INDICATION FOR SURGICAL TREATMENT OF SPONDYLOLISTHESIS

T. Greggi,

Spine Surgery Division
Rizzoli Orthopedic Institute
Bologna, Italy
When we have to treat an onthogenetic spondyloolistesis in infant/adolescent???

- Treat the pain that has not responded to farmacological/conservative treatment
- STOP worsening

ITS’ NOT JUST GROWING PAINS !!!!!!
CONGENITAL: typical isthmic lysis
- Young people
- Degree of vertical sliding and sacrum obliquity

Meyerding Grading:
Gr I: <25%
Gr II: 25-50%
Gr III: 50-75%
Gr IV: 75-100%
>100% Spondyloptosis
Features:
• L5-S1 is the most affected segment
• Sacral dome
• Trapezoidal L5

• High probability of worsening (PI increasing)

...Delpech Law: the growth of the bone is more in the zone without pressure...

• There is not clear correlation between slippage and symptoms
CLINICAL PRESENTATION

- Vertical Sacrum
- Flexion of the hips and knees
- Hyperlordosis
- Low back pain meccanical
- Worsening with activity
- Improves thanks to the rest
- Radicular leg pain
- Claudicatio spinalis
- Cauda equina syndrome

IMAGING

- X-rays Standard and dynamic
- MRI
- CT
- isthmic lesion
- EMG
TREATMENT

CONSERVATIVE

- No heavy sports
- Pharmacological treatment (NSAIDs, cortisone)
- Rehabilitation (Strengthening abdominal and lumbar)
- Lumbar Brace
INDICATIONS FOR SURGERY

- **Up to Grade II**
- **Pain**: back pain crises become more frequent and more intense, radicular symptoms or cauda equina syndrome
- **Progression** (displasyc sacrum, trapezoidal L5, Sex F)
Surgical indications

**Low grade spondylolisthesis**

Patients who fail at least 6 months of conservative treatment should be considered for surgery.


Several surgical techniques are reported in literature.
Direct pars repair:
- option in younger patients
- no or minimal spondylolisthesis, no radiculopathy, normal vertebral disc on MRI.


In situ fusion:
- gold standard
- controversies still exist about the role of instrumentation and decompression.
Decompression alone:
- never indicated in young patients
- option in elderly patients without signs of instability.

Decompression:
- is required if significant radicular symptoms or neurologic deficits are present.
- is associated with an increased rate of pseudoarthrosis and unsatisfactory clinical results.

Instrumentation:

- **no benefits**: Moller (Spine 2000), France (Spine 1999), McGuire (Spine 1993), Thomsen (Spine 1997)
- **benefits**: Bridwell (J Spinal Disord 1993), Deguchi (J Spinal Disord 1998), Ricciardi (Spine 1995)
- **no differences** between instrumented and non instrumented fusion: Amundson (Spine 1987)

Fusion extended to L4 (or L3) in case of:

- L4-L5 instability
- L4-L5 disc degeneration
- L5 transverse processes are very small
- high grade slip
Circumferential fusion:

- the literature seems to suggest that a circumferential fusion (PLIF, TLIF, combined approach) is associated with a higher fusion rate and improved clinical outcomes
- however, **no clear indications are reported**
- it should be considered in case of **risk of pseudoarthrosis** (decompression, lysthesis reduction with increase in the disc height)


Reduction:
- not adequately assessed the benefits in the literature
A. A., female, 17 yrs.
Isthmic spondylolisthesis L4-L5 (Meyerding grade 1) + spondylolysis L3-L4.
Low back pain.
MRI – CT
L3-L4 lysis
No signs of disc degeneration
Dynamic views:
L4-L5 instability

Low grade
Reduction followed by PLF + TLIF L4-L5 + L3-L4 pars repair (Scott technique)
Low grade
High grade spondylolisthesis

Surgery is indicated in young patients even if asymptomatic or with clinical symptoms.

Several surgical techniques are described:

- Anterior fusion
- Posterolateral in situ fusion
- Posterior reduction and posterolateral fusion
- Posterior reduction and posterior interbody fusion (PLIF, TLIF)
- Posterior reduction and 360° fusion (double approach)
Role of reduction

Spondylolisthesis reduction is still controversial in literature

Reduction advantages:

- lumbosacral kyphosis correction and sagittal malalignment improvement
- fusion rate improvement (through a conversion of shear forces in compressive forces)

Reduction disadvantages:

- increased risk of neurologic complications (8-30%)
In 2007 Transfeldt and Mehbod performed a literature review: five comparative retrospective studies were analyzed, none of which showed any benefit to reduction.


Despite this, several studies have reported good results with reduction of high-grade slips: Bartolozzi (Spine 2003), Shufflebarger (Spine 2005), Ruf (Spine 2006), Fabris (Spine 1996), Smith (Spine 2001).
THE ROLE OF REDUCTION

- controversial in literature

BENEFITS

- restoration of lumbosacral kyphosis
- Best fusion (conversion of shear forces in compression)

LIMITS

- increased risk of complications

The reduction may not be necessary when the sagittal alignment is preserved.
THE ROLE OF REDUCTION

"SPINE Deformity Study Group"

Classification system into 6 types based on pelvic parameters for the choice of surgical treatment:

- Type 1: PI < 45°
- Type 2: PI 45° - 60°
- Type 3: PI > 60°
- Type 4: Balanced Pelvis
- Type 5: Balanced spine
- Type 6: Unbalanced spine

Degree of slip
Spino-pelvic alignment

- SPL
- L5-S1

Role of reduction

In conclusion, a reduction procedure is best reserved for patients with lumbosacral kyphotic deformity with loss of global sagittal balance.

