Volume Two

Pediatric Orthopaedics

Second Edition

edited by

Wood W. Lovell, M.D.

Robert B. Winter, M.D.

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Spinal Problems In Pediatric Orthopaedics

Robert B. Winter

Deformity of the spine was probably the most neglected area of orthopaedics during the first half of this century. In the past 35 years, there has been tremendous progress in this field. New approaches and devices have made possible better operative correction of advanced deformities, and better nonoperative treatment of the lesser deformities. Despite all these new advances, the basic fundamentals remain much the same. The care of the patient with a spine deformity must be approached with thoughtfulness and attention to small details. There is no easy "cookbook" solution.

CLASSIFICATION

The following classification is that which has been endorsed by the Scoliosis Research Society. It is a "fluid" classification, that is, one that is constantly undergoing revision and alteration according to new advancements in the basic sciences.

CLASSIFICATION OF SCOLIOSIS

- Idiopathic
  - Infantile—0–3 years
    - Resolving
    - Progressive
  - Juvenile—4 years–puberty onset
  - Adolescent—puberty onset to epiphyseal closure
  - Adult—epiphyses closed
- Neuromuscular
  - Neuropathic
    - Upper motor neuron lesion
      - Cerebral palsy
      - Spinocerebellar degeneration
        - Friedreich's
        - Charcot-Marie-Tooth
        - Roussy-Lévy
      - Syringomyelia
      - Spinal cord tumor
      - Spinal cord trauma
      - Other
    - Lower motor neuron lesion
      - Poliomyelitis
      - Traumatic
      - Spinal muscular atrophy
      - Myelomeningocoele (paralytic)
    - Dysautonomia (Riley-Day)
    - Other
  - Myopathic
    - Arthrogryposis
    - Muscular dystrophy
      - Duchenne (pseudohypertrophic)
      - Limb-girdle
      - Facio-scapulohumeral
    - Congenital hypotonia
    - Myotonia dystrophica
    - Other
- Congenital
  - Congenital scoliosis

- Failure of formation
  - Wedge vertebra
  - Hemivertebra
  - Failure of segmentation
    - Unilateral bar
    - Bilateral ("fusion")
  - Mixed
- Associated with Neural Tissue Defect
  - Myelomeningocele
  - Meningocele
  - Spinal dysraphism
    - Diastematomyelia
    - Other
- Neurofibromatosis
- Mesenchymal
  - Marfan's
  - Homocystinuria
  - Ehlers-Danlos
  - Other
- Traumatic
  - Fracture or dislocation (nonparalytic)
  - Postirradiation
  - Other
- Soft Tissue Contractures
  - Postempyema
  - Burns
  - Other
- Osteochondrodystrophies
  - Achondroplasia
  - Spondyloepiphyseal dysplasia
  - Diastrophic dwarfism
  - Mucopolysaccharidoses
  - Other
- Tumor
  - Benign
  - Malignant
- Rheumatoid Disease
- Metabolic
  - Rickets
  - Juvenile osteoporosis
  - Osteogenesis imperfecta
- Related to Lumbosacral Area
  - Spondylolysis
  - Spondylolisthesis
  - Other
- Thoracogenic
  - Post-thoracoplasty
  - Post-thoracotomy
  - Other
- Hysterical
- Functional
  - Postural
  - Secondary to short leg
  - Due to muscle spasm
  - Other

CLASSIFICATION OF KYPHOSIS

- Postural
- Scheuermann's Disease
- Congenital
  - Defect of segmentation
  - Defect of formation
  - Mixed
- Paralytic
  - Polio
  - Anterior horn cell
  - Upper motor neuron
- Myelomeningocele
- Post-traumatic
  - Acute
  - Chronic
- Inflammatory
  - Tuberculosis
  - Other infections
  - Ankylosing spondylitis
- Postsurgical
  - Postlaminectomy
  - Post body excision (e.g., tumor)
- Postirradiation
- Metabolic
  - Osteoporosis
    - Senile
    - Juvenile
  - Osteogenesis imperfecta
  - Other
- Developmental
  - Achondroplasia
  - Mucopolysaccharidoses
  - Other
- Tumor
  - Benign
  - Malignant
    - Primary
    - Metastatic
- Postural
- Congenital
- Paralytic
  - Neuropathic
  - Myopathic
- Contracture of Hip Flexors
- Secondary to Shunts

TERMINOLOGY

A glossary of terms has been developed by the Scoliosis Research Society so that a working set of words is understood by everyone. In the past, there was much confusion between the terms *major, primary, secondary, compensatory, structural, nonstructural, postural, functional.* Hopefully, these terms are better

defined and better understood now. The following list has been slightly modified from the original.

