Adult degenerative scoliosis:
the extent of surgery - does it correspond to the
extent of deformity? and how to handle failures.

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Adult Scoliosis

Type 1: "De nuovo" = disc degeneration

Type 2: Progressiv Adult Idiopathic Scoliosis

Type 3: Secondary to pelvis tilt, Hip problem

Type 4: Secondary to metabol. Bone disease

Secondary Lumbar deg. Scoliosis in Thoracic AIS
Secondary Degenerated curve in NM Scoliosis
Two main types exist:

• **adolescent scoliosis**, which continues to progress in adult life *(type A)*;

• or late onset scoliosis, *de novo* *(type B)* - is a multilevel disc disease
13 years old boy

25 years old male
Type A adult scoliosis

13 years old boy

25 years old male
G.V. 25 y/o boy postop. progressive kyphosis. T4-L2 PSF, Ponte OT, sublaminar wiring
Epidemiology

The *prevalence of ASD* is increasing in industrialized countries due to an aging population, demographic shifts, increased life expectancy and, likely, increased recognition of the disorder.(1,2,3)

**AIS:**
33% is younger than 15 years = 750‘000 people
2-3% of adolescent population has **AIS**: ca. 5000 AIS

**Adult Degenerative Scoliosis**, all forms
6% prevalence of **adult scoliosis** in population > 50 years old (= ca. 500‘000 of the population) corresponds to ca. 30‘000 people with adult scoliosis.

Number of patients, who need some sort of surgery is unknown, but still a significant number.
Fig. 1 SF36 scores in ASD patients and in four chronic conditions as assessed in the IQOLA project

The eight sections are:
- vitality (VT)
- physical functioning (PF)
- bodily pain (BP)
- general health perceptions (GH)
- physical role functioning (RP)
- emotional role functioning (RE)
- social role functioning (SF)
- mental health (MH)

* Role limitations due to physical health
• Patients improvement: better after surgical treatment than medical treatment

• Improvement in SRS scores

• Significant rate of complications: 9-66%
  • >50 yo: 55%
  • <50 yo: 31%

Bridwell, Spine 2009
Smith, Neurosurg. 2009
Smith, Spine 2009
Li, Spine 2009
Degenerative Adult Scoliosis

De novo deg. Scoliosis is the most frequent form of Adult Scoliosis
In the industrialized countries

This is a multilevel disc disease!
Cause of symptomatology

-Degenerative disc disease, loss of disc height, osteochondritis, pathological movement
-Facet joint arthritis, asymmetrical facet joints, subluxation
-Osteoporosis, osteoporotic compression fractures
-Spino–pelvic parameters
  -Sagittal orientation of the pelvis
    -Pelvic tilt
    -Sacral slope
  -Intrinsic shape of the pelvis
    -Pelvic incidence
Adult, deg. Scoliosis

Instability

Pain

Claudication

Cosmesis

Stenosis

Deformity

Neurol. Deficit

Progression

Frontal, Sagittal plane

Scoliosis Cyphosis

Central, Recessal

Bone metabolism Mechanics
Clinical Presentation

- **Pain**
  - Back pain 40% to 90%
  - At the apex
  - Referred pain
  - Radicular pain
    - At concavity
    - At convexity
  - Pain due to stenosis (claudication)
  - Pain associated with sagittal compensation and decompensation
- **Functional disability: global axial instability and local instability**
- **Increasing deformity and imbalance**
- **Neurological Deficit: root irritation, claudication symptoms in central stenosis**

Incidence of back pain similar to general population but greater and more persistent

Psychological impact of chronic pain associated with deformity
Flexion/extension and side bending view: native and with functional myelogram.

Standard whole spine ap standing

Under traction

**Functional x-rays**

Traction for a “collapsing” spine: realignment: see the air inclusion in the mobile disc.
Realignment objectives in the sagittal plane. SVA < 60mm PT < 20°, and LL PI +/- 9° sets the stage for achievement of a successful harmonious spinopelvic realignment.

