Scoliosis in CP

Dr. Hatem Al-Harbi
Dr. Missuina

July 12, 2006
Scoliosis

- Scoliosis is a sign not a disease
- Idiopathic Scoliosis is a diagnosis of exclusion
- History, Physical and Investigation should rule out underlying pathologies
Definition

- Scoliosis: a coronal plane curve $> 10^\circ$
- Spinal asymmetry: curve $< 10^\circ$
Red Flags of Scoliosis

- Severe back pain
- Neurological symptoms
- Severe progression
- Syndrome-related
CLASSIFICATION

- Idiopathic
- Neuropathic
- Myopathic
- Congenital
- Associated with neural tissue defect
- Neurofibromatosis
- Mesenchyma
- Soft tissue contactures
- Osteochondrodystrophies
- Tumor
- Rheumatoid disease
- Metabolic
- Related to lumbosacral area
- Thoracogenic
- Hysterical
- Functional
CLASSIFICATION

- Idiopathic
- Neuropathic
- Congenital
CP Scoliosis Differs From Idiopathic

- Curves are more likely to progress, even if the patient is skeletally mature
- Curve tends to begin at an earlier age
- Bracing is less effective
- Unique indications and guidelines for treatment
- Treatment is often more difficult because of comorbidities
CP Scoliosis

- Cobb angle >10°
- Overall incidence of 20%
- Incidence varies with the extent and severity of the neurologic involvement:
  - Nonambulatory: 62%
  - Bedridden: 100%
Deformities in CP

- These deformities isolated or in combination:
  - Scoliosis
  - Kyphosis
  - Lordosis
  - Pelvic obliquity

- The classic curve pattern in CP: a long, C-shaped curve that is kyphoscoliotic (sometimes lordoscoliotic)

- In children with lesser degrees of CP involvement (hemiplegic or ambulatory diplegic), the pattern of deformity resembles idiopathic
Curve Progression

- Curve progression is typically gradual but can be rapid with:
  - the onset of puberty,
  - deteriorating neurologic function,
  - shunt malfunction,
  - prolonged time in a wheelchair
Etiology of Scoliosis in CP

- Still unknown
  - primary cerebral injury or
  - secondary impairments: muscle weakness, spasticity, poor balance, or a nonambulatory status

- Iatrogenic: after selective dorsal rhizotomy.
  - Turi and Kalen 2000: 28 spinal deformities in 19 of 43 patients following dorsal rhizotomy associated with wide laminectomies
  - Spiegel 2004: did not demonstrate significant spinal deformity 4.2 years after rhizotomy, although 13 of 79 patients had mild curves (mean, 16°)
Larger curves are associated with an increase in hip and pelvic deformity.

Majd et al., concluded that there was a correlation between the size of the deformity and the decline in functional activities.

In patients with CP, as in those with idiopathic scoliosis, the larger the curve, the more likely it is to progress.

Thometz and Simon, found that the rate of curve progression in skeletally mature patients with CP was 0.8°/yr when the curve was <50° and 1.4°/yr when the curve was >50°.
Assessment

- Multidisciplinary approach
- History:
  - perinatal history,
  - growth,
  - development,
  - previous medical treatment.
  - Evidence of neurologic progression, normal early developmental milestones, or a positive family history should raise concerns about the diagnosis.
Physical Examination

- General and MSK:
  - patient’s nutritional status,
  - respiratory function,
  - sitting/standing posture,
  - gait
  - upper extremity functional capacity.
  - functional status: ability to swallow, communication skills, and acuity of hearing and vision.
  - The musculoskeletal examination: range of motion, tone, and motor strength.
  - The spinal examination: degree and flexibility of the spinal deformity, assessment of spinal balance (ie, shoulder height), and evaluation of pelvic obliquity.
Radiographs

- No consensus as to the frequency and technique (sitting, standing, or supine)
- Bending or traction radiographs help assess stiffness
- Look for spondylolisthesis (4-21% in children with spastic diplegia)
- Indications for MRI screening:
  - recent major alterations in neurologic function
  - rapid curve progression
Non-surgical Treatment

- Options:
  - Physical therapy: ineffective
  - Electrical stimulation: ineffective
  - Botulinum toxin injections: short term benefits in 12 patients (Nuzzo 1997)
  - Bracing

- Molded wheelchair inserts:
  - Unclear whether molded inserts have any role in preventing or slowing curve progression.
  - Improve sitting balance
  - Does not seem to negatively affect pulmonary function, and it may decrease the work of breathing by improved positioning

- The role of bracing for the treatment of scoliosis in children with CP is more limited than for children with idiopathic scoliosis.

