SPONDYLOLISTHESIS AND SPONDYLOLYSIS

Herbiniaux[1782] described obstetric problem caused by spondylolisthesis

Kilian [1854] coined the term spondylolisthesis

Definition
Spondylolysis is defect in the pars inter-articularis whereas as spondylolisthesis is a forward displacement of the proximal vertebra with vertebral column above over the distal vertebra

Classification
I (Newman, Wiltse, McNab)

<table>
<thead>
<tr>
<th>Type</th>
<th>Form</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysplastic</td>
<td>20%</td>
<td>I Lysis of Pars (Fatigue #)</td>
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<td>Isthmic</td>
<td>45%</td>
<td>B. Attenuation of Pars</td>
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<td>C. Acute # (Acute Pars #)</td>
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<tr>
<td>Degenerative</td>
<td>20%</td>
<td>III Degenerative</td>
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<td>IV Traumatic (Vertebra’s other than Pars)</td>
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<td>V Pathological (Neoplastic or metabolic, Paget’s , OI)</td>
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<td>VI Post-surgical</td>
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II Marchetti and Bartolozzi

<table>
<thead>
<tr>
<th>Type</th>
<th>Form</th>
<th>Condition</th>
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</thead>
<tbody>
<tr>
<td>Developmental</td>
<td>High Dysplastic</td>
<td>Pars lysis</td>
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<tr>
<td></td>
<td>Low Dysplastic</td>
<td>Pars elongation</td>
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<tr>
<td>Acquired</td>
<td>Traumatic</td>
<td>Acute fracture</td>
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<td></td>
<td></td>
<td>Stress fracture</td>
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<tr>
<td>Surgical</td>
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<tr>
<td>Pathological</td>
<td>Local pathology</td>
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<td></td>
<td>Systemic Pathology</td>
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<tr>
<td>Degenerative</td>
<td>Primary, Secondary</td>
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</tbody>
</table>
**III Hermon’s classification**

Dysplastic
Developmental
Fracture: Acute
Chronic: Stress reaction
Stress fracture
Pseudarthrosis

Pathological

**Etiology**
1. Congenital: rare. No evidence of lytic defect in the newborn
2. More in athlete: Mechanical stress can cause acute or stress fracture
3. Stress: During flexion and extension: compression and tensile force
4. Genetic: Autosomal dominant with incomplete penetration
5. Dysplastic: lack of lumbo-sacral facet joint may not withstand even normal daily activities

**Incidence**

Overall incidence: listhesis/Lysis: 16%
Female Gymnasts: 10-20%
Alaskan population: 50%
African: 1.8%
Caucasian: 5.6%

**Natural History**
1. Progression is rare in adults. Only in 5% progression of Spondylolysis to a low-grade listhesis. Progression to high-grade spondylolisthesis is rare.
2. Adults with Spondylolysis have no more back pain than the rest [10%]
3. Dysplastic type have frequent neurology and progression of deformity.
4. Athletes Vs normal. 8% incidence of asymptomatic spondylolysis and spondylolisthesis reported in the general population as opposed to 40% of athletic participants.
**Dysplastic Type I**
L5-S1 common site
Male: Female 1:2
Pathology: Spina bifida, Elongation of pars, Rounded sacrum, trapezoid vertebra, Hamstring tightness (High grade slip)

**Isthamic Type II**
Male: Female 2:1.
Familial
Common in Athletes, gymnasts, fast bowlers, Scheurman’s 50% in Eskimos (Genetic)
Site: Level: L5 (87%); L4 (10%) and L3 (3%)
Neurological symptoms or hamstring spasm is not seen

**Clinical**
Children: 3 presentation
I. Mild-moderate slip Low back ache with stiffness
II. High grade slip Back ache +/- radicular pain
Bizarre posture and gait problems
III. Severe slip Like II with or without cauda equina lesion

Adults
Long standing backache (common)
High slip
Crab like gait [flexion at Hip and knee, broad base]
Buttocks become flattened; Step
Paraspinal spasm
Hamstring spasm
Torso is foreshortened
Lumbo-sacral Kyphosis and hyperlordosis, Scoliosis
Neurological assessment