**Chain of interconnected parameters: TK – LL – PI, SVA and T1-SPI**

- LL = Lumbar Lordosis
- TK = Thoracal Kyphosis
- T1-SPI = Spino pelvic inclination

SPINE (2010): 35(25), 2224ff F. Schwab et al
Risk factors:

• Osteoporosis
• Osteomalacia
• Age
• Early asymmetric disc degeneration
Strategy and technique selection

• Previous surgery?
• Free levels
• Focal deformity, sagittal balance?
• More correction in lower levels
• Risks
  • Bleeding
  • Surgery duration
  • ICU
  • Neurological risks
Position of diseased discs, balanced

Type I

Type II

Type III

Imbalanced

Type IVa

Type IVb

Far from apex: NONAPICAL

Limited to apex: APICAL

All the coronal curve: EXTENDED

Sagittal

Sagittal and coronal
Type I: (balanced)
Localized NONAPICAL
Type I: (balanced) Localized NONAPICAL

Rules

- Correction of the curve not necessary
- Decompression (+/- fusion) in nonapical area
Type II: (balanced) Localized APICAL
Type II: (balanced)
Localized **APICAL** DDD

**Rules**

- Complete correction is desirable
- Fuse the disc above and below the apical vertebra
Type I: 68 yrs old female pat with severe motion and activity dependent left leg pain: Surgery L3/4
Anterior surgery alone
XLIF Procedure: far lateral approach
De novo adult scoliosis:
Typ I: non apical disc disease with severe stenosis

79 yrs old polymorbid female patient
Type III
Balanced extended

**Significant problem:**
- Root Claudication on the concave side
- Osteoporosis
- Collapsing spine
Type III
Balanced extended

Significant preop problem:
• Root Claudication on the concave side
• Osteoporosis
• Collapsing spine

Postop. Good functional outcome
Lumbosacral – pelvic fixation
Typical Problem:

- Progressive curve
- Pain
- Loss of lumbar lordosis
- Imbalance
- Spinal Stenosis
- Osteoporosis
- Lumbosacral fixation

Adult, deg. Scoliosis

(Secondary deg. Scoliosis of an originally AIS, Type III)
Type IVa: Sagittally Imbalanced

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<thead>
<tr>
<th></th>
<th>Preop</th>
<th>Target</th>
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<tbody>
<tr>
<td>PI</td>
<td>63°</td>
<td></td>
</tr>
<tr>
<td>SS</td>
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<tr>
<td>PT</td>
<td>47°</td>
<td>16°</td>
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<tr>
<td>LL</td>
<td>-1°</td>
<td>73°</td>
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<tr>
<td>L3-L4</td>
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</tbody>
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Type IVa: Sagittally Imbalanced

70°
51°
18°
Type IV:
Sagittally Imbalanced

**Rules**

- Sagittal restoration of PI-LL mismatch is mandatory

- Powerful corrective methods are needed:
  - PSO
  - Anterior release techniques

- Lateral for:
  - Restoration of anterior column in PSO
  - Anterior release and PSO avoidance
C.M. female physician, 72 yrs.preop, severe back pain when up and sitting
C.M. female 72 yrs. preop, 4 / 2009

Reclination with roll

Inclination, supine

Supine, under traction

Supine, R bending
C.M. 6 ms postop

Post. Correction
2 Smith-Peterson OT, Stabilisation and Fusion T10 - S1
C.M. Female, 73 yrs., 10 ms postop.
C.M. Female, 73 yrs., 11 ms postop.1 and 1 m postop.2
On average, elderly adults with scoliosis have significantly greater disability, greater severity of back and leg pain, and worse health status at baseline, compared with younger adults with scoliosis.

Elderly adults with scoliosis had significantly more complications with surgical treatment, with the oldest age group (65–85 years) having nearly 4 times the number of minor complications and nearly 5 times the number of major complications compared with the youngest age group (25–44 years).
Adult spinal deformity surgery

Early triage is necessary:
Interdisciplinary spine team approach:
• Imaging,
• neurological and
• clinical diagnostic abilities as well as
• surgical armentarium both, in terms of human resources and technological resources available in the team,
• weighting non surgical-versus surgical treatment
• Anaesthesiology, Internal Medicine, Postop. rehabilitation

The best triageur is the specialized spine surgeon:
Indication is key

Definitely a tertiary care procedure:
cases need to be centralized: bigger the case load and routine lesser complications and better outcome and lower the costs!
Thank you for listening