

SRS GOC Meeting

December 6th, 2013 Marrakech-Morocco



Management of Complications in AIS: Infectious-Neurologic Decompensation

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Complications - Etiology

2005 Non Fatal Complications by Diagnosis:

Non Fatal Complication by Diagnosis	Number of Complications	Rate 2006	Rate 2005	Rate 2004
Degenerative Spinal Disorders	681	5.2%	5.6%	5.0%
Fracture	107	5.6%	4.5%	3.8%
Kyphosis	157	17.8%	15.1%	16.4%
Other	267	7.9%	6.9%	7.5%
Scoliosis	597	9.5%	8.9%	10.8%
Spondylolisthesis	259	8.5%	7.9%	6.3%
Total/Overall	2068	7.2%	7.0%	7.0%

Classification of Non-Fatal Complications in AIS Surgery

- Neurologic
- Non-neurologic
 - Infection: Early, late
 - Decompanation
 - Pseudoarthrosis
 - Junctional kyphosis
 - Blindness

Neurologic Complications

- 1975 M&M report of SRS: Harrington Era
 - 0.72 % neuro comp

Mac Ewen GD, et al, J Bone Joint Surg Am 1975;57:404–8

- Recent M&M report of SRS: Pedicle screw Era
 - 1 % for PSF neuro comp
 - 1.75 for combined procedures neuro comp

Coe JD, et al, Spine 2006;31:345–9

Neurologic Complications in AIS

- 1301 patients followed prospectively
 - 4 spinal cord injury
 - 1 nerve root injury
 - 3 thecal penetrations
 - 1 positional femoral nerve palsy

0.38

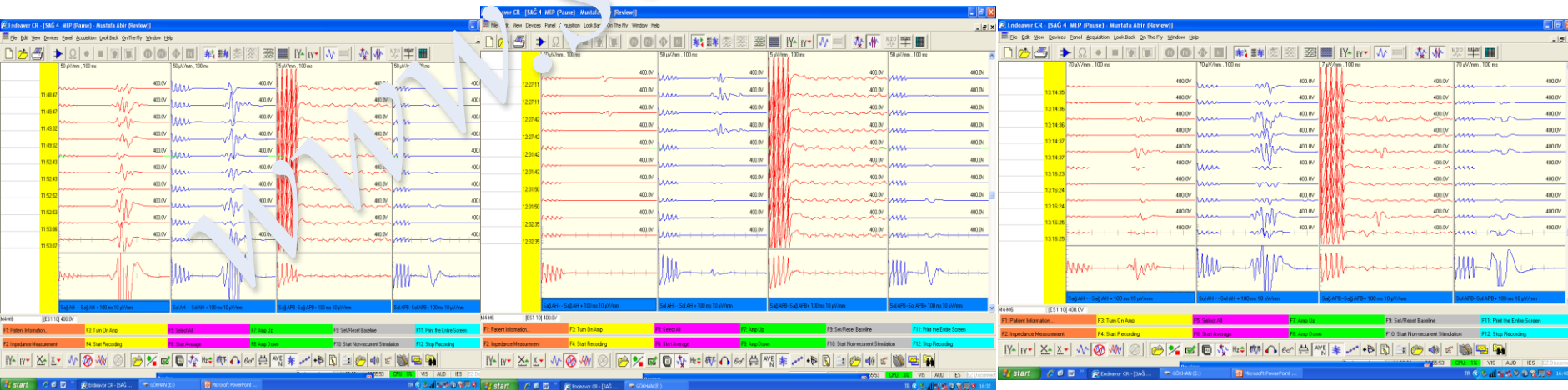
0.69
- All recovered within 6 months

Risk Factors

- Surgeon dependent
 - Type of procedure
 - Distraction
 - Overcorrection,
 - Kyphosis correction
 - Osteotomy
 - Type of approach: Combined with ↑ risk
 - Type of instrumentation: Sublaminar wires with ↑ risk
 - Hemorrhage and prolonged hypotension
- Surgeon independent
 - Curve magnitude
 - Preexisting neurologic deficit

Management

- Perioperative decrement of tcMEP amplitudes
 - Intraoperative multimodal neuromonitoring
 - MEP
 - SSEP
 - Free run EMG
- Postoperative (early) neurologic problems



Peroperative decrement of tcMEP amplitudes-1

Rule out technical error (electrodes, cables etc.)



