Deformity and its correction with osteotomies

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BACKGROUND

- In 2050, 54% of the population will be older than 65 y
- The scoliosis present in 68% of people older than 60 y
- Surgical treatment of adult spinal deformity frequently necessitates osteotomies and multilevel arthrodesis
- For this high-risk surgical group, complication rates in the literature range from 30% to 90%

Michael G. Fehlings, M.D Spine Dec 2010 / Vol. 13 / No. 6 / Pages 663-664
Riggs BL, Melton LJ. 1995; Crafts NFR., 1997
BACKGROUND

• Instrumentation-related complications (instrumentation failure, progressive kyphosis and pseudarthroses) of multilevel fusions for adult spinal deformity patients over age 65 – 50%

• Laminar fixation does not provide sufficient stability & correction of sagittal balance under poor bone mineral density.

• Standard transpedicular screw fixation not effective and in many cases seems to be a contraindication in patients with osteoporosis.

• Cement and perforated screws definitely have greater resistance to pullout.

  DeWald CJ, Stanley T. Spine 1. 2006;31:144–151
Epidemiology of deformities in elderly

1. **Progression of the disease from childhood.** This usually occurs when scoliosis has not treated early or went unnoticed.

2. **The asymmetric degeneration of spinal elements.** This may be caused by osteoporosis, disc degeneration, compression fracture, or a combination. These conditions usually affect the lumbar spine and can affect vertebral height, shape, or basic structural integrity.

3. **Combination of numbers 1 and 2.**

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Edgar G. Dawson. Scoliosis in Adults From Diagnosis to Treatments. 2013 [http://www.spineuniverse.com]
Decision making in treatment of deformity in elderly

- Clinical & X-Ray symptoms
- Somatic status
- Type of surgery:
  - Decompression with or without fusion?
  - With or without fixation?
  - Fixation “in situ” or with correction?
  - Extension of fixation?
  - Approach – anterior or posterior or combined?

Implant selection
Smith-Peterson Osteotomies (SPO), Ponte Osteotomy or PCO

• The goal - removing of the posterior elements of the vertebrae for posterior release.

• One level correction 5-15°

• Depends from disk elasticity

• Compression leads to contraction of the neural foramina, which necessitates a preceding wide facetectomy to prevent nerve root impingement.

Smith-Peterson Osteotomies (SPO), Ponte Osteotomy or PCO

- With respect to safety and efficacy, SPOs compare favorably with other osteotomy techniques.

- Blood loss in 3 SPOs (to achieve a comparable degree of correction with a single PSO) resulted in an average blood loss of 1392 ml, versus nearly twice as much for a PSO (2617 ml).

- No difference was noted in fusion rates or the ODI, although patients undergoing PSO experienced greater sagittal plane imbalance correction (≥ 3 SPOs 5.49 ± 4.5 vs PSO 11.19 ± 7.2 [p < 0.01]) and reduced risk of coronal decompensation.

♀ 72 year-old
Ds: adult
degenerative scoliosis with
osteoporosis (Type D,B,H,VP from SRS Schwab).

T9–S1-pelvis instrumented fusion
with a posterior-only, pedicle screw with PMMA ThX, ThIX, L1,2,3 construct as well as a total of 9 apical SPOs.
♀ 64 Ds: post idiopathic scoliosis (Lenke 3C -)
♀ 64: polysegmental SPO + correction + ThIII-Pl fixation
Pedicle Subtraction Osteotomy (PSO)

- The goal – post. vertebral body resection for sagital correction
- One level correction 20-45°
- Not depends from disk elasticity
- Asymmetric PSO can improve coronal correction
- Better fusion us result of a large contact area of bone

Pedicle Subtraction Osteotomy (PSO)

- The patients with greater than 10 cm of sagittal imbalance would be more likely to benefit from a PSO than SPOs.

- The rate of intraoperative and postoperative neurological deficits 11.1%  

- ODI improving from 51.5 ± 16.2 to 29.5 ± 18.7 (p < 0.001)  
  SRS-22 improving from 48.4 ± 15.3 to 71.2 ± 15.3 (p < 0.001)

- Intraoperative monitoring & wake-up test reduced the risk of neurological complications

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♀ 73 year-old

Ds: adult degenerative scoliosis (Type L,C,H,VP from SRS Schwab).

Surgery: T12–L5 instrumented fusion with a posterior-only, pedicle screw with PMMA Th12,L5 and PSO
♀ 63 year-old

Ds: adult degenerative scoliosis (Type L,B,H,VP from SRS Schwab).

Surgery: T10–Pi instrumented fusion with a posterior-only, and asymmetric PSO
Vertebral Column Resection (VCR)

- The goal – total vertebral body resection for multiplanar correction
- One level correction 30-50° in sagittal & up to 30° in coronal plans
- The anterior expandable cage allows for relative anterior lengthening & enhances the degree of correction


Vertebral Column Resection (VCR)

- VCR poses with significant long operative times and blood loss, and its use can be fraught with complications
- Operative times have ranged from 266 to 577 minutes
- Blood loss has ranged from 691 to 2810 ml
- Rate of posop. complications - 34.3% (15-17% - rate of neurological complications)


Case report

Case report

1 y post. 1-st revision

2 y post. 2\textsuperscript{nd} revision
Pitfalls of postoperative spine instability

- Bone quality
- Balance restoration
- Biomechanics of fixation
- **Bone quality**

♀ 70 year-old
Ds: adult degenerative scoliosis (Type L,B,L,N from SRS Schwab), antelaterolistesis L2,3 with stenosis & spine cord compression
4 years later (74 y.o.)

Complaints:
chronic back pains

Surgery:
PSO at L4

Complication:
L4 fracture
Bone quality + Balance restoration + Biomechanics of fixation

♀ 81 D: osteoporotic deformity, degenerative stenosis LIV-SI, paresis 22
Bone quality + Balance restoration + Biomechanics of fixation
♀ 82 D: osteoporotic deformity, degenerative stenosis LIV-SI, paresis 22

8 months post.op
Bone quality + Balance restoration

♀ 82 y.o. Ds: ADS, antelaterolistesis L4 with stenosis & nerve ruts compression

Surgery: T2–S1-pelvis instrumented fusion + 9 apical SPOs + TLIF L4-5.
Bone quality + Balance restoration

♀ 83 y.o. Ds: broken rods

Surgery: Shift of screws in lateral masses of S1 & pelvis with PMMA
Bone quality + Balance restoration

♀ 84 y.o. Ds: S1-pelvis screws instability and sagittal & coronal balance failed

Surgery: PSO at L2 + new rodes
CONCLUSION

- The osteotomies is the helpful tools in treatment of osteoporotic spinal deformity in elderly, **but** should be always in balance with:
  - Bone quality
  - Balance restoration
  - Biomechanics of fixation
  - And......
CONCLUSION

• The osteotomies is the helpful tools in treatment of osteoporotic spinal deformity in elderly, but should be always in balance with:
  • Bone quality
  • Balance restoration
  • Biomechanics of fixation
  • And the common sense