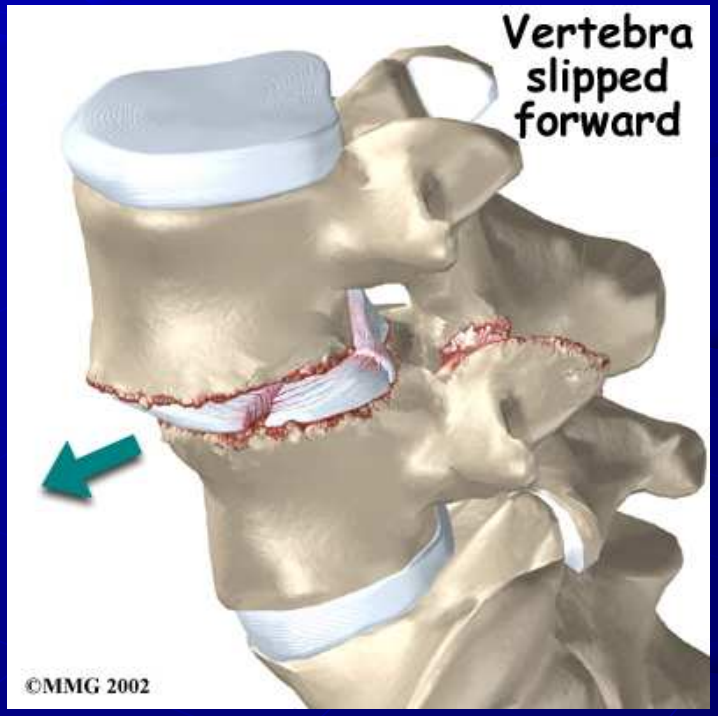
1. Decompression
2. Decompression and posterior fusion without instrumentation
3. Decompression and posterior fusion with instrumentation
4. Decompression and posterior fusion with instrumentation with interbody fusion



Spondylolisthesis

- Anterior subluxation of one vertebral body on another
- Usually L5 on S1, occasionally L4 on L5
- Degenerative: L4 on L5, then L4-3, and L5-S1



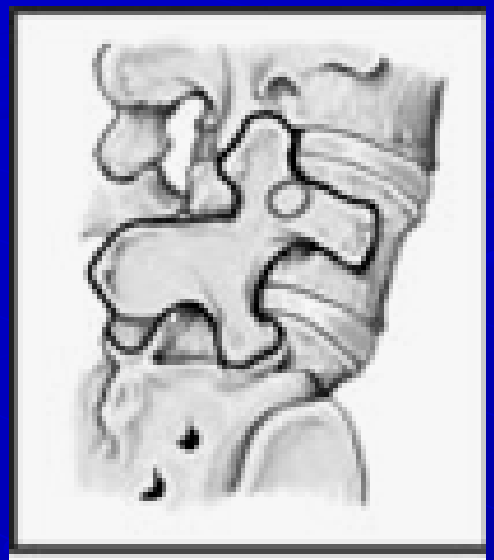
History

- Herbineaux, Belgian obstetrician in 1782
- Kilian 1854 - Spondylolisthesis

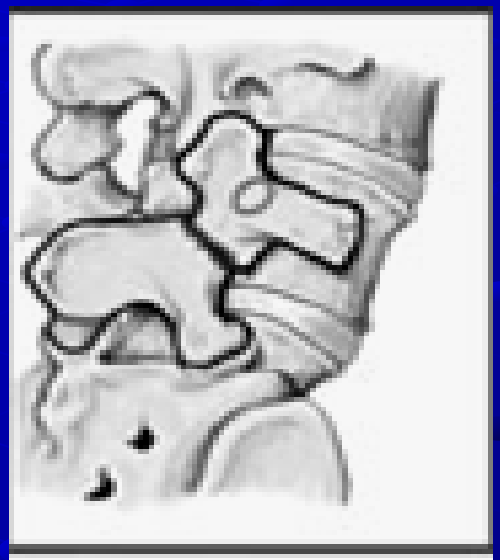
  spondylos (vertebra) and *olisthanein* (to slip)

- 1950, Macnab – spondylolisthesis with an intact neural arch
- 1955, Newman – degenerative spondylolisthesis
- 1976, Wiltse et al – classification

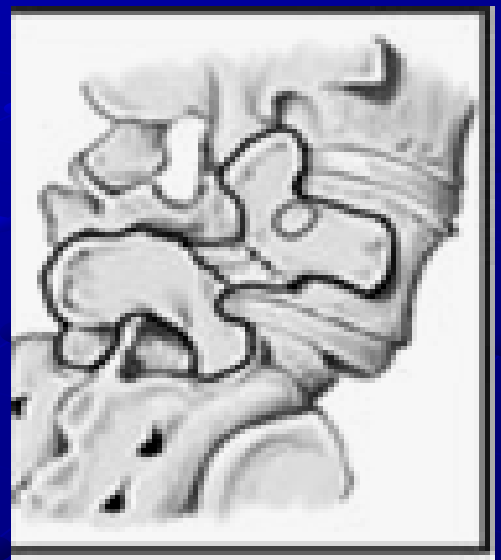
Spondylolysis Vs Spondylolisthesis



Normal



Spondylolysis



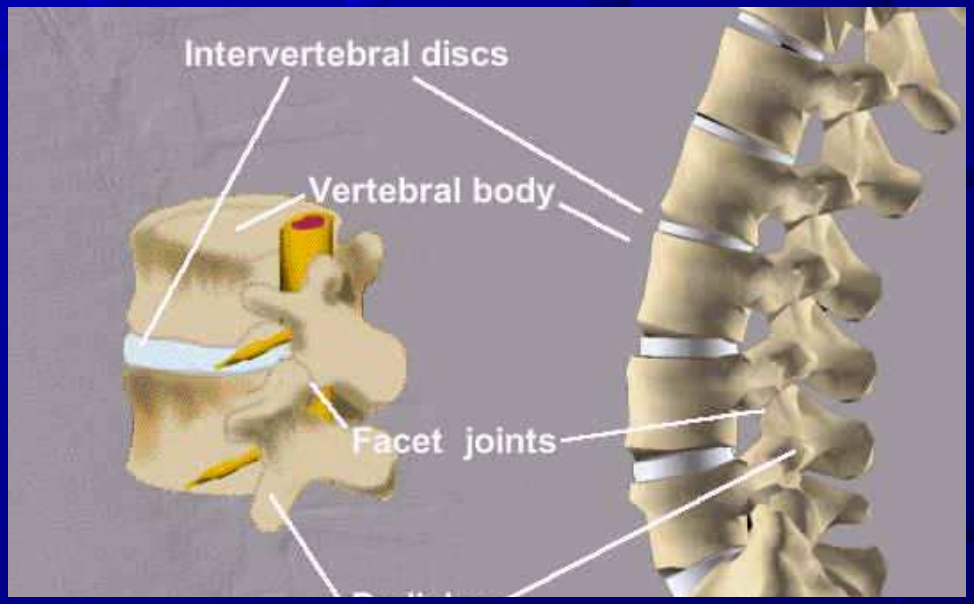
Spondylolisthesis

Frequency

- Isthmic type in 5% based on autopsy study
- Degenerative spondylolisthesis in 5.8% of men and 9.1% of women
- Isthmic type most common in males and degenerative most common in females
- Racial: spondylolysis seen in up to 50% of Eskimos

ANATOMY

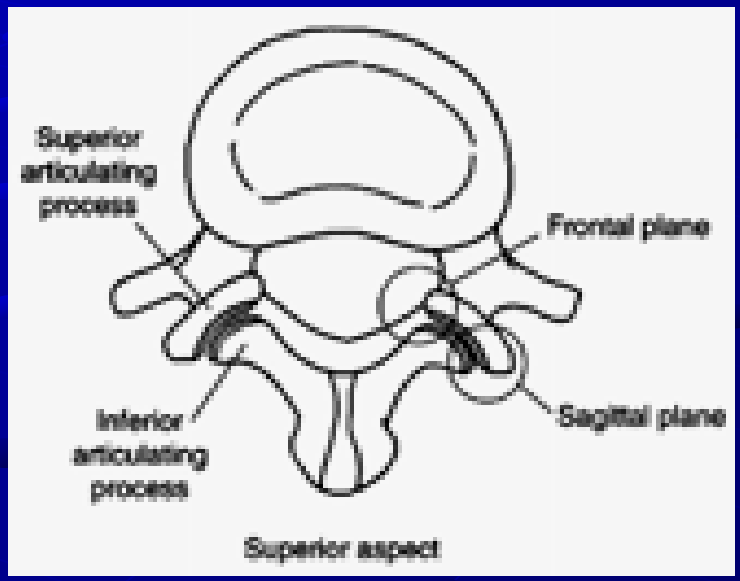
- Facet joint in coronal plane -
  - Inferior articular process (upper vertebra) located posteriorly
  - Superior articular process (lower body) located anteriorly.
- Prevents forward movement
- Locks in the superior vertebra relative to the inferior vertebra



