Current Concepts in Scoliosis

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Scoliosis

• 4 million new cases diagnosed per year

• Prevalence
  • Idiopathic
    • 0.5% Infantile
    • 10.5% Juvenile
    • 89% Adolescent
  • 0.5 – 3 per 100 individuals have curves > 10°
  • 1.5 – 3 per 1000 individuals have curves > 30°
Scoliosis

Prevalence – Idiopathic

• Only 5% progress to > 30°
• M:F equal for smaller curves
• Females higher percentage with larger curves
• 8:1 F:M for those requiring treatment
Scoliosis – Prevalence

• Congenital
  • 0.5 – 1 per 1000 live births

• Neuromuscular
  • ??
Terminology – Scoliosis

• An abnormal 3D deformity of the spine
• On 2D radiographs, it is a deviation in the coronal plane (side to side) measuring more than 10°
• There is also a rotational deformity associated with this
Scoliosis – Classification

- Idiopathic
- Congenital
- Neuromuscular
- Syndromic (Neurofibromatosis, Marfan’s)
Scoliosis – Idiopathic

• Infantile: 0 – 3 years
• Juvenile: 3 – 10 years
• Adolescent: Older than 10
Scoliosis – Congenital

Failure of formation
Scoliosis – Congenital

Failure of segmentation
Scoliosis – Congenital
Scoliosis – Neuromuscular

- Duchenne’s muscular dystrophy
- Spinal muscle atrophy
- Spinal cord injury
Scoliosis – Syndromic

- Marfan’s
- Neurofibromat
Early Onset Scoliosis – Classification

Current Concept

• Scoliosis with onset less than 10 yrs of age regardless of etiology
• C-EOS Classification System
  • Etiology
    – Congenital
    – Neuromuscular
    – Syndromic
    – Idiopathic
  • Magnitude of Curve
  • Kyphosis
  • Rate of Progression

Vitale, M., et. al., JBJS, Aug., 2014
Scoliosis – Idiopathic – Cause?

- Genetic
- Hormonal
- Tissue deficiencies
- Vertebral growth abnormalities
- CNS Theories

“It’s time we face reality, my friends... We’re not exactly rocket scientists.”
Scoliosis – Idiopathic – Cause?

Current Concept

Genetic
• Great deal of research going into this
• Whole exom sequencing
• Multi-genic
• Different modes of inheritance
Scoliosis – Idiopathic – Cause?

Current Concept

Tissue Deficiencies – osteopenia and risk of progression

• 30% adolescents with scoliosis are osteopenic
  • 17.2% likely to progress to curve >45 degrees and require surgery compared to 7.6% of adolescents who are not osteopenic

Lam, Tsz Ping, POSNA 2016
Scoliosis – Idiopathic – Cause?

Current Concept

Tissue Deficiencies – osteopenia and risk of progression

• Calcium and Vitamin D supplementation may reduce the risk of progression in adolescents with scoliosis and osteopenia
  • 47% adolescents in placebo group vs. 24% of those treated with Calcium and Vitamin D progressed >6°
  • 600 mg calcium + 400/800 IU Vit D3

Lam, Tsz Ping, POSNA 2016
Scoliosis – History

- Onset, progression
- Pain
- Neurologic symptoms
- Family history
- Growth history
- Onset of menses in girls
- Tanner staging
Scoliosis – Physical Exam

• Coronal alignment
Scoliosis – Physical Exam

• Sagittal alignment
  • Adams forward bend test
Scoliosis

• Greater than 7° detects all curves > 30°

• Obesity will mask this deformity, larger curves at referral. Recommend 5° referral threshold
Scoliosis – Physical Exam

• Other findings
Scoliosis

- 36” PA and Lateral
Scoliosis – Radiology

- Standard radiographs: Life time cumulative x-ray exposure with scoliosis management creates 4.3% cancer risk (breast, endometrial) 17X greater than normal population
- EOS reduces x-ray exposure of standard radiographs 2 - 3 times
- Ability to evaluate 3D deformity

Simony, Ane, SRS 2015
Cobb Angle
Growth vs. Progression

![Graph showing growth vs. progression in scoliosis](image)

**Figure 1**

Longitudinal study of the development of scoliosis compared with growth velocity.