Rule out anesthesia related factors (muscle relaxants, dosage etc.)



Irrigate the wound with warm saline for prevention of hypothermia



Assess the circulation

Hypotension (map \geq 90mmhg)

Increase pO₂ saturation

Check the Hb, metabolic abnormalities

Peroperative decrement of tcMEP amplitudes-2

Assessment of spinal instrumentation

Direct screw stimulation with electrode

Consider decrease distraction forces

Laminectomy if needed

Modify or remove screws if needed

Stagnara wake-up if still no improvement within 30 min

Consider removal all instrumentation

Consider starting corticosteroids (NASCIS-III protocol)

Emergency imaging study (MRI, CT-myelo)

Postoperative (early) neurologic problems

Discontinue the analgesia from the epidural catheter
(No improvement)

Emergency imaging study (MRI, CT-myelo)

Epidural hematoma

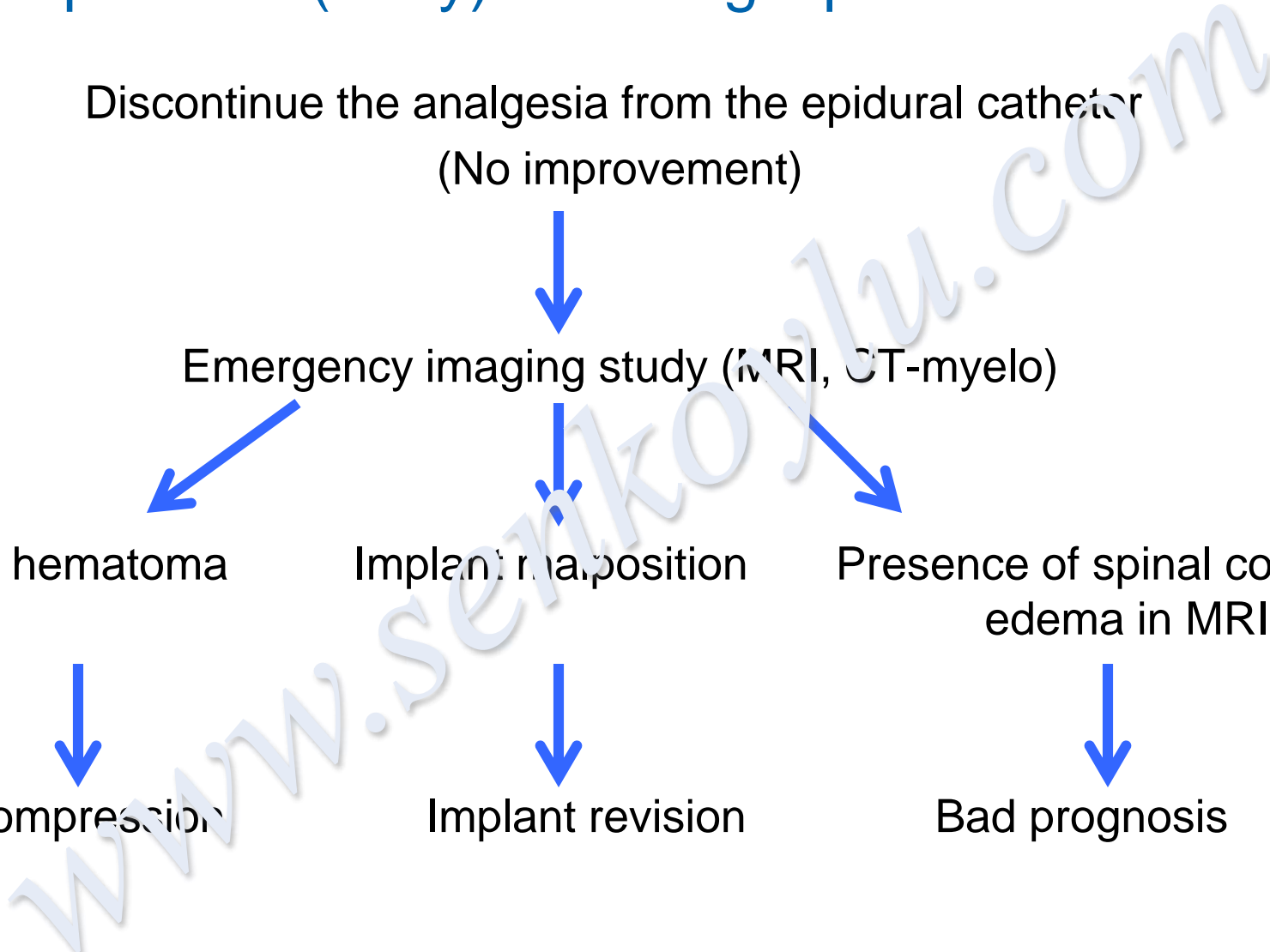
Implant malposition

Presence of spinal cord edema in MRI

Decompression

Implant revision

Bad prognosis



Non-neurologic Complications

- Correlated with
 - Renal disease
 - Increased operative blood loss: ↑ 775 ml
 - Prolonged posterior surgery time: ↑ 63 min
 - Prolonged anesthesia time
 - A-P combined procedure
- Not correlated with:
 - Age
 - Cardiopulmonary disease