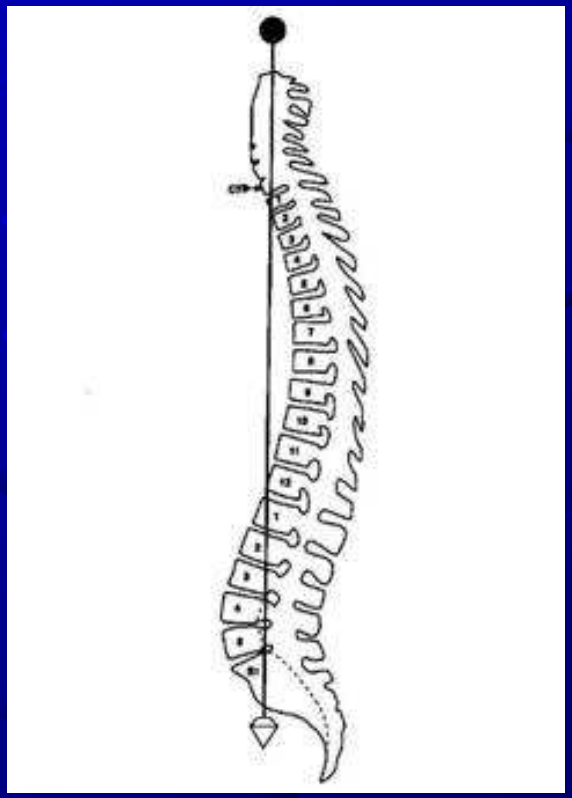
Anatomy

- Articular Processes

  Orientation of articular processes critical for spinal motion
- Lumbar facets are biplanar
  - General orientation is 45 deg from sagittal or frontal plane
  - 90 deg from transverse plane
- Anterior aspect in frontal plane
  - Resists anterior shear
- Posterior aspect in sagittal plane
  - Resists rotation



- Center of gravity of the human body is anterior to the spine - exerts a forward slipping force on the spine, especially at the L5-S1 level
- Anteriorly located center of gravity causes a rotating movement, with the axis of rotation oriented transversely at the L5-S1 level
  - In severe spondylolisthesis, a kyphotic deformity also develops



Resistance to Listhesis

- Pair of pars joints
- Intact posterior neural arch
- Pedicle
- Normal bone resilience preventing stretch of the pedicle
- Intervertebral disc binding the vertebral bodies
- And the ligaments and muscles

Classification

- Wiltse Classification – etiology based
- Marchetti – Bartolozzi classification

Wiltse Classification

I. Dysplastic (congenital)

II. Isthmic

- A. Lytic-fatigue fracture of the pars.
- B. Elongated but intact pars.
- C. Acute fracture of pars (not to be confused with "traumatic" [see IV]).

III. Degenerative (pseudospondylolisthesis)

IV. Post Traumatic (fracture of the bony hooks other then pars)

V. Pathologic

Wiltse, L.L., Newman, P.H., MacNab, Ian: Clin. Ortho. Vol. 117, p. 23, June 1976.

Classification based on etiology but it does not predict prognosis and likelihood of progression

Marchetti – Bartolozzi Classification

Table 1: Marchetti and Bartolozzi classfication for spondylolisthesis

Acquired	**Developmental**
Traumatic	**High Dysplastic**
Acute Fracture	With Lysis
Stress Fracture	With Elongation
Post Surgical	**Low Dysplastic**
Direct	With Lysis
Indirect	With Elongation
Pathologic	
Local	
Systemic	
Degenerative	
Primary	
Secondary	

1.DEVELOPMENTAL (20%) : in children

- DYSPLASTIC FEATURES PRESENT IN VERTEBRAE
- POST.DEFECT-IN LAMINA, FACET,PARS
- ANT.DEFECT-IN DISC,SACRAL DOME

2.ACQUIRED:

- IN ADULTS
- ARCHITECTURE OF VERTEBRAL ELEMENTS IS NORMAL
- NOT AS PROGRESSIVE AS DYSPLASTIC

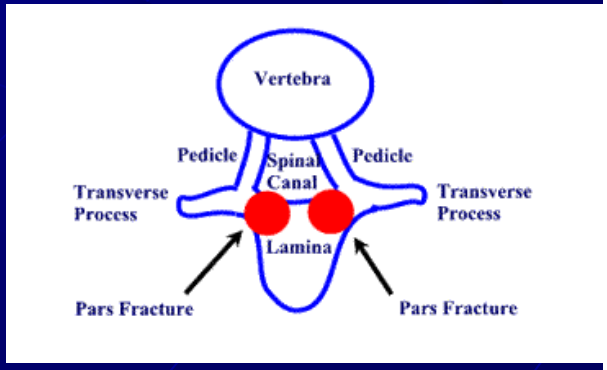
- High Dysplastic
  - Significant LS kyphosis
  - Trapezoid L5 (wedge L5)
  - Hypoplastic transverse process
  - Doming of sacrum
  - Verticalisation of sacrum
  - High chances of progression

- Low dysplastic (only post. elements dysplastic)
  - Normal LS profile
  - Rectangular L5
  - Flat upper end plate of sacrum
  - No significant verticalisation
  - Facets - axial or sagittal orientation
  - A/W Spina bifida

Isthmic Spondylolisthesis

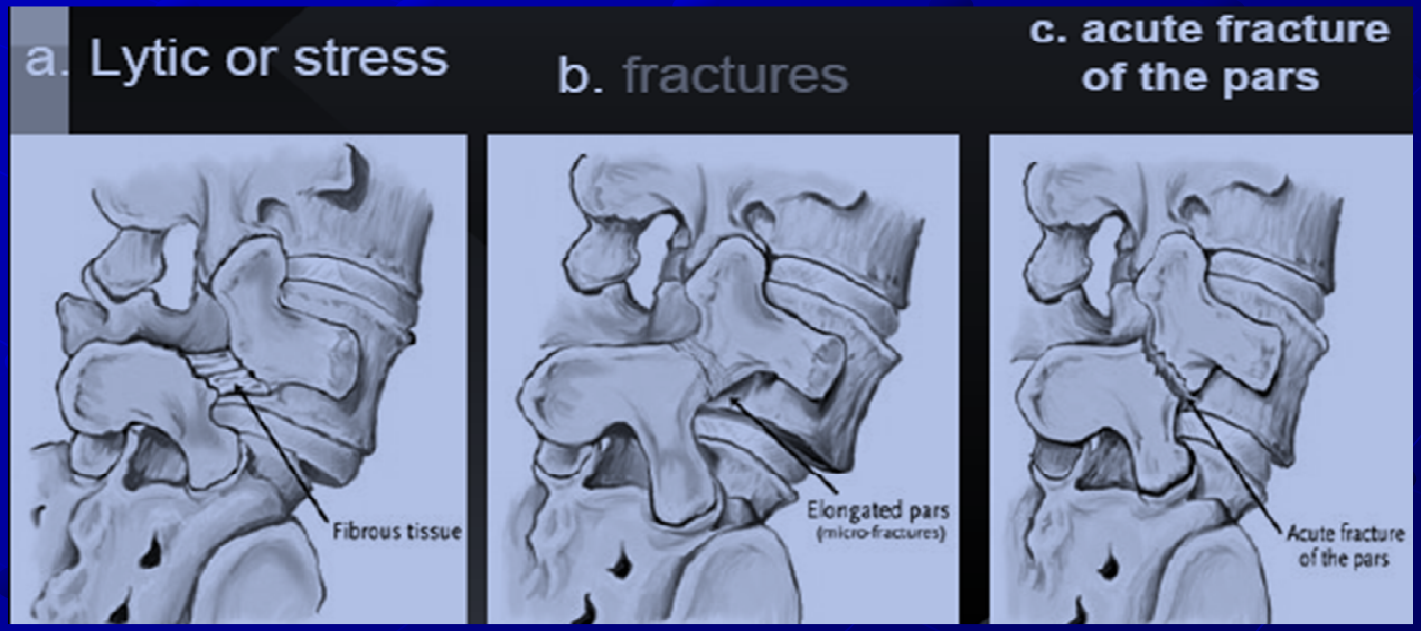
- Most common cause of spondylolisthesis
- Occurs in young people
- Affects ***pars interarticularis*** - the junction of the pedicle and lamina, where the articular and transverse processes arise
- CAUSE
  - Genetic (54% prevalence in Eskimos and 12% pts has first degree relative)
  - Mechanical - High-risk activities include gymnastics (11%), rowing, tennis, wrestling, weightlifting, and football

Isthmic defects are due to successive fatigue fractures in genetically predisposed individual.



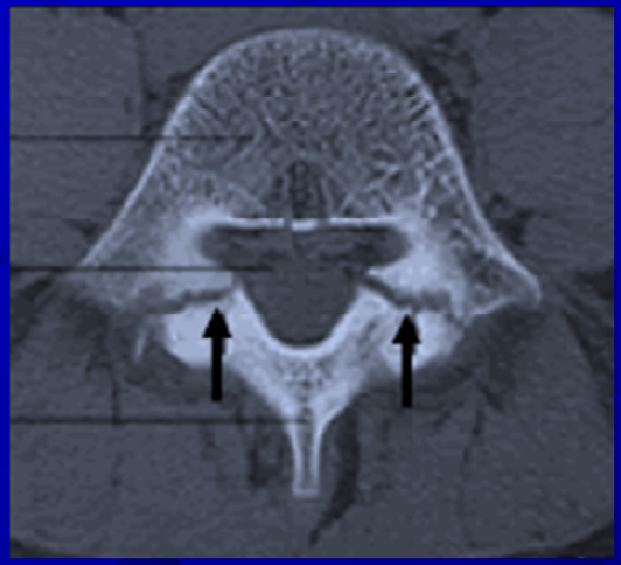
SUBTYPES OF ISTHMIC

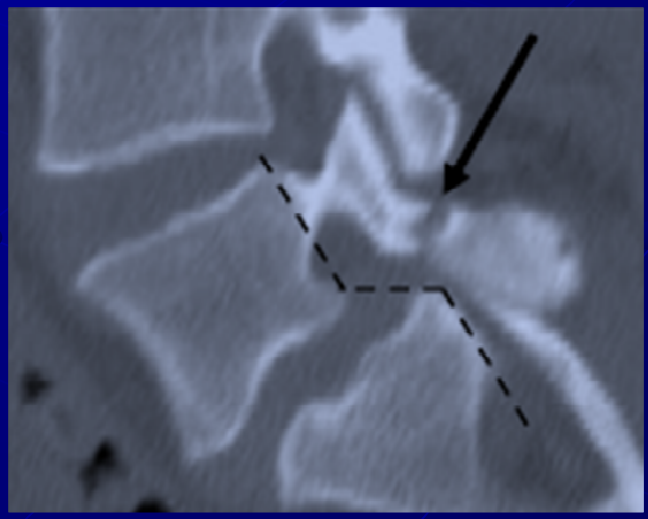
- Wiltse
  1. **Subtype A**: fatigue fracture of pars w/o complete separation of bone
  2. **Subtype B**: elongated pars due to recurrent fracture and healing
  3. **Subtype C**: acute fracture of pars