Key:
- Dotted line: 500 Paralytic
- Solid line: 60 Idiopathic scoliosis

- 53 Normal girls
Risk and Rate of Progression

- Etiology
- Age of onset
- Gender
- Curve location
- Curve type
- Curve magnitude
- Risser sign/Phalangeal age
- Menarche
Scoliosis – Risk of Progression

- Risser 0-1 with curves 20 – 29°: 68% risk of progression
- Risser 2-4: 28% risk of progression
- Risser 0-1: 78% will require treatment
Scoliosis – School Screening, “Schooliosis”

- 40% unnecessary referral rate (Cobb <20°)
- $780/referral
- In states that have discontinued school screening, 45% reduction in unnecessary referrals with no significant change in curve size or rates of bracing or surgery
- Center for Preventative Medicine just released a statement the stated school screening was not necessary

School Screening (POSNA 2016)
Scoliosis – Referral

• Any child less that 10 yrs. with curve greater than 10°
• Child 10 yrs. or older with a curve ≥ 20°
• Scoliometer ≥ 7°(≥ 5° in obese patients)
• Any child with scoliosis and findings suggestive of an underlying neurologic problem or syndromic problem.
• Atypical curve pattern: LEFT thoracic curve
Scoliosis – Long Term Effects

• Pain
• Decreased cardio-pulmonary function
• Decreased body self image
• Neurologic compromise
• Increased mortality?
Scoliosis Treatment: What Has Been Tried?

- Traction
- Manipulation
- Physical therapy
- Massage
- Exercise
- Herb, minerals, vitamins
- Electrical stimulation, magnets
Scoliosis Treatment: What Has Been Tried?

Current Concept

- Physical therapy
  - Schroth Method – Christa Lehnert-Schroth
    - 100 + exercises to improve scoliosis
    - No good evidence that it works
    - Multicenter study underway
Scoliosis – Treatment

- Observation
- Bracing
- Surgery
Scoliosis – Treatment

• Observation
  • Growing child
  • Curve less than 25°
Scoliosis – Treatment

• Observation
Scoliosis – Bracing

- Growing child
- 25° - 45°
  - Progression to 25°
  - 30° at presentation
- Risser 0,1,2
Scoliosis – Bracing

• Worn 16 – 20 hrs per day
• Prevents progression
Scoliosis – (BrAIST)

Current Concept

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Effects of Bracing in Adolescents with Idiopathic Scoliosis

Stuart L. Weinstein, M.D., Lori A. Dolan, Ph.D., James G. Wright, M.D., M.P.H., and Matthew B. Dobbs, M.D.

- Conclusively demonstrated the effectiveness of bracing in adolescent idiopathic scoliosis
- Rigid Boston TLSO
- Dose response
  - Overall, 72% success rate with brace wear
Scoliosis Treatment

- Early onset
Scoliosis Treatment

• Early onset, Metha casting
Scoliosis – Surgical Treatment

• Curves greater than 45 – 50°
• Lumbar curves 45°
Scoliosis Treatment

• Surgery, 1960’s
  • Paul Harrington, MD
Scoliosis Treatment

• Surgery, present day
Scoliosis

- Treatment
  - Early onset – Growth modulation
Scoliosis

• Treatment
  • Early onset – Growth modulation
    • Vertical Expandable Prosthetic Titanium Rib (VEPTR)
  • Robert Campbell, MD
Scoliosis – Current Concept

- Treatment – Early Onset Scoliosis
  - MAGEC Rods
Scoliosis – Surgical Treatment – QVSI

Current Concept

• Decrease costs without compromising outcomes

• Patient safety initiatives to diminish hospital acquired infections, decrease blood transfusions requirements, and diminish risk or neurologic injury
• Decrease costs without compromising outcomes
  • Expedited discharge
    • Decrease hospital stay form 4.6 days to 3.4 days
    • 20 – 25 % reduction in costs without compromising patient experience
• Patient safety initiatives to diminish hospital acquired infections, decrease blood transfusions requirements, and diminish risk or neurologic injury
  • TCH – Standardized infection protocol has reduced an infection rate of 7% to about 1.5 – 2%
  • Complex spine pathway has diminished in-hospital events on the neuromuscular spine patients
Scoliosis – Surgical Treatment – QVSI

Current Concept

• Patient safety initiatives to diminish hospital acquired infections, decrease blood transfusions requirements, and diminish risk or neurologic injury
  • **Use of the O-arm and Stealth machine to guide and confirm screw placement**
Scoliosis – Current Concept Summary

• Research efforts are trying to unlock the genetics of scoliosis

• Calcium and Vitamin D supplementation may slow progression of scoliosis in adolescents with osteopenia

• EOS imaging is reducing radiation exposