Scoliosis/Kyphosis in children and adolescents
Diagnosis and treatment

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Scoliosis/ Kyphosis in children and adolescents

**Diagnosis**

- Majority of patients manifest in between 8 and 13 years of age
- Signs are often subtle
  - Differences in both waist lines
  - Shoulder asymmetry
  - Uneven clavicles and breasts
  - Lumbar and thoracic humps- aggravated on bending forward
- Scoliosis diagnosis
  - Often accidental on unrelated X rays
- Kyphosis diagnosis
  - Often missed on X rays
Scoliosis/ Kyphosis in children and adolescents

Diagnosis- why is it delayed/ missed?

- Curves look clinically less than on X-rays
- Signs are often subtle with curves less than 40°
- By the times curves manifest girls/ boys enter puberty
  - They don’t undress in front in front of parents
  - Girl who start breast development early try to hide them
  - They don’t tell parents
- Parents have mild to moderate deformities and think it is inevitable or normal
- Parents think the posture forms part of the protest in puberty- get angry
  - Don’t slouch
  - Sit straight
- Curves need to be diagnosed early in order to avoid the need for surgery
Scoliosis/ Kyphosis in children and adolescents

When should kids be referred?

- When in doubt
- All children with vertebral anomalies
  - Angular curves
- Scoliosis over 20°
  - Clinical signs are often subtle with curves less than 40°
  - Therefore often diagnosed on unrelated X-rays
- Kyphosis
  - Over 40°
  - Lumbar kyphosis
Scoliosis/ Kyphosis in children and adolescents

Radiographic evaluation?

- Whole spine standing radiographs
  - AP (scoliosis) radiograph
  - Lateral (kyphosis) radiograph
  - 90 cm/ 36 inch plates
- AP pelvis
  - To check Risser sign (iliac growth plates)
- Side bending views in scoliosis
- Lying radiographs with bolster under apex (kyphosis)
Scoliosis/ Kyphosis in children and adolescents

Classification

- **Congenital**
  - Vertebral abnormalities
    - Hemivertebra
    - Block vertebra
    - Unilateral bars
- **Neuromuscular / paralytic**
- **Idiopathic**
Scoliosis/ Kyphosis in children and adolescents

**Treatment**

- **Conservative**
  - Postural exercises – adjunct to other treatment
- **Bracing** - mostly with Milwaukee type brace
  - In scoliosis between 25 and 35 degrees
  - In Kyphosis up to 60 degrees
  - Less effective in congenital and neuro-muscular scoliosis
- **Surgery**
  - **Scoliosis:**
    - Curves over 40-45° in thoraco-lumbar and lumbar curves
    - Over 50° in thoracic curves
  - **Kyphosis:** Curves over 60°
Congenital Kypho-Scoliosis

Prognosis and treatment recommendation?

- Winter et al: slowly but relentlessly progressive
- Nasca et al: yearly progression $1^\circ$ - $33^\circ$
- McMaster and Ohtsuka:
  - $1^{st}$ worst prognosis Hemivertebrae with contralateral bar
  - $2^{nd}$ two unilateral hemivertebrae
  - $3^{rd}$ single hemivertebra
- Current case:
  - 9 year 7 m old girl
  - Triple left posterior hemivertebra with triple right anterior bar
  - Additional vertebral abnormalities
- Prognosis: extreme spinal kyphoscoliosis
Congenital Kypho-Scoliosis

Case report 1

- **Current case:**
  - 9 year 7 m old girl
  - Very bright
  - Sports: Hip-Hop dancing, swimming

- **Radiographs**
  - Triple left-posterior hemi-vertebra with triple right-anterior bar
  - Additional vertebral abnormalities
  - Rapidly increasing curve (mother)
  - 88° kyphosis, 58° scoliosis

- **Second opinions:**
  - 1) growth rods
  - 2) non-instrumented fusion in situ
Congenital Kypho-Scoliosis

Case report  1
Congenital Kypho-Scoliosis
Case report 1
Congenital Kypho-Scoliosis

Case report 1
Congenital Kypho-Scoliosis

Case report 1: Operation planning:

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Inclination</th>
<th>Screws</th>
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</thead>
<tbody>
<tr>
<td>Right 10°</td>
<td>R 20°</td>
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<td>L 20°</td>
<td>5.5 x 35</td>
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<tr>
<td>Left 10°</td>
<td>L 15°</td>
<td>5 x 35</td>
</tr>
<tr>
<td>Left 15°</td>
<td>50°</td>
<td>5 x 35 Ext</td>
</tr>
<tr>
<td>L 20°</td>
<td>L 28°</td>
<td>6 x 35 Ext</td>
</tr>
<tr>
<td>L 17°</td>
<td>L 28°</td>
<td>5 x 35 Ext</td>
</tr>
<tr>
<td>L 17°</td>
<td>L 29°</td>
<td>6 x 35 Ext</td>
</tr>
<tr>
<td>L 10°</td>
<td>L 22°</td>
<td>5 x 35 Ext</td>
</tr>
<tr>
<td>L 15°</td>
<td>Up 10°</td>
<td>5 x 35 Ext</td>
</tr>
</tbody>
</table>
Congenital Kypho-Scoliosis