Grade 1 Isthmic
Spondylolisthesis


[R]
[L]
R
KLJ
PO
[F]





Pathophysiology

- Physiologic response:

1. Facet hypertrophy
2. Healing around pars
   - Cartilage
   - Fibrous tissue
3. Narrowing canal
4. COMPRESSION!!

Degenerative Spondylolisthesis

- There is no defect in the pars.
- The posterior arch is intact.
- Slip is never great.
- Osteoarthritic changes develop in the facet joints.
- Erosive changes lead to abnormal alignment of the articular surfaces.
- Deficient coronal portions of the facet and narrow lamina
- Abnormalities of the ligamentous structures and loss of disc height.
- Excessive mobility in lumbar motion segment (usually L4/L5) following degenerative changes.

Degenerative Spondylolisthesis

Found in :

- 5.8% of men
- 9.1% of women
- 3 times greater in African American women

Most are asymptomatic

Greater incidence in females:

- Ligamentous laxity
- Pregnancy
- Less lumbosacral lordosis
- Increased sacralization of L5

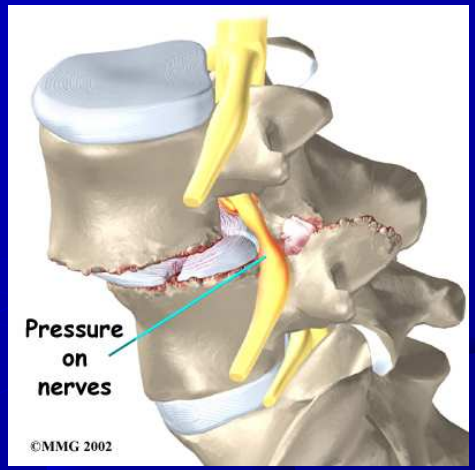
Bird HA et al. Is generalized joint laxity a factor in spondylolisthesis? *Scand J Rheumatol* 1980;9:203–5.

7. Sanderson PL, Fraser RD. The influence of pregnancy. *J Bone Joint Surg Br* 1996;78:951–4.

- Asian population overall incidence is 8.7%
  - Single level in 66%
  - Multiple levels in 34%
  - Anterolisthesis in 70% cases, which were predominant at L4–L5 in women
  - Retrolisthesis was found in 30% predominant in L2–L3 and equal in both sexes

Iguchi T, Wakami T, Kurihara A, et al. *J Spinal Disord Tech* 2002;15:93–9.

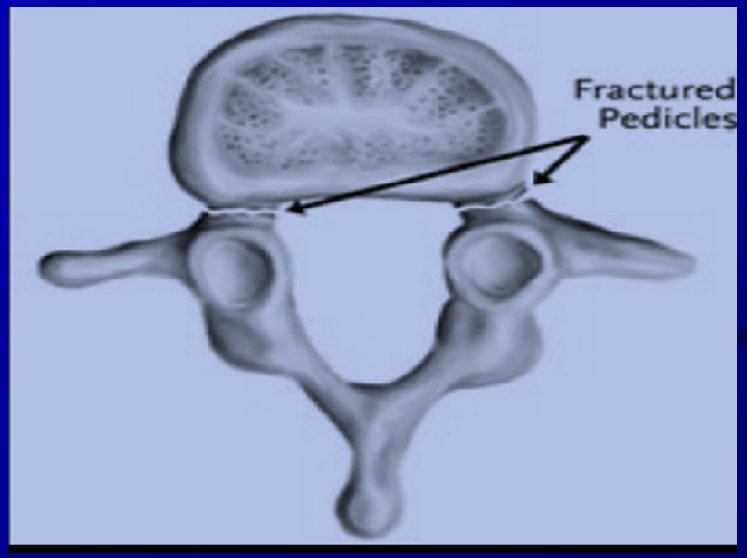
- Primary symptoms are from:
  - Lateral recess stenosis – from forward slippage of the inferior articulating process
  - Disc herniation – contributes to central stenosis caused by intact neural arch



Nerve root below pedicle of subluxated vertebra is compressed

Traumatic

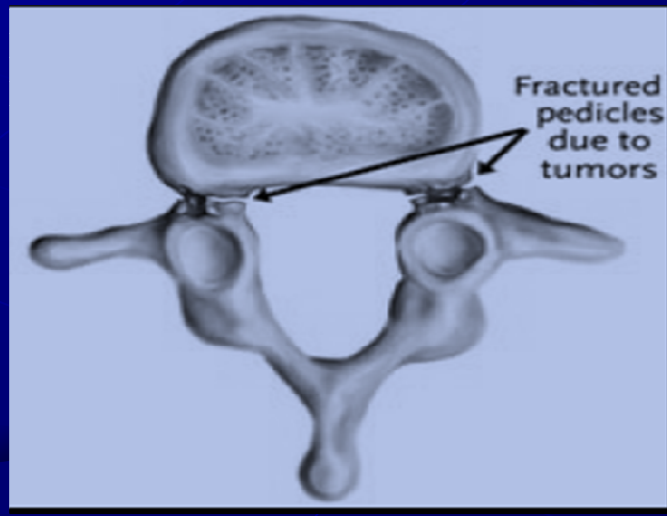
- Rare
- A/W - major trauma ? hyperextension
  - pars is normal
  - fractures occur as a result of excessive force
  - Fracture of pedicle/facets
  - ligament and disc injury
  - Clearly defined edges after trauma
  - If x ray after trauma show spondylolysis and sclerotic margins than it is old



Pathological

- Alteration of bone tissue results in loss of ability of bony hook to maintain alignment
- 2 subtypes:
  - Generalized - widespread changes e.g. osteopetrosis, osteomalacia, pagets disease
  - Localized - tumors (primary/secondary), infection

- Most difficult of all types to treat.
  - Treat underlying cause
  - Surgical fixation . Difficult to obtain with impaired bony healing



Post-Surgical spondylolisthesis

- Damage to facet joint, disc or pars
- Low grade slip but very symptomatic
- Mostly after decompressive laminectomy with partial or complete facetectomy
- After discectomy and partial facetectomy
  - Axial load on facet joint increases
  - Increases translational and rotational movement in sagittal plane
- Spondylolysis after fusion at adjacent level or discectomy at adjacent caudal level - spondylolysis acquisita

Clinical Presentation

- Mechanical Back Pain
  - Worse with activity
  - Better with rest
- Leg Pain
  - Radicular
  - Neurogenic Claudication
    - **Aches, fatigue, tiredness**
    - **Better with forward flexion**
- Bowel, Bladder Function

Degree of vertebral slip does not directly correlate with the amount of pain

Symptoms, Signs, and Functional Disability in Adult Spondylolisthesis

Hans Möller, MD,* Agneta Sundin, RPT,† and Rune Hedlund, MD, PhD*

SPINE Volume 25, Number 6, pp 683–689

- Low back pain, and sciatica 62%
- Sciatica only 7%
- Low back pain only 31%
- Most common signs:
  - Positive SLR test, 12%
  - L5 sensory deficit, 13%