 - Previous surgery
 - Curve type and magnitude

Infectious Complications

2005 Reported Infections by Diagnosis (Compared to 2003 & 2004):

Infections per Diagnosis	Rate - 2005	Rate - 2004	Rate - 2003
Degenerative Spinal Disorders	1.3%	1.6%	1.0%
Fracture	1.6%	1.9%	1.0%
Kyphosis	5.7%	4.4%	4.3%
Other	2.7%	2.1%	2.7%
Scoliosis	2.8%	2.5%	2.1%
Spondylolisthesis	2.4%	1.7%	1.6%
Overall Infection Rate	2.1%	2.0%	1.6%

Superficial and deep wound infection is 1.0% and 1.7% of pediatric patients (n=25,432) respectively

Classification

- Early infections → within 12 weeks postop
 - uncommon
 - *Staphylococcus aureus*
- Late infections → after 12 weeks postop
 - *Propionibacterium acnes* and *Staphylococcus epidermidis*

Richards BS and Emara KM, Spine 2001;26:1990–6
Richards BS, et al, Spine 2006;31: 3018–26

Prophylaxis

- Preoperatively: 1st or 2nd generation cephalosporines
- Peroperatively
 - Vancomycine powder
 - Frequent irrigation

Delayed infections after AIS

Risk Factors:

- Approach:
 - Lower in anterior spinal fusion
 - Higher in posterior spinal fusion
- Implant type:
 - Harrington rod higher, all-pedicle screw constructs lower
 - Titanium lower

Ho C, et al, 2007 Spine 32:2272–2277

Management of Early Infection (within 12 weeks)