Case report 1: Operative outcome

- 11 hr operation
- Spinal cord monitoring did not work - wake up test
- Woke up with right sided weakness which recovered within 2 weeks completely
- Very stressful for mother and surgeon
- Excellent deformity correction
Congenital Kypho-Scoliosis
Case report 1: 7 months after operation
Scoliosis in children and adolescents

Case Report 2: Severe idiopathic scoliosis

- 13, 5 year old girl
- Nickname at school: “Spiny”
- I had seen her first time 8 years before
  - 27 ° right thoracic scoliosis
  - Was braced until last year June by orthopaedic surgeon
- 160 cm tall
- 117 ° right thoracic scoliosis T5-T11
- 65° left upper thoracic T1-T5
- Off balance but still playing hockey
- Patient herself pushed for surgery
Severe Idiopathic Scoliosis

Case report 2
Severe Idiopathic Scoliosis

Case report 2
Severe Idiopathic Scoliosis
Case report

- 13, 5 year old girl
- 160 cm tall
- 117° right thoracic scoliosis
- Off balance
Severe Ideopathic Scoliosis

Case report 2

- 13, 5 year old girl
- 160 cm tall
- 117 ° right thoracic scoliosis – rigid on side-bending
Severe Idiopathic Scoliosis

Case report 2

➢ Posterior alone
Severe Idiopathic Scoliosis

Case report 2

- Posterior alone
- 12 cm taller
Severe Idiopathic Scoliosis

Case report 2

Pre-op

Post-op

Pre-op

Post-op

Post-op
Severe Idiopathic Scoliosis

Case report 2
Severe idiopathic scoliosis – Outcome
Case report 2

- Excellent outcome
  - 12 cm taller
  - Well balanced
  - Rip hump significantly reduced
  - Self esteem restored

- But
  - Earlier bracing might have reduced the deformity considerably
  - Operation would have been saver if done at an earlier age
Scoliosis in children and adolescents

Insufficient corrected Scoliosis / Kypphosis

- What happens to the back
  - Uneven loading of the remaining mobile discs
  - Remaining unbalance
  - Increasing deformity in the mobile spine, as degeneration progresses
  - Surgical options very limited when LBP becomes severe

- Therefore
  - Bottom vertebra of scoliosis needs to be fairly horizontal
  - Operations are saver and render better results if deformity not too extreme
Case report 3

- 34 year old woman
- Had scoliosis operation in 1994
  - Had always severely unequal waist
- LBP since pregnancy 3 years ago
- Increasing LBP over the last 2 years
  - Not responding to exercise program
  - Temporary relieve with physiotherapy, acupuncture
  - Short term relieve with facet infiltration
- Had problems to continue working as a Rep
  - Had to stop working 6 months ago
  - Was given unpaid leave to sort back out
Incomplete Reduction in Ideopathic Scoliosis

Case report 3: Complaints + Examination

- Pain over both iliac crests and hips – right > left
- Had always severely unequal waists
- Unable to sit, drive longer or to stand in a cue
- Tender below scar of old fusion
- Tender over iliac crests and right buttock
Incomplete Reduction in Ideopathic Scoliosis

Case report 3
Incomplete Reduction in Ideopathic Scoliosis

Case report 3
Incomplete Reduction in Idiopathic Scoliosis

Case report 3

right

left
Case report 3: Treatment Options

- Do nothing?
- Extension of fusion to L5 or S1?
- Disc replacement?
- Posterior Dynamic stabilization?
- Other?
Case report 3: Operation performed

- Multiple osteotomies, instrumentation and re-fusion in corrected position
- No additional levels fused
- Pain free at 6 weeks and 4 months
Incomplete Reduction in Ideopathic Scoliosis

Case report 3
Scoliosis/ Kyphosis in children and adolescents

Conclusion

- Don’t delay investigations if suspected
- Conservative treatment
  - Postural exercises
    - Only under close supervision in significant curves
  - Bracing- mostly with Milwaukee type braces
    - Needs to be worn day and night
    - In scoliosis between 25 and 35 degrees
    - In Kyphosis up to 60 degrees
    - Must be adjusted in regular intervals
- Surgery
  - Scoliosis:
    - Curves over 40- 45° in thoraco-lumbar and lumbar curves
    - Over 50° in thoracic curves
  - Kyphosis: Curves over 60°
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Conclusion

➢ Early diagnosis is essential

Thank you

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