PRINCIPLES OF MANAGEMENT

Symptoms are very important as management depends upon these

Compressive symptoms- decompression

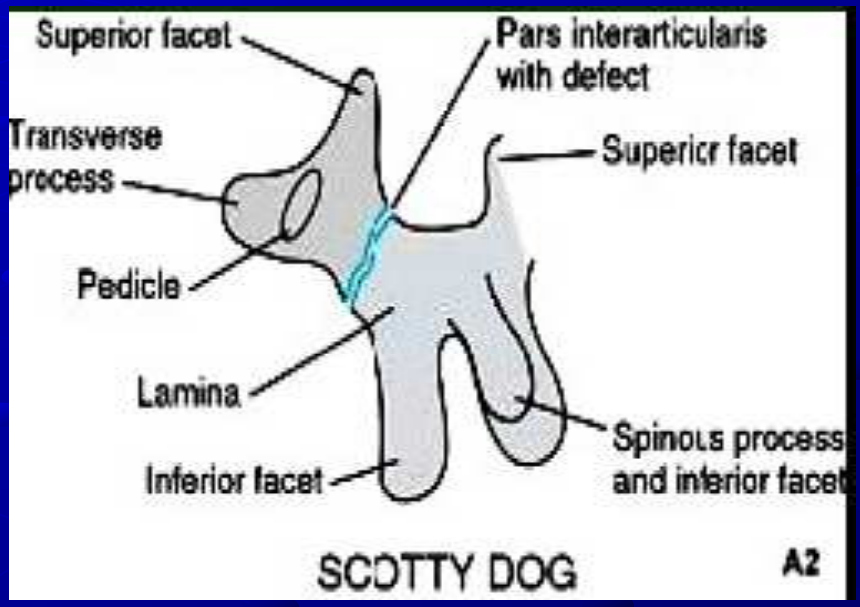
Mechanical symptoms – stabilization

Examination findings

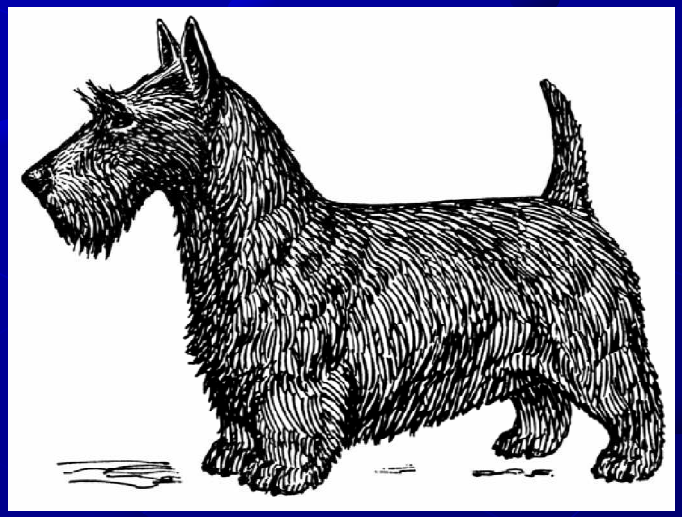
- Isthmic and dysplastic type-
  - Palpable step-off of lumbar spinous processes.
  - In severe cases bodies may be palpable through abdominal wall.
  - Exaggerated lumbar lordosis.
  - Tight hamstrings in younger patients
  - Stooped posture with flexion at hip and knees with waddling gait.
  - SLR may be positive

Imaging

- **X-rays**:
  1. Lateral - flex./ext.
  2. Oblique
     - Integrity of the pars "Scotty Dog"



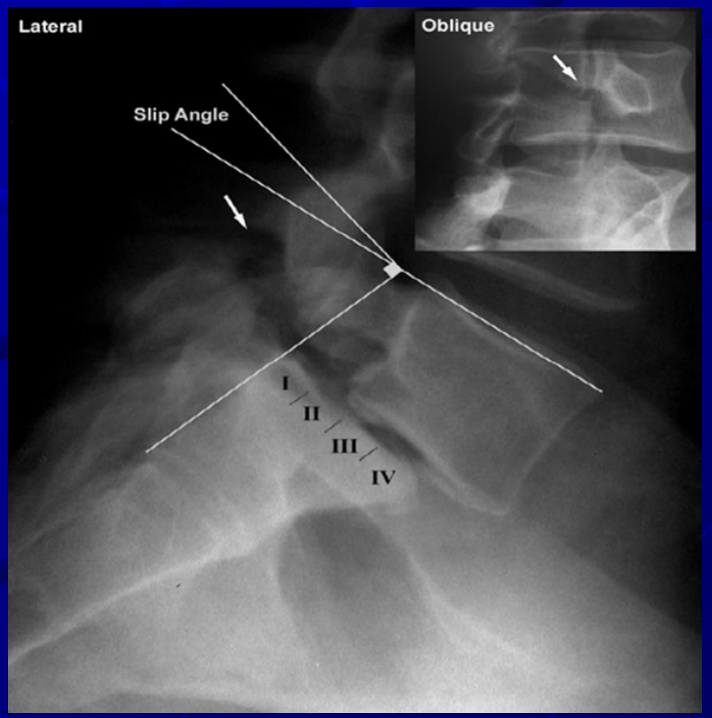
PARS IS SEEN AS NECK OF SCOTTIE DOG AND DEFECT AS COLLAR OF DOG



Scottie Dog

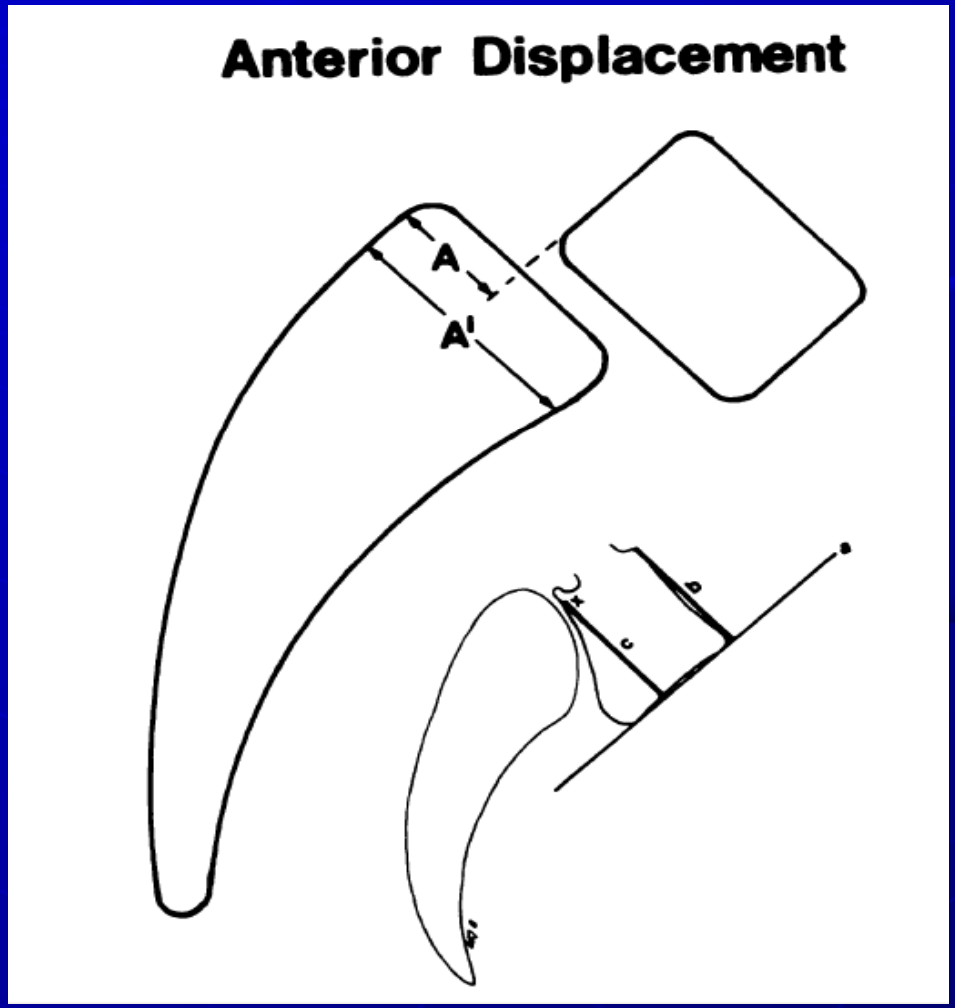
Meyerding's Scale

Grade	Amount of Subluxation (Taillard)
Grade I	<25%
Grade II	25-50%
Grade III	50-75%
Grade IV	75-100%
Grade V	>100%
	(Spondyloptosis)



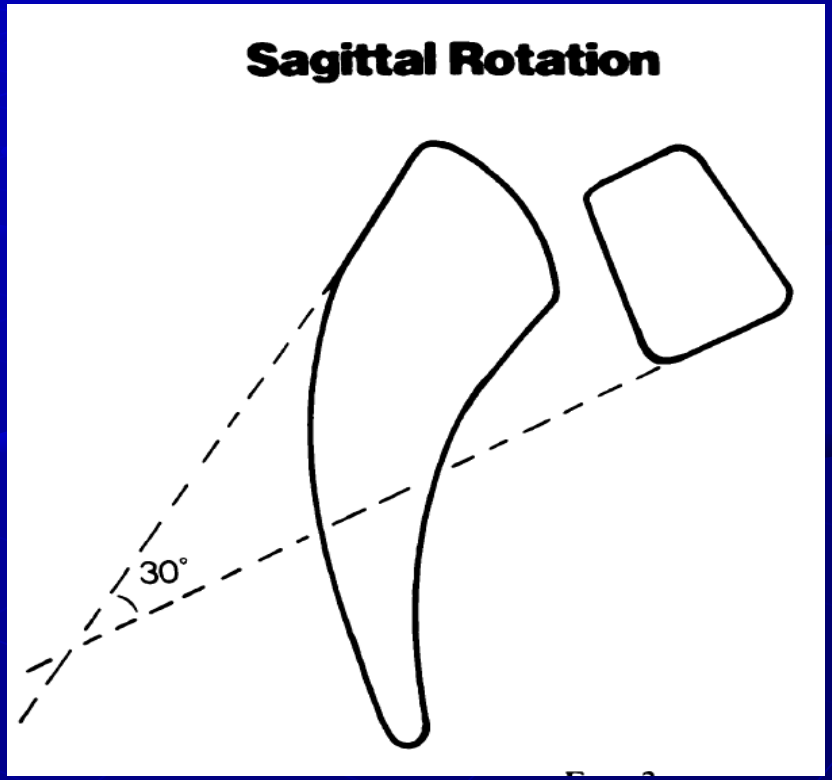
Meyerding HW: Spondylolisthesis. Surg Gynecol Obstet 54:371–379, 1932.