If reduction is performed, circumferential fusion (PLIF, TLIF, ALIF) is strongly recommended to prevent slip progression and pseudoarthrosis (particularly in patients with high PI, who have additional shear forces at lumbosacral junction).

A partial reduction can be an option, with reduced risk of neurologic complications, and the achievement of the same goals.
If the vertebra adjacent part of the unstable area must be included in the arthrodesis.
G. Y., female, 11 yrs.
Isthmic spondylolisthesis L5-S1 (Meyerding grade 3).
Reduction followed by PLF + PLIF L5-S1.
C. M., female, 11 yrs.
Isthmic spondylolisthesis L5-S1 (Meyerding grade 3). Low back pain.
Reduction followed by PLF L5-S1. 18 months later, recurrence of deformity.
Revision surgery with double approach (PLF L4-S1 + anterior TranS1 L5-S1).
T. A., female, 14 yrs.
High grade isthmic spondylolisthesis. Low back pain.
PLF L4-S1 (little reduction was achieved) followed by anterior TranS1 L5-S1
FU 18 months
S. M., female, 17 yrs.
Isthmic spondylolisthesis L5-S1 (Meyerding grade 3/4). Low back pain.
Reduction followed by PLF + PLIF L5-S1.
1. Indipendent Scoliosis

F 8 yrs/o
2. Olisthesic Scoliosis

- STRUCTURED Scoliosis and spondylolisthesis: SIMULTANEOUS TREATMENT

- Painful Scoliosis unstructured (unilateral sciatica) TREATING SPONDYLOLISTHESI regress scoliosis
Our Choice

Low grade isthmic spondylolisthesis
Young patients: reduction and posterior instrumented fusion + interbody fusion (depending on disc height)

High grade isthmic spondylolisthesis
Reduction and fusion (posterior instrumented fusion + interbody fusion like PLIF or TLIF)
ALIF (like anterior TRANS1) in case of incomplete or impossible reduction or as salvage surgery
MATERIAL AND METHODS

Spondylolisthesis treated surgically from 1990 to 2010 477 cases

Age <18 years: 77 cases (16%)

30 cases (38%) High grade

SPONDYLOLISTHESIS IN THE ADOLESCENT INFANTE AGE
Average age: 16 years (11 to 18)
No previous surgery

L5-S1 = 26/30
L4-L5 = 4/30

Meyerding
III = 16
IV = 8
V = 6
MATERIAL AND METHODS

SURGICAL INDICATIONS

- Lumbar Pain 30/30
- Lower limb pain 26/30
- Progression 23/30
- Sciatica 8 / 30

SPONDYLOLISTHESIS IN THE ADOLESCENT INFANTE
SURGICAL TREATMENT

Anterior interbody fusion
Posterolateral arthrodesis
Posterior interbody arthrodesis
Combined arthrodesis
Reduction of the slip when it is important

· Modified Gill’s Technique

Neural structures
Decompression
SURGICAL TREATMENT

PLF/PLIF + Reduction
Modern systems

BENEFITS

Less exposure to tissues

less bleeding
F. 16 y/o SPL L5-S1
SPL L5-S1
Reduction + PLIF
PI
F. 12 y/o SPL L5-S1
Reduction + PLIF
COMPLICATIONS

6 cases (20%)  
2 sacral screw loosening  
2 loss of reduction (revision surgery)  
1 post-op Sciatica (L5, S1)  
1 wound Infection

Revision Surgery

· Interbody screw (Trans1) 2 cases (7%)  
· Proximal extension to restore sagittal parameters 2 cases (7%)

· SPONDYLOLISTHESIS IN THE ADOLESCENT INFANTE AGE
M, 13 y/o SPL L5-S1
PLF + Reduction

**SPONDYLolisthesis in the Adolescent Infante Age**

Bartolozzi screw L5-S1
## RESULTS

### % SLIPAGE

<table>
<thead>
<tr>
<th>Preop.</th>
<th>Postop.</th>
<th>F.up</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.3%</td>
<td>32.4%</td>
<td>33.8%</td>
<td>56.8%</td>
</tr>
</tbody>
</table>

SPONDYLOLISTHESIS IN THE ADOLESCENT INFANTE AGE
Net improvement of the clinical and radiographic aspect

SPONDYLOLISTHESIS IN THE ADOLESCENT INFANTE AGE
The surgical treatment of spondylolisthesis in adolescence is reduction + PLF/PLIF/TLIF.

The reduction is designed to convert shear forces into compression forces restoring spinal-pelvic parameters.

Very interesting is the use of Bartolozzi screw.
CONCLUSIONS

Before SURGICAL TREATMENT OF ontogenetic SPONDYLOLISTHESIS we have to keep in mind NUMEROUS FACTORS (Zagra 2008)

1. clinic
2. Worsening of slippage
3. Age and PHYSICAL CONSTITUTION
THANKS