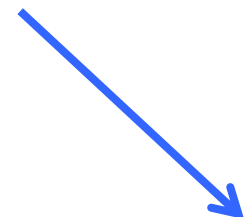
Early Infection



Irrigation & Debridement
Remove loose bone grafts



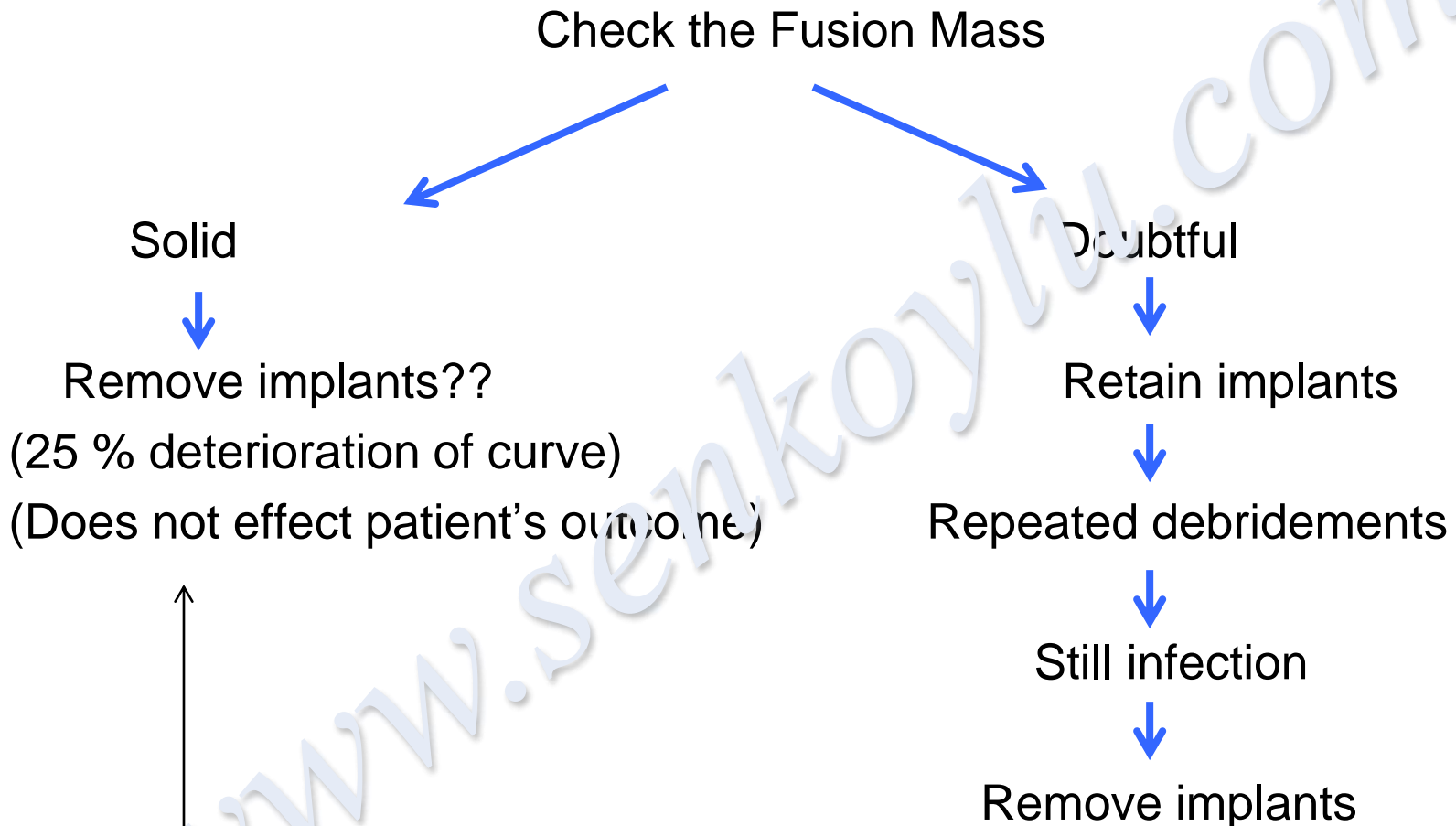
Repeat I&D at 48-72 hours



Negative Culture
Parenteral / Oral Ab

Positive Culture
Consider the implant removal

Management of Delayed Infection



Sink EL, et al, Spine, 2003; 28:1396–403

Rihn JA, et al, Spine, 2008; 33:289-94

Another option

One-stage rod removal and reinstrumentation

- Debridement of all necrotic and infected tissues
- Irrigation with antibiotic in every 30 min
- 3 min betadine soaks before final decortication
- Reimplantation with titanium implant

Reduces loss of reduction in late infection

Muschik M, Luck W, Schlenzka D, Eur Spine J, 2004;3:645–51

VAC (Vacuum assisted wound closure)