Anterior Displacement



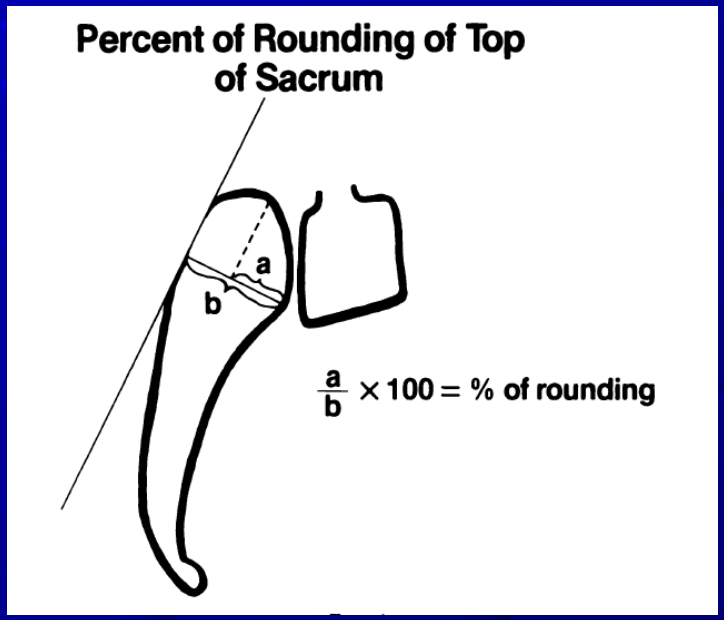
SAGITTAL ROTATION

- Angle between anterior margin of L5 and post. Margin of S1
- Measures rotational listhesis.
- BEST predictor of instability and progression

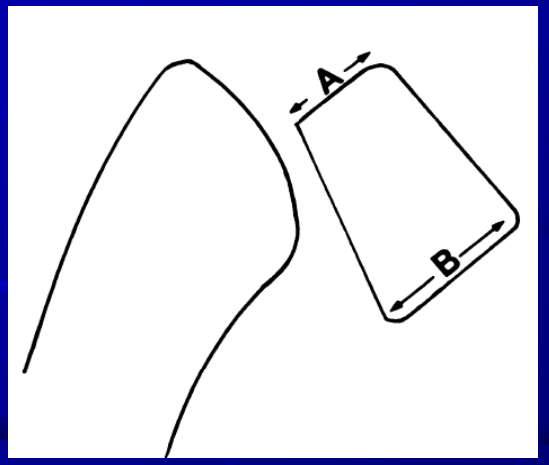


LL Wiltse and RB Winter, Terminology and measurement of spondylolisthesis, J Bone Joint Surg Am. 1983;65:768-772.

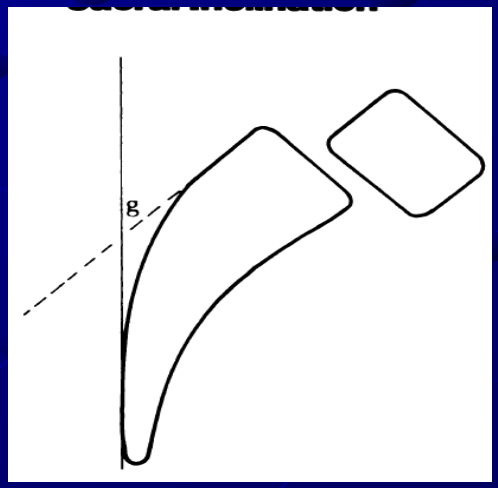
- SACRAL ROUNDING: percentage of superior end plate of sacrum deformed, usually at anterior margin .
- It is sign of instability and represents barrier to reduction



- LUMBAR INDEX (Wedging of the Olisthetic Vertebra) - posterior height of body /ant.ht.



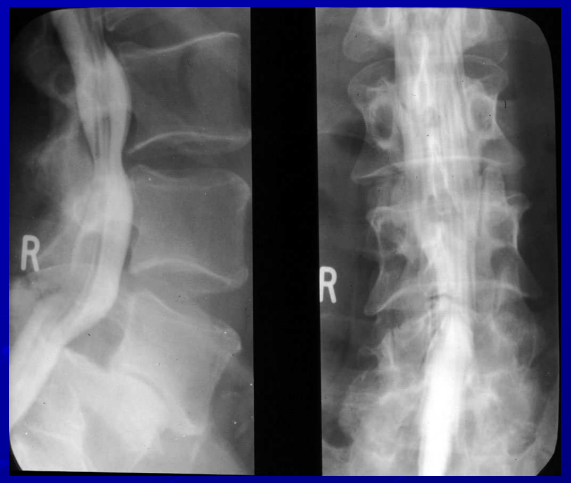
- SACRAL INCLINATION: angle between vertical and posterior margin of S1.



Imaging

- CT scan
  - Evaluate bony pathology
  - Spondylolysis diagnosed by “incomplete ring” sign (ring of cortical bone should be present on at least one axial cut in normal vertebra with intact arch)
  - Best test to diagnose pseudoarthrosis after failed fusion

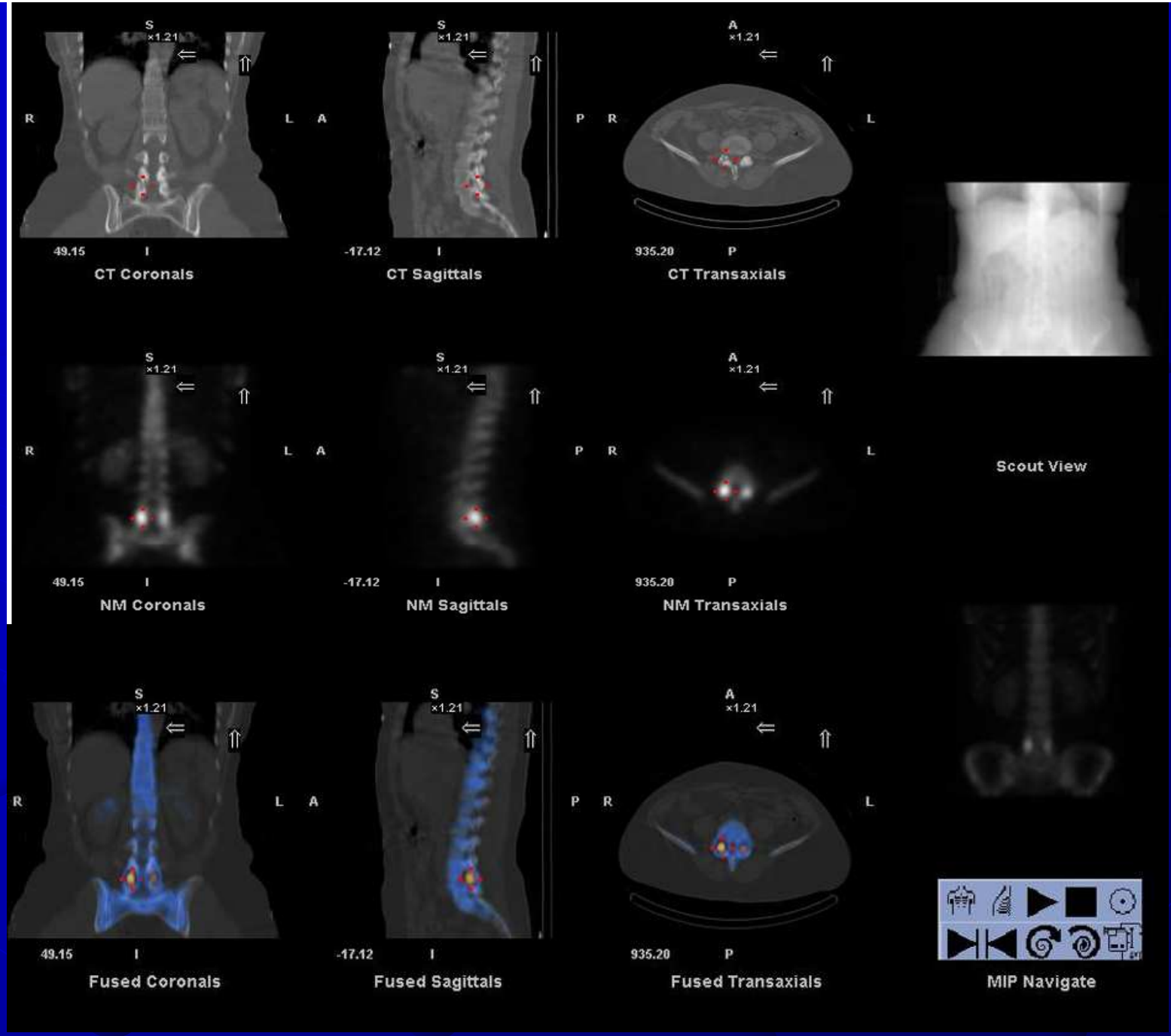
- CT myelography:
  - Good quality dynamic scans can be obtained.
  - Bony anatomy is better defined
  - In already instrumented cases



- MRI: evaluate soft tissue pathology
  - Nerve compression
  - Spinal compression
  - Sagittal image demonstrate pars defect.
  - Assess disc herniation

- SPECT:
  - Inconclusive x-rays despite high clinical suspicion
  - May be positive for pars injury that is radiographically inapparent.

  - Acute vs. chronic


S
×1.21
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CT Coronals
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CT Sagittals
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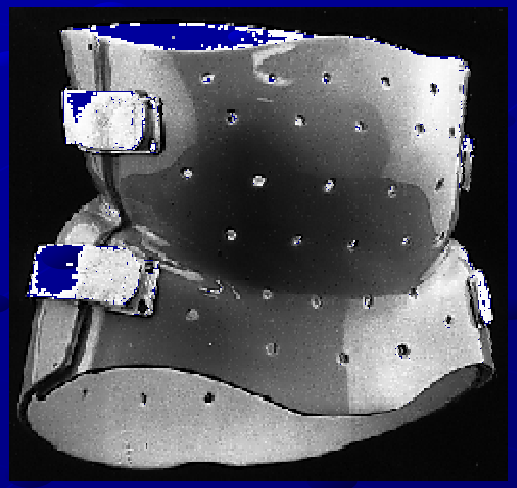
P
CT Transaxials
Scout View
NM Coronals
NM Sagittals
NM Transaxials
Fused Coronals
Fused Sagittals
Fused Transaxials
MIP Navigate

Conservative Treatment

1. NSAIDS
2. Weight loss
3. Steroid injections
   - Acute phase
   - Not for long term use
4. Bracing
5. Physical therapy:
   - Physiotherapy
   - Aerobic conditioning



Conservative Treatment

- 1- to 2-day period of rest followed by a short course of anti-inflammatory medications
- If symptoms persist beyond 1–2 weeks, physical therapy can be applied.

Leonid et al, Diagnosis and conservative management of degenerative lumbar spondylolisthesis. Eur Spine J (2008) 17:327–335

- Stationary bicycling is an excellent exercise because it promotes
  - spine flexion,
  - deconstriction of the thecal sac.
  - avoid the wear and tear associated with impact aerobic exercise such as running

Vibert BT, Sliva CD, Herkowitz HN (2006) Clin Orthop Relat Res 443:222–227

Conservative Treatment

Swimming, walking, and elliptical machines are other good alternatives for cardiovascular exercise, albeit there is no evidence of their value for DS

Vibert BT, Sliva CD, Herkowitz HN (2006) Treatment of instability and spondylolisthesis: surgical versus nonsurgical treatment. Clin Orthop Relat Res 443:222–227

Opioids and muscle relaxants have not been shown to be more effective than acetaminophen and NSAIDs in well-controlled studies

van Tulder MW et al,(2000) Nonsteroidal anti-inflammatory drugs for low back pain: Spine 25:2501–2513

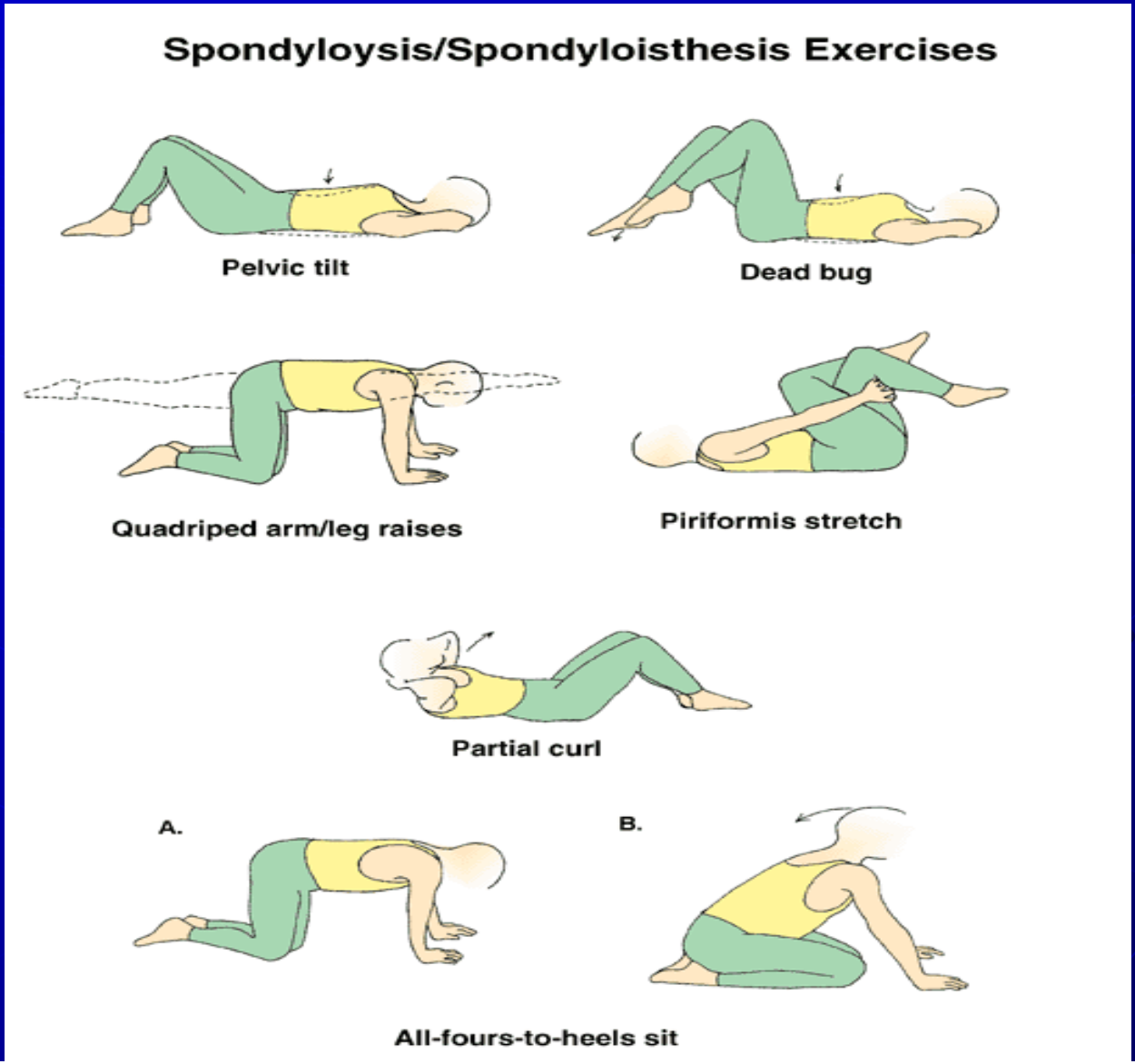
Epidural steroids may offer short-term relief but long-term prospective studies do not show a lasting effect

Flexion/extension strengthening exercises

		Flexon	Extension
Pain	3 months	27%	67%
	3 yrs	19%	67%
Inability to work	3 months	32%	61%
	3 yrs	24%	61%
Overall recovery rate	3 months	58%	6%
	3 yrs	62%	0%

Sinaki M, Lutness MP, Ilstrup DM, Chu CP, Gramse RR (1989) Lumbar spondylolisthesis: retrospective comparison and three year follow-up of two conservative treatment programs. ArchPhys Med Rehabil 70:594–598

Conservative Treatment



Operative Management : Indications

- 10-15% will fail conservative therapy (minimum of 3 months)
- Absolute indications:
  - Progressive weakness
  - Cauda Equina-type symptoms
- Myelopathy, radiculopathy or neurogenic claudication
- Radiographically documented instability

Surgery vs. Conservative Management

Surgery *Versus* Conservative Management in Adult Isthmic Spondylolisthesis

A Prospective Randomized Study: Part 1

Hans Möller, MD, and Rune Hedlund, MD, PhD

SPINE Volume 25, Number 13, pp 1711–1715

Table 2. Mean Values of Disability Rating Index and Pain Index Before Treatment and at 1- and 2-Year Follow-Up Assessments for the Surgical Group and the Exercise Group

	Before (n = 106)	1 Yr (n = 98)	2 Yr (n = 106)	*P*
Surgery				
DRI	48 (43.9–52.3)	29 (23.0–34.6)	29 (23.5–34.9)	<0.0001
Pain index	63 (58.5–67.7)	35 (28.7–42.2)	37 (29.6–43.8)	<0.0001
Exercise				
DRI	44 (38.2–50.3)	45 (36.4–53.7)	44 (36.5–50.9)	0.53
Pain index	65 (57.3–71.9)	54 (44.7–63.7)	56 (48.7–63.8)	0.024

CI = confidence interval, DRI = Disability Rating Index.
The worst possible status is 100, and the best possible status is 0. The *P* value refers to the comparison between the pretreatment score and the score at 2-year follow-up assessment in each group.
95% CI in parentheses.

Functional outcome (pain reduction and DRI) was better in the surgically treated group than in the exercise group at both the 1-year and 2-year follow-up assessments ($p<0.01$).

Surgery vs. Conservative Mgmt

Surgery vs. Non-Operative Treatment for Lumbar Degenerative Spondylolisthesis; 4 year result in the Spine Patient Outcome Research Trial (SPORT)

Randomized and Observational cohorts

Compared with patients treated non-operatively, patients in whom degenerative spondylolisthesis and associated spinal stenosis are treated surgically maintain substantially greater pain relief and improvement in function for four years

Weinstein et. Al. J Bone Joint Surg Am. 2009 Jun;91(6) 1295-304

Surgical Intervention

- GOALS:

1. Stabilization
2. Decompression of neural elements
3. Both

- Points to be assessed:
  - Operative approach
  - Whether to perform decompression or not
  - Whether to perform fusion or not
  - Whether to perform fixation or not
  - What type of fusion and fixation?