- Radiographic confirmation that the brace provides effective curve correction is necessary, as is compliance with brace wear.
Bracing CP Scoliosis

- Olafsson et al 1999 found that
  - Curve progression was prevented in only 23 of 83 patients with neuromuscular disorders (38 with CP) treated with bracing
  - Failure to prevent progression was attributed to discontinuation of brace wear in 41 of the 60 patients in whom the curve progressed
  - The authors thought that success of bracing was more likely to occur in ambulatory patients who had lumbar curves <40°

- Terjesen et al 2000 found that
  - Age and initial correction in the orthosis were the only variables that influenced the rate of progression.

- Renshaw et al 1996 reported
  - Success (<5° progression) in only 22% of their 46 patients with CP; the curve magnitude was 47° at the time of bracing, and the degree of correction in the brace was small (13°).
Surgical Treatment

- **Goal:** to achieve a solid spinal fusion that will result in a corrected, well-balanced spine with a level pelvis.

- **Prerequisites** should be established before considering surgery:
  - Scoliosis >40° to 50° that is either progressive or interfering with sitting;
  - Age >10 years;
  - Adequate hip range of motion to allow for proper seating postoperatively; and
  - Stable nutritional and medical status.

- **The decision to perform surgery** depends on:
  - Degree of curve and evidence of progression
  - Careful assessment of the patient’s and family’s goals and evaluation of the risks and perceived benefits.
  - Questions related to the patient’s awareness, ability to interact, tolerance to pain, and ability to express pain should be assessed, although these factors are difficult to quantify.
Surgical Treatment

- Cassidy, compared 17 patients who had undergone a spinal fusion (mean curve, 35°) to 20 patients who did not undergo fusion (mean curve, 76°). They found no significant difference in the degree of pain, need for pulmonary medication, decubiti, function, or time required for daily care.

- Askin, evaluated 20 patients before and after spinal fusion for neuromuscular scoliosis and found no functional gains at 1 year.

- Conversely, Larsson, evaluated 94 patients with paralytic scoliosis 1 year after surgery and found improvements in curve magnitude, sitting balance, weight distribution, and skin discoloration.

- According to most subjective surveys, the majority of health care workers believe that the patients who underwent fusions were more comfortable and were satisfied with the results of the surgery.

- Although there is little evidence that posterior spinal fusion results in significant functional gains, most surgeons believe that sitting balance, cosmesis, and caregiver assessment all improved after spinal fusion.
Preoperative Assessment

- Pulmonary Function
- Nutritional Status
- Gastrointestinal Evaluation
- Neurologic Function
Surgical Technique

- **Technical Considerations**

  - For internal fixation, multisegmental fixation (usually sublaminar wires) has been used in combination with either Luque rods or a unit rod.

  - Several authors have reported the technical results of spinal fusion for treatment of scoliosis in children with neuromuscular disorders. Curve correction varied from 45% to 76%; pelvic obliquity improvement was between 49% and 88%. Curve progression after fusion is typically small (<10°) and may be related to the magnitude of the residual curve and remaining growth of the anterior spine.

  - Anterior release and fusion are often performed for larger, more rigid curves.

  - The indications for anterior release may be changing, especially as more mechanically effective posterior constructs are being implemented.
Some surgeons believe that children who are skeletally immature should have an anterior spinal fusion to prevent progression that can occur even after successful posterior spinal fusion.

- Comstock, found a 30% rate of late progression, and >75% of their patients who progressed after surgery were skeletally immature.

The indication for fusion to the pelvis is still under debate.

Several additional methods to supplement fixation to the pelvis have been shown to provide satisfactory correction, including bilateral sacral screws, iliosacral screws, spinopelvic transiliac fixation, and an S-contoured rod that wraps over the sacral ala (the Dunn-McCarthy technique).
- **Halo Traction**
  - Preoperatively → an option when the curve is severe and rigid
  - The efficacy of this practice was questioned

- **Neuromonitoring**
  - SSEP has become the gold standard for intraoperative monitoring of scoliosis surgery
  - Although there is no consensus regarding the need for and degree of monitoring in children with CP
Postoperative Complications

- Range from 44% to 80%, with a perioperative death rate of 0% to 7%.

- Recently reported complication rates 21.6% had major and 22.5% had minor complications.

- Pulmonary insufficiency was the most frequent complication.

- Implant Failure:

- Pulmonary Complications

- Gastrointestinal Complications

- Neurologic Complications

- Wound Complications
Thank you