- Effective in the treatment of deep infections
- It prevents:
 - removal of instrumentation
 - Multiple irrigation and debridement



van Rhee MA, et al, 2007, Spine J 7: 596–600

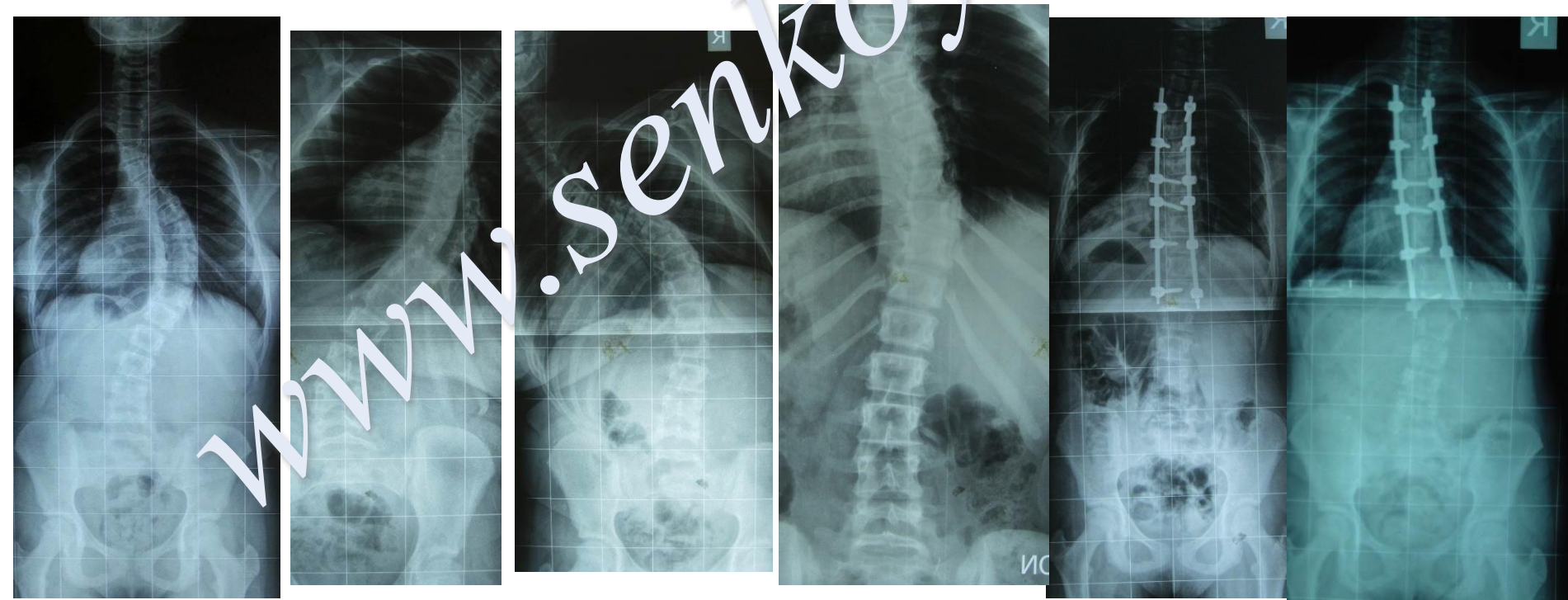
Decompensation

Loss of the postsurgical ability of the unfused spine to compensate

Growing spine

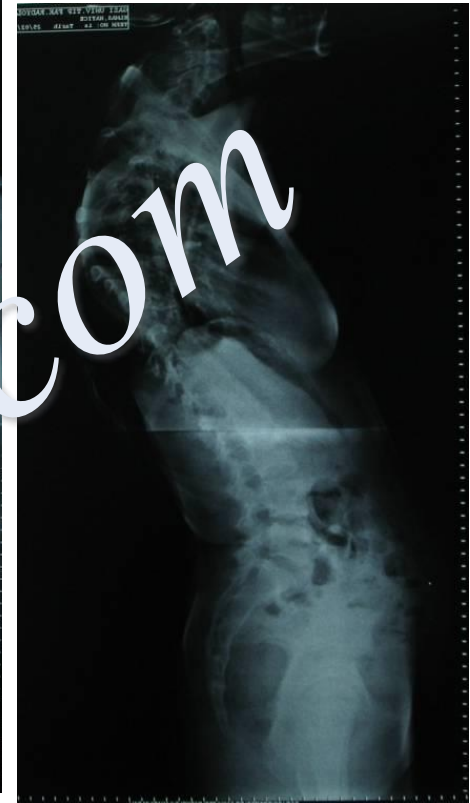
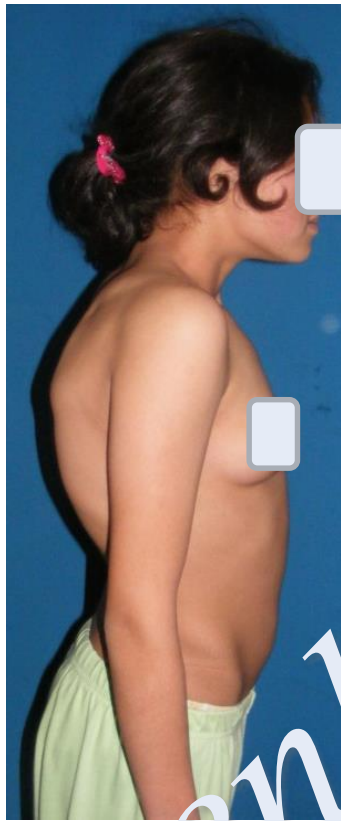