**X ray**
Standing: AP, Lateral, Oblique
Dysplastic or Isthamic depending on shape of the sacrum or vertebra

In spondylolysis in oblique view
Scottish terrier: with the defect in the dog’s neck
Listhesis: 1. Grade [Meyerding]
   2. Slip angle
   3. Sacral inclination
   4. Lordosis

**Listhesis**

I  **Amount of displacement**
Meyerding grading
   I    0-25%
   II   25-50%
   III  50-75%
   IV   >75%

> 50% means a high grade

II  **Slip angle:** N: 0 to -10º
   >10º means high grade
Superior border may be difficult to define and therefore perpendicular is drawn from the posterior aspect of S1 to the anterior lip

III  **Angle of sacral inclination**
Measured from the vertical axis and the posterior cortex of the sacrum

IV  **Lumbar index**
Angle of Lumbar lordosis
L1 to L5 (superior surface)

**SPECT**
SPECT scan is negative in isthamic, genetic and healed stress fracture
Positive in stress reaction or fracture
Negative SPECT with pars defect means spondylolysis is not the source of pain

**CT**
Thin-cut axial CT of the lumbosacral spine using the reverse gantry
Localized sclerosis without trabecular disruption is a stress reaction.
With a break in par interarticularis is a Stress fracture
CT also is useful to assess the morphology of vertebra and canal

**MRI**
Is indicated when neurologic symptoms
Risk factors for slip progression
young age at presentation

**Treatment**
I Low grade slip and all asymptomatic patients when slip is < 50% does not require any treatment.

II When symptomatic
Reduce sports and activity modification
Exercises: Flexion strengthening exercise
Stop smoking
X-rays every 6 months until maturity

Role of brace
Not beneficial unless one hip is included

Athlete
Once asymptomatic, can return to sports and there is no need to curtail their activity
If Pain returns: then consider surgery.

High grade slip
Usually requires stabilization

Acute fracture
Always need surgery

Chronic fracture
Always hot
CT scan at 6 months after non-op
Go back to sports
If symptomatic: Repair
Operative
Indications
1. Always indicated when slip is over 50% or slip angle >10º as in dysplastic
2. Failed Non-operative treatment in Lysis or Grade I and II listhesis
3. Significant neurological deficit

Options
1. Operative repair
2. Only decompression (Gills Procedure)
3. In situ, Intertransverse fusion
4. Decompression and Intertransverse fusion
5. Instrumentation and fusion
6. Reduction and Instrumentation fusion with or without Anterior or posterior interbody fusion

Gills laminectomy
Technique
Laminectomy and excise fibrocartilage at pars interarticularis
30% instability [displacement] at 5 yrs
60% good to excellent results.

Repair Pars Interarticularis
Indicated: Spondylolysis or grade I listhesis in young adolescent
Advantages: Preserves motion segment

Types
Scott and Nicol
Tension band wiring around the transverse process and Spinous process.
Reported 92% success

Bucks
Screw fixation from inferior facet to the pedicle
Bone graft the defect.
Reported 95% healing
Morscher:  
Sublaminar Hook and screw

Hodgson  
Pedicle screw and wire

Surgical treatment of spondylolisthesis

1. Level of Fusion  
Grade I & II slip  
Grade III, IV, V  
L5-S1 Posterolateral fusion  
L4-S1 Posterolateral fusion

2. Type of fusion  
Posterolateral fusion is common  
Posterior interbody fusion  
Anterior interbody fusion

3. Instrumentation  
In Children –Posterolateral fusion and Pantaloon type cast x 3 months  
In adults  
Posterolateral fusion and pedicle fixation

4. Decompression  
When neurology is present  
When reduction is planned in spondylolisthesis when slip is over 50%
Spondyloptosis
1. Leave it alone
2. Reduction: High incidence of neurology
3. Resection of L5 with reduction of L4 on to the sacrum

Weinstein: Results of high grade slips treated with and without fusion. Their conclusion is at an 18 yr follow up, there was little difference between the results of operative and nonoperative treatment.

Recently in some spinal centres, there is a trend to use of open technique to reduce high grade slip as it improves cosmesis, restores of trunk height, improves buttock and spine contour and decompresses nerve root.