SPONDYLOLISTHESIS

WAYNE CHENG, MD

Bones and Spine
OUTLINE

- Definition
- Classification
- Clinical presentation
- Imaging - measurement
- Natural history
- Treatment -
  - Non Surg Vs. Surg
    - Decomp with fusion Vs. without fusion
    - Fusion with instrumentation Vs. without
    - Reduction Vs. In-situ fusion
- High grade
SPONDYLOLYSIS VS. SPONDYLOLISTHESIS

- Greek roots:
  - Spondylo = spine or vertebra
  - Lysis = to dissolve
  - Listhesis = to slide or slip
CLASSIFICATION
WILTSE, NEWMAN, MCNAB 1976

- **dysplastic**: 20% listhesis, 2F : 1 M, Cause: L5-S1
- **isthmic**: Most common, 2M : 1F, Cause: L5-S1
- **degenerative**: 6F : 1M, Age >40, 10%F>60, cause
- **traumatic**
- **pathologic**
CLINICAL PRESENTATION

- Mostly asymptomatic
- Back pain
- L5 root
- Claudication
- Vespers curse
- Tight Hamstrings (80%)
- High slip:
  - L/S kyphosis
  - flattening of buttocks
  - forward thrust of Abd.
  - Absence of waistline
ASSOCIATED CONDITIONS

- Spinal bifida occulta (24-70%)
- Scoliosis (5-7%)
- Disk Degeneration (50%)
- Lumbarization/sacralization (7-9%)
- Osteoarthritis (11-17%)
RADIOGRAPHIC STUDY

- **Standing** AP/Lateral
  - Inc. slip 17%
  - Inc slip angle 5 degree
- Oblique views
  - Scottie dog’s neck
- Bone scan-cold/hot
- SPECT bone scan (single photon emission CT)
- MRI/CT myelogram
RADIOGRAPHIC MEASUREMENTS

- Percentage slip
- Meyerding
  - I 0-25%
  - II 26-50%
  - III 51-75%
  - IV 76-100%
  - V > 100%
RADIOGRAPHIC MEASUREMENTS

- **Slip Angle:**
  - Angle between L5 inf. Endplate to line perpendicular to post surface of S1.
RADIOGRAPHIC MEASUREMENTS

- Sacral Inclination:
  - Angle between vertical line and back of S12
RADIOGRAPHIC MEASUREMENTS

- Rounding ratio:
  - % of round shape of sacrum

\[
\frac{a}{b} \times 100 = \% \text{ of rounding}
\]
RADIOGRAPHIC MEASUREMENTS

Lumbar Index = posterior height / anterior height
PELVIC INCIDENCE
NATURAL HISTORY

**Isthmic**
- Spondylolisthesis does not exist at birth
- Spondylolysis 4.4% at age 6, 6% in adult
- Development of pars defect does not cause pain in most patients
- Progression is unusual.

**Degenerative**
- Less understood
- Progression of slip 30%
- Clinical deterioration 10%
- No correlation between slip progression and deterioration of Sx.
- 15% patients require surgery

Fredrickson, JBJS, 1984
Fitzgerald, JBJS, 1976
Frymoyer, JAAOS, 1994
NON SURGICAL TREATMENT

**Children**
- Asymptomatic: no activity restriction
- Frequency of x-ray:
  - <10 YO: q4month
  - 11-15YO: q6month
  - >15 YO: q1-2years
- Stop aggravating activities
- Period of brace
- Trunk strengthening

**Adult**
- Mild analgesics/NSAID
- Weight control
- Aerobic exercise
- Bracing
- Epidural steroids
SURGICAL INDICATIONS

- Persistence or recurrence of major symptoms for at least one year despite conservative treatment (incapacitating radicular pain or claudication)
  - Quality of life
- Progressive neurologic deficit (cauda equina, motor weakness)
- Progressive slipping beyond 50% or high slip angle above 50 degree in a growing child (even if child is asymptomatic)
- Gait or postural deformity unrelieved by therapy
SURGERY