GLOSSARY

Adolescent scoliosis. Spinal curvature developing after onset of puberty and before maturity.

Adult scoliosis. Spinal curvature existing after skeletal maturity (closure of epiphyses).

Apical vertebra. The vertebra most deviated from the vertical axis of the patient.

Cervical curve. Spinal curvature that has its apex between C2 and C6.

Cervicothoracic curve. Spinal curvature that has its apex at C7 and T1.

Compensation. Accurate alignment of the midline of the skull over the midline of the sacrum.

Compensatory curve. A curve (which can be structural) above or below a major curve, that tends to maintain normal body alignment.

Congenital scoliosis. Scoliosis due to congenitally anomalous vertebral development.

Double structural curve (scoliosis). Two structural curves in the same spine, one balancing the other.

Double thoracic curve (scoliosis). Two structural curves, both having their apex within the thoracic spine.

End vertebra. The most cephalad vertebra of a curve whose superior surface or the most caudad one whose inferior surface tilts maximally toward the concavity of the curve.

Fractional curve. A curve that is incomplete because it returns to the erect position. Its only horizontal vertebra is its caudad or cephalad one.

Full curve. A curve in which the only horizontal vertebra is at the apex.

Gibbus. A sharply angular kyphos.

Infantile scoliosis. Spinal curvature developing during the first 3 years of life.

Juvenile scoliosis. Spinal curvature developing between the skeletal ages of 4 years and the onset of puberty.

Kyphos. An abnormal kyphosis.

Kyphoscoliosis. Lateral curvature of the spine associated with either increased posterior or decreased anterior angulation in the sagittal plane in excess of the accepted normal for that area.

Lordoscoliosis. Lateral curvature of the spine associated with an increase in anterior curvature or a decrease in posterior angulation in the sagittal plane in excess of normal for that area.

Lumbar curve. Spinal curvature that has its apex from L2–L4.

Lumbosacral curve. Spinal curvature that has its apex at L5 or below.

Major curve. The most apparent curve, and usually the most structural curve.

Nonstructural scoliosis. Spinal curvature without structural characteristics. (See structural curve.)

Pelvic obliquity. Deviation of the pelvis from the horizontal in the frontal plane.

Primary curve. The first or earliest of several curves to appear. Usually, but not necessarily, the most structural curve.

Structural curve. The segment of spine with a fixed lateral curvature. It is not necessarily the major or primary curve. Radiographically, it is identified in supine lateral side-bending or traction films by the failure to demonstrate normal flexibility.

Thoracic curve (scoliosis). Curve with the apex between T2 and T11.

Thoracolumbar curve. Spinal curvature that has its apex at T12 or L1 or at the interspace between these.

EVALUATION OF THE PATIENT

HISTORY TAKING

As in all fields of medicine, the taking of an adequate history is important. Quite frequently, this seems to be ignored in the field of scoliosis and other spine deformities. Important clues for both diagnosis and treatment can be derived from the taking of a good history.

The following questions are important: When did the deformity first appear? In what manner did it come to attention (pain, elevated shoulder, prominent hip, and so on)? Is the deformity progressive? Is there pain? Is there any family history of spine deformity? Is there any weakness, numbness, tingling sensation, or awkwardness of gait? Is there any family history of neurologic disease? Have there been any past illnesses? Has radiation been given? Is there any shortness of breath, either with or without exertion?

One of the most important aspects of spinal problems is growth. It is of the utmost importance to determine the status of growth. Therefore we ask: Is there still active growth? Have the menses begun? When? Has pubic hair development begun? Has breast development begun? In boys one asks about the onset of pubic hair development, change of voice, and onset of facial hair.

It is also important to ask about other observations or treatment. Has the patient seen another doctor? What was that doctor's opinion? Was treatment given? Was an x-ray taken? Were chiropractic treatments given? Was a brace applied? Was surgery done? What kind of surgery? Has the patient had surgery