Degenerative Lumbar Spondylolisthesis with Spinal Stenosis

A Prospective Study Comparing Decompression with Decompression and Intertransverse Process Arthrodesis*†

BY HARRY N. HERKOWITZ, M.D.‡, AND LAWRENCE T. KURZ, M.D.‡, ROYAL OAK, MICHIGAN

From the Section of Spine Surgery, Department of Orthopaedic Surgery, William Beaumont Hospital, Royal Oak

- 50 pts with a clinical diagnosis of degenerative spondylolisthesis and spinal stenosis who were unresponsive to an adequate course of conservative therapy
- Randomized to decompressive laminectomy (n=25) alone or decompressive laminectomy and bilateral intertransverse process arthrodesis (n=25)

- Spondylolisthesis increased postoperatively in 96 versus 28 percent
- Markedly improved clinical outcome was found in patient who underwent fusion
- Although the pseudoarthrosis rate was 36%, clinical results were good or excellent for all patients who underwent fusion

TABLE I

DATA ON THE FIFTY PATIENTS

	Arthrodesis (N = 25)		No Arthrodesis (N = 25)	
	Preop.	Postop.	Preop.	Postop.
Result				
Excellent		11 (44%)		2 (8%)
Good		13 (52%)		9 (36%)
Fair		1 (4%)		12 (48%)
Poor		0 (0%)		2 (8%)
Mean scores for pain *(points)*				
Back	3.3	1.3	2.9*	2.5†
Lower limbs	4.3	1.0	4.0*	1.7
Mean height of disc space *(mm)*	6.8	5.7	7.4	5.8
Mean olisthesis *(mm)*	4.8	5.3	5.3	7.9‡
Mean olisthesis on flexion and extension *(mm)*	2.8	0.1	3.4	5.8
Mean vertebral motion *(degrees)*	9.3	4.2	9.6	12.8‡

* The patients who had not had an arthrodesis had significantly more pain in the low back and lower limbs at the most recent follow-up evaluation.

† $P < 0.01$ (chi-square test).

‡ $P = 0.002$ (Student t test).

Fusion: Indications

- **Decompression with >= Grade II Spondylolisthesis**
- **After repeated discectomies**
- **Unstable (>10 degrees on flex-ex films)**
- **Established mechanical back pain**
- **Post-Bilateral facetectomy**

- Controversial: Decompression with Grade I, suggestive mechanical back pain, unilateral facetectomy

Degenerative Lumbar Spondylolisthesis With Spinal Stenosis: A Prospective, Randomized Study Comparing Decompressive Laminectomy and Arthrodesis With and Without Spinal Instrumentation

Fischgrund, Jeffrey S. MD; Mackay, Michael MD; Herkowitz, Harry N. MD; Brower, Richard MD; Montgomery, David M. MD; Kurz, Lawrence T. MD

Spine. Volume 22(24), 15 December 1997, pp 2807-2812

- 68 patients randomized to
  - Decompression and arthrodesis
  - Decompression and arthrodesis and instrumentation
- Instrumentation: segmental transpedicular screws
- Average follow-up of two years

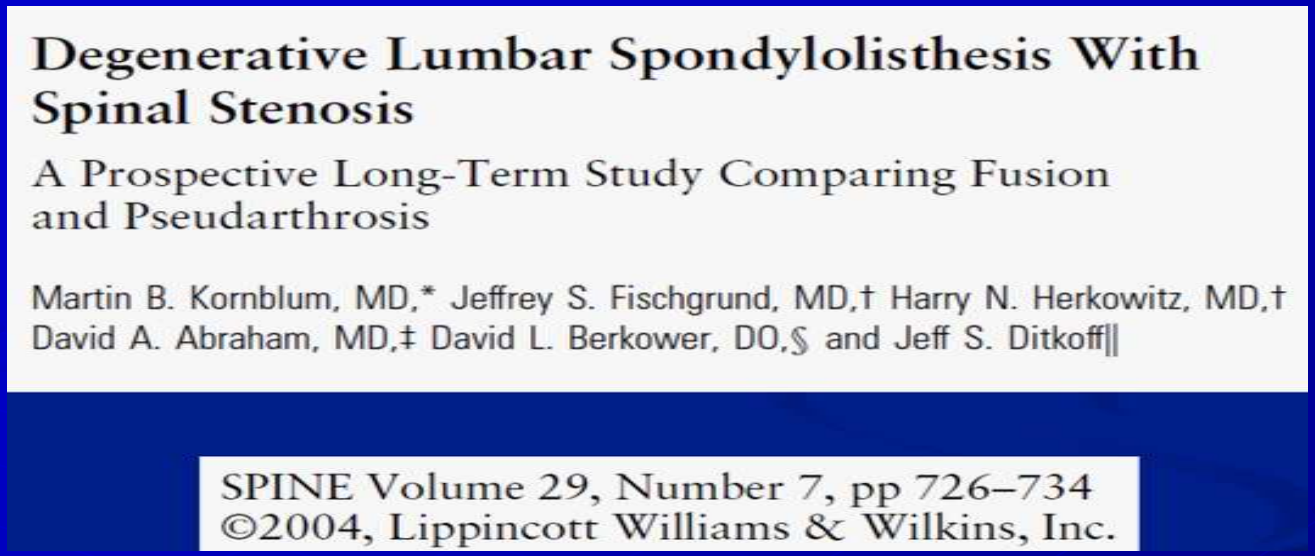
Fischgrund et al: Rate of Fusion

	Instrumentation (N = 35)		No Instrumentation (N = 33)	
	Preoperative	Postoperative	Preoperative	Postoperative
Result				
Excellent		20 (57%)		16 (49%)
Good		7 (21%)		12 (36%)
Fair		4 (12%)		1 (3%)
Poor		4 (12%)		4 (12%)
Mean scores for pain (points)				
Back	4	1	4	2
Lower limbs	4	1	4	1
Mean olisthesis (mm)	8	6	7	7
Mean sagittal motion on flexion and extension (mm)	3	1	3	2
Mean angulation (°)	9	1	9	5

	Successful Arthrodesis	Pseudarthrosis
Instrumentation	29 (83%)	6 (18%)
No instrumentation	15 (45%)	18 (55%)
Preoperative		
Olisthesis (mm)	8	7
Angulation (°)	8	11
Motion (mm)	3	4
Postoperative		
Olisthesis (mm)	7	7
Angulation (°)	1	8
Motion (mm)	1	3

Fischgrund et al: Results

- Clinical outcome was excellent or good in 76% of the patients with instrumentation and in 85% of those without instrumentation (P = 0.45)
- Successful arthrodesis occurred in 82% of the instrumented cases versus 45% of the non instrumented cases (P = 0.0015)
- In patients undergoing single-level posterolateral fusion for degenerative spondylolisthesis with spinal stenosis, the use of pedicle screws may lead to a higher fusion rate, but clinical outcome shows no improvement in pain in the back and lower limbs



- 47 patients prospectively studied
- Underwent Posterior decompression and bilateral posterolateral arthrodesis with autogenous bone graft.
- Follow up from 5 to 14 years: fusion or pseudoarthrosis, clinical analysis
- Clinical outcome was excellent to good in 86% of patients with a solid arthrodesis and 56% in patients with a pseudoarthrosis (p=0.01)

Surgery for Degenerative Lumbar Spondylosis: Updated Cochrane Review

J.N. Alastair Gibson, MD, FRCS, and Gordon Waddell, DSc, MD, FRCS

SPINE Volume 30, Number 20, pp 2312–2320

- 31 RCTs identified
- Conflicting evidence of clinical effectiveness of fusion
- 8 trials addressed whether instrumentation improves the outcome of posterolateral fusion
- There is moderate evidence that instrumentation improves the fusion rate
- There is conflicting evidence that instrumentation improves clinical outcomes

Review: Surgery for degenerative lumbar spondylosis
Comparison: INSTRUMENTED POSTEROLATERAL FUSION vs GRAFT ONLY (mixed disease)
Outcome: Fusion at 2 yrs

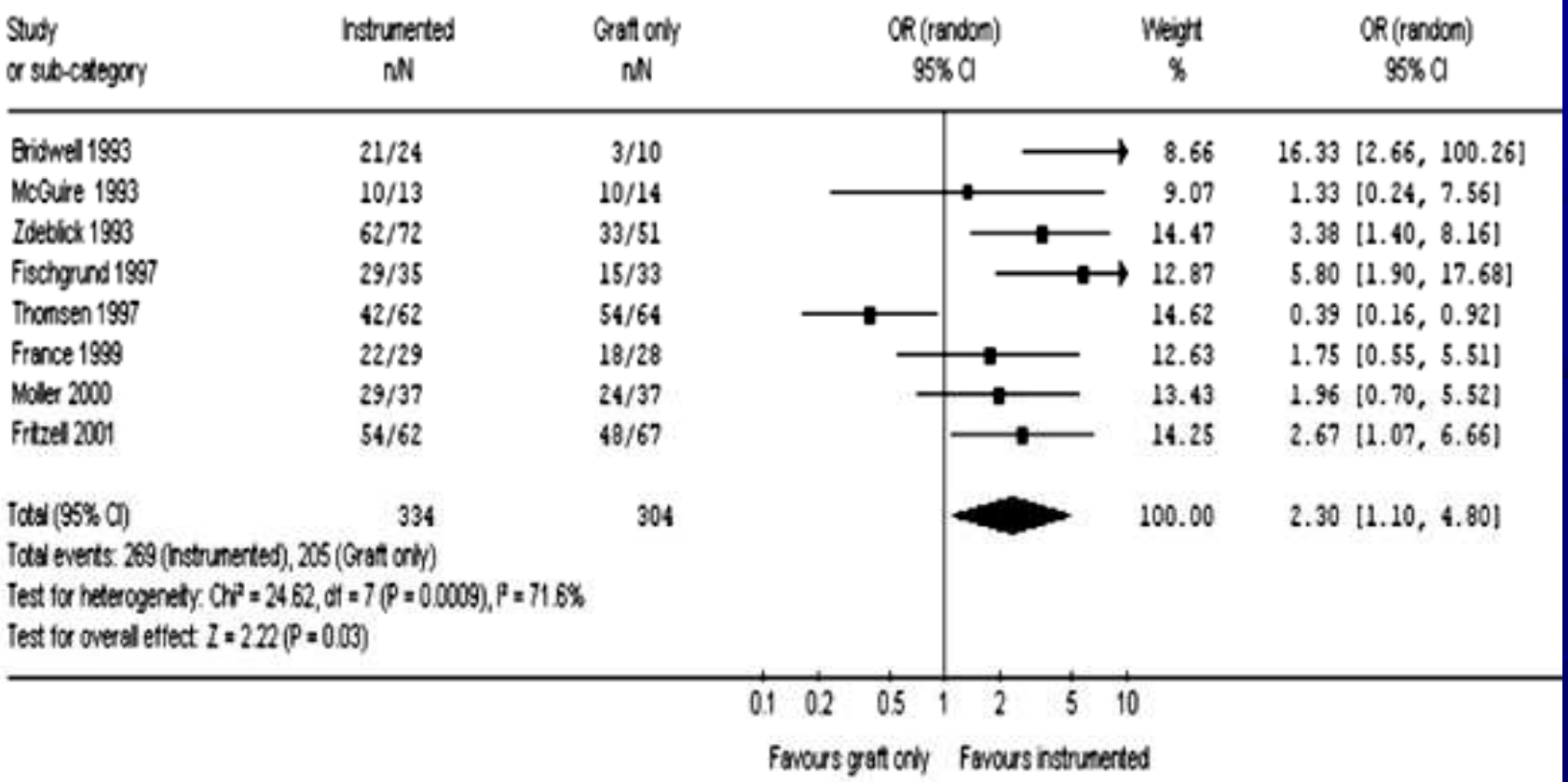


Figure 1. Instrumented posterolateral fusion *versus* graft only: a likelihood of fusion.