- Decompression alone without fusion.
- Fusion
  - With decompression, without decompression.
  - Levels
  - Anterior vs. posterior vs. front&back
  - In situ vs. Reduction
  - Instrumentation Vs. no instrumentation
DECOMPRESSSION
WITH FUSION VS. WITHOUT FUSION
(DEG. SPONDYLOLISTHESIS+STENOSIS)

- Herkowitz, JBJS, 1991
  - Prospective/random.
  - 50 pts
  - 3 year f/u
  - Post op listhesis:
    - 96% non fused group
    - 28% fused group
  - Op results:
    - 96% good or excelnt. (fused group)
    - 44% good or excelnt (nonfused group)

- Epstein, J. Spinal Disord, 1998
  - Retrospective
  - 290 pts with decomp. Only
    - (<4mm, 10 degree)
  - 10 year f/u
  - 69% excellent, 13% good.
  - Only 2.7% required secondary fusion
INSTRUMENTED VS. NON-INSTRUMENTED FUSION

- Zdeblick, Spine, 1993
  - Prospective, randomized.
  - 124 pts.
  - F/u 16 month
  - Fusion rate 95% for rigid instrumt group vs. 65% for non instrumt group
  - 95% good/excell. Result with Vs. 71% good/excell result without.

- Herkowitz, Spine, 1997
  - Prospective, randomized
  - 76 pts
  - F/u 24 month
  - Fusion rate 82% with instrumentation, 45% without.
  - 76% good/excell. With instrumentation Vs. 85% without.
IN SITU FUSION VS. REDUCTION/FIXATION FOR HIGH GRADE SLIP

- Wiltse, JBJS, 1989
  - 8 young adults with grade III or IV with marked pre-op sciatica undergone In Situ fusion without decompression
  - F/u 5.5 years
  - All healed. Excellent results with resolution of marked pre-op sciatica
  - No neurologic complication

- Edward & Spinal fixation Study group
  - (Rothman-Simeone)
  - 25 young adults with grade II to V undergone one stage post. Reduction /fixation.
  - F/U 2 years
  - 91% slip correction, 88% kyphosis correction
  - One nonunion. No long term neurologic complication
RISK FACTORS FOR PROGRESSION

- Slip angle > 25 degree
- Lumbar index (wedging ratio) < 75%
- Rounded sacral end plate
- Slip > 50%
- Hyperlordosis (> 50 degree) L2-S1 or vertical sacral inclination
- Female adolescents
- Lumbosacral hypermobility (> 4mm, 10 degree deflection in flex. And ext. xray)
- Pelvic incidence > 68 degree (low grade); 79 degree (high grade)
ADVANTAGES OF REDUCTION

- Restore body posture and mechanics.
- Decreases 30% chance of progression despite good in situ fusion.
- Permits full nerve decompression.
- Limits fusion length.
INDICATIONS FOR REDUCTION

- Cauda Equina Syndrome
- Progressive Slip surpassing 50%
- Severe deformity causing decompensation or distress
- Major pain plus two or more risk factors
SPONDYLOPTOSIS

- Posterior gradual instrumented reduction/fixation
- Anterior resection + posterior fixation (Gaines procedure)
- Fibula Strut graft
FIBULA STRUT GRAFT
16 YEAR OLD GIRL WITH BACK PAIN AND SOME L5 RAD.
INTRA-OP
1 YEAR POST OP
SPONDYLOPTOSIS
CONCLUSION

PERSONAL PREFERENCE

- 80% of patients:
  - Good trial of conservative treatment.
  
- 20% of patients:
  - Adolescent without neuro. Deficit
    - In situ fusion with or without instrumentation
  - Adults with unstable degenerative spondylolisthesis
    - Post. Decompression, in situ fusion + instrumentation
  - High Grade Slip

INDIVIDUALIZE TO EACH PT’S NEEDS
A healthy 70 YO man has back and leg pain in an L5 distribution that is increased with standing and walking, relief by sitting. Neurological and pulse exam normal. X-ray reveals spondylolisthesis, MRI with stenosis. Management should be:

- A. Laminectomy
- B. Hemilaminectomy
- C. Laminectomy and fusion
- D. Anterior interbody fusion
- E. Posterior fusion
CASE DISCUSSION
CASE DISCUSSION
THANK YOU