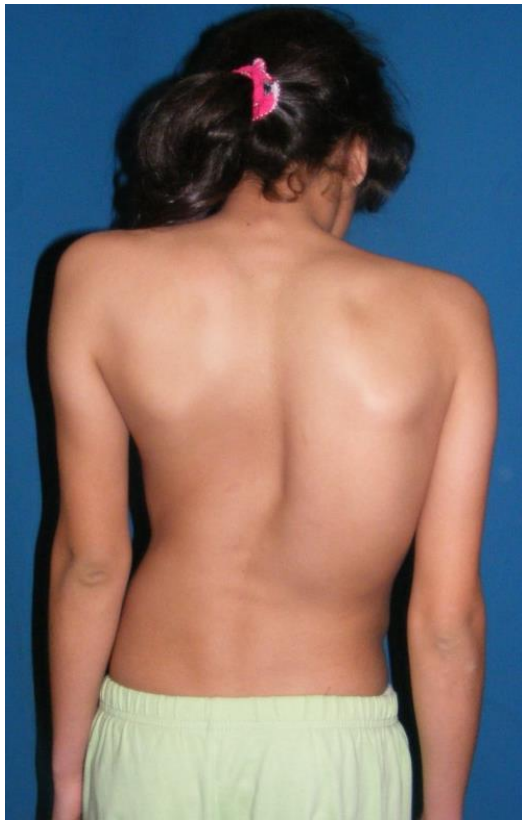
Risser 0

Open triradiate cartilage



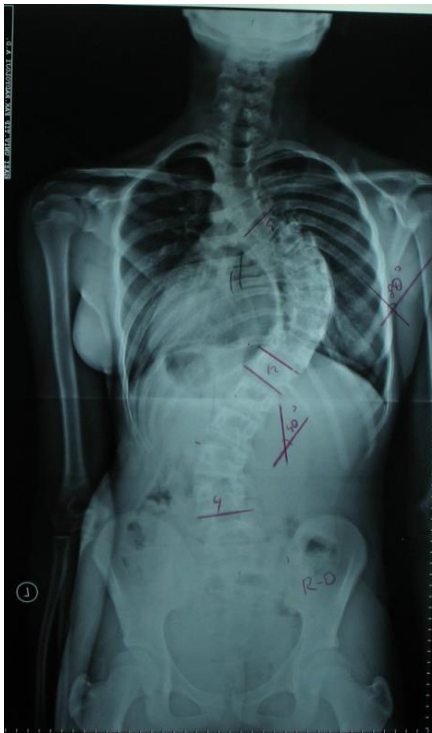
Risk Factors

- Failure to identify the curve pattern
- Failure to select proper fusion levels
- Lumbar curve progression after selective thoracic fusion
- Overcorrection of the thoracic curve
- Rigid lumbosacral hemicurve
- Crankshaft phenomenon
- Adding proximal or distal to the fused spine