Review: Surgery for degenerative lumbar spondylosis
Comparison: INSTRUMENTED POSTEROLATERAL FUSION vs GRAFT ONLY (mixed disease)
Outcome: Good clinical outcome

Study or sub-category	Instrumented n/N	Graft only n/N	OR (random) 95% CI	Weight %	OR (random) 95% CI
Bridwell 1993	20/24	3/10		7.24	11.67 [2.08, 65.59]
McGuire 1993	10/13	7/14		7.64	3.33 [0.63, 17.57]
Zdeblick 1993	67/72	36/51		12.81	5.58 [1.88, 16.61]
Fischgrund 1997	27/35	28/33		11.18	0.60 [0.18, 2.07]
Thomsen 1997	52/63	49/66		15.97	1.64 [0.70, 3.85]
France 1999	21/37	18/33		14.67	1.09 [0.43, 2.81]
Moller 2000	31/37	25/38		12.67	2.69 [0.89, 8.08]
Fritzell 2001	41/60	40/67		17.82	1.46 [0.70, 3.03]
Total (95% CI)	341	312		100.00	2.05 [1.19, 3.54]

Total events: 269 (Instrumented), 206 (Graft only)
Test for heterogeneity: Chi² = 14.07, df = 7 (P = 0.05), I² = 50.3%
Test for overall effect: Z = 2.58 (P = 0.010)

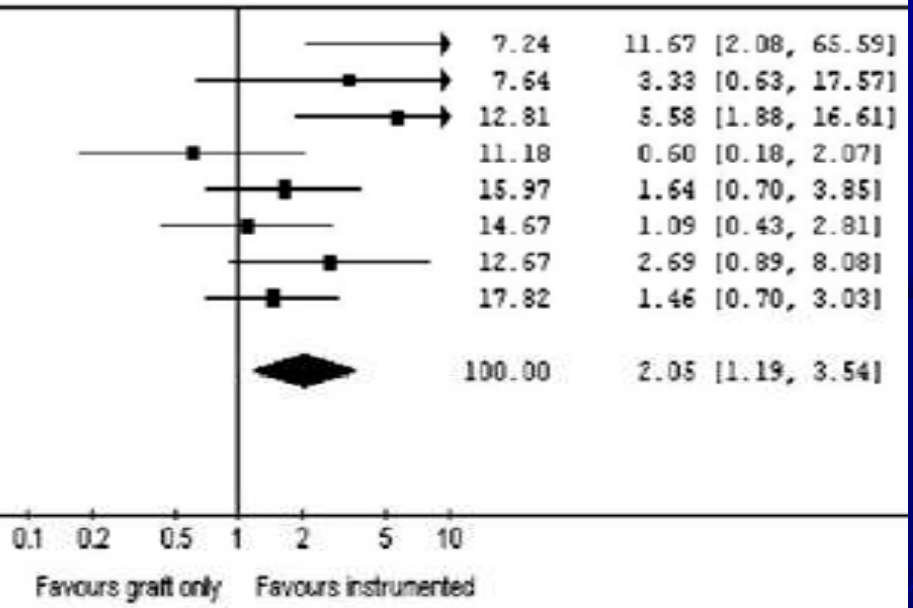


Figure 2. Instrumented posterolateral fusion *versus* graft only: a likelihood of good outcome.

The Effect of Pedicle Screw Instrumentation on Functional Outcome and Fusion Rates in Posterolateral Lumbar Spinal Fusion: A Prospective, Randomized Clinical Study

Thomsen, Karsten MD, DMSc; Christensen, Finn B. MD; Eiskjær, Søren P. MD; Hansen, Ebbe S. MD; Fruensgaard, Søren MD†; Bünger, Cody E. MD

Spine. Volume 22(24), 15 December 1997, pp 2813-2822

- Significantly better ($P < 0.05$) functional outcome in relation to daily activities in the instrumented group when neural decompression had been performed.
- Global patients' satisfaction was 82% in the instrumented group versus 74% in the non-instrumented group (not significant).
- Significant symptoms from misplacement of pedicle screws were seen in 4.8% of the instrumented patients

Karsten et al: Conclusions

- Lumbar posterolateral fusion with pedicle screw fixation increases the operation time, blood loss, and reoperation rate, and leads to a significant risk of nerve injury.
- A gain in functional outcome was found in the daily activity category in patients with instrumentation and supplementary neural decompression.
- The results of this study do not justify the general use of pedicle screw fixation alone as an adjunct to posterolateral lumbar fusion

SPORT TRIAL

Degenerative Spondylolisthesis

Does Fusion Methods Influence outcome? 4 yr Result of Spine pt Outcome trial (SPINE vol 34,number 21,2009)

PLF Vs PPS Vs PPS + INTERBODY FUSION (360^{O})

At 4 yrs there was no difference in health related quality of life outcomes, satisfaction and bothersome scores.

Surgical Management

- Depends upon
  - Symptoms
  - Grade
  - Etiology

Decision to operate depends upon symptoms and which operation to perform depends upon other two factors

Management

- For management pts can be divided into 3 group
  - Group I – children and adolescents
  - Group II – adults
  - Group III – age > 40 years
- Groups further subdivided into
  - A – low grade (I ,II)
  - B – high grade (III,IV and V)

Group I - A

- No symptoms – follow up
- symptomatic
  - Conservative management
    - Slip < 25% - no need to restrict activity
    - Slip > 25%
  - Surgical management
    - Posterolateral fusion

Group I - B

- Indications
  - Slip > 50% in symptomatic and asymptomatic pts
  - Progression of symptoms
- Slippage of less then 50% - single level fusion
- Slip > 50% - extend fusion to one level above
- Isolated decompression without fusion is contraindicated in children
- Role of instrumentation is controversial

Group II - A

- Surgery when conservative management fails
- Fusion with or without decompression
- Only decompression not recommended
- Fusion
  - Posterolateral intertransverse fusion (PLF)
  - Anterior Lumbar interbody fusion (ALIF)
- instrumentation ????

Group II - B

- No symptoms and slip is more – conservative (as chances of progression are low in adults and they have a sagitally balanced deformity)
- Fusion with instrumentation is recommended
  - PLIF
  - TLIF
  - ALIF
- Reduction ???
  - When there is significant sagittal imbalance
  - Partial reduction is sufficient
  - Partial reduction of slip angle is more important than translation reduction.

Group III – A and B

- Degenerative spondylolisthesis
- Rarely exceeds grade I and II
- Surgery
  - Decompression
  - Fusion
  - Instrumentation

Group III – A and B

- Indications of fusion and instrumentation
  - Preoperative factors
    - Disc height – preoperative disc height > 2 mm
    - Degree of kyphosis – (N – saggital angle at L4-L5 is 8 to 17 degree
    - Degree of instability – 5 mm in flexion- extension x rays
    - Degree of listhesis - > 50%
    - Previous laminectomy
    - Adjacent segment disease

- Intraoperative factors
  - Extent of decompression
    - >50% facet excision on each side
    - Total facet excision on any side
    - Discectomy + partial removal of the facets
  - Correction of listhesis
  - Available bone stock

Type and extent of instrumentation

- Posterior pedicle screw only
  - Adequate in most cases
  - Unilateral is as good as bilateral
  - Multi-level fusion then bilateral screws to be placed
- Interbody fusion
  - Correction of listhesis
  - > grade II slip
  - Recurrent cases

AIIMS Data

- Pedicel screw fixation in lumbar spondylolisthesis – 5 year retrospective study – 2007
- Total patients – 30
- Degenerative spondylolisthesis
  - 46.7%
  - Mean age – 44.5 yrs
  - L4 – L5 level – 64.2% cases
  - 57% - women
- Isthmic – 36.7%, mean age – 37 yrs and 54% were women and L5S1 level was most common(63.6%)

AIIMS Data

- Symptoms
  - Back ache – 76%
  - Radicular symptoms – 80%
  - Neurogenic claudication – 36%
  - Bowel/bladder – 10%
- Mean duration of surgery was 5 hrs and blood loss was 950ml
- Symptomatic relief in almost all patients with backache and radicular pain
- Dural tear – 20% with 6.7% having CSF leak
- Malpositioning of the screw – 10% and implant failure in 2.5%
- Follow up range 2-36 months

Thanks ....