12yo, F
Premenarche

$T2-4=35$
 $T5-12=80$
 $T12-L4=40$



T2-4=35

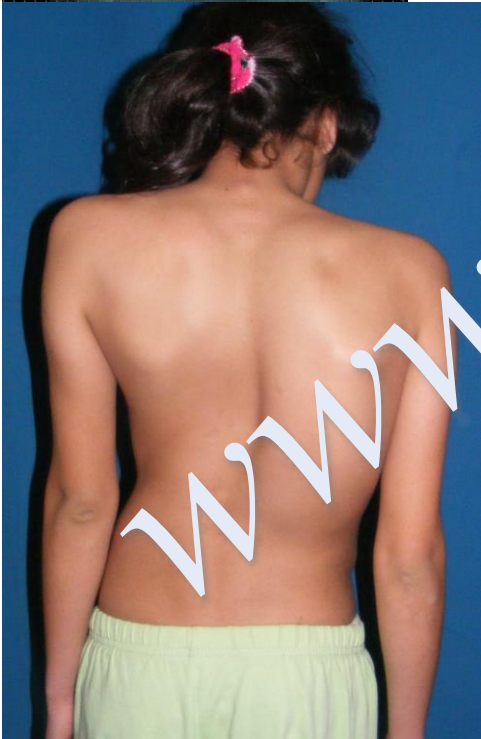
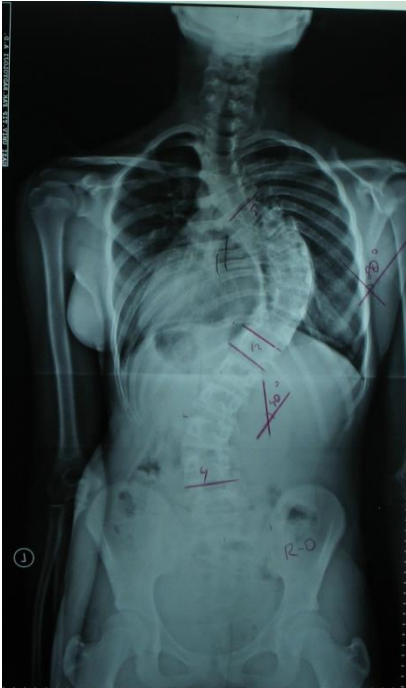
T5-12=80

T12-L4=40

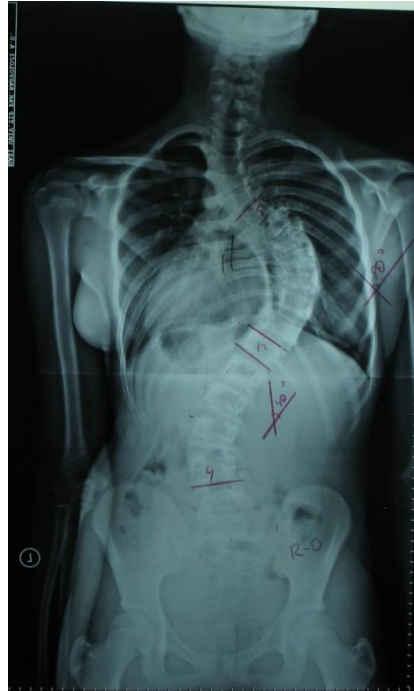
T5-12=67

T2-4=16

T12-L4=22



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Management

- Sufficient growth
 - Brace for lumbar curve?
- Insufficient growth
 - Extension of fusion down to stable vertebra

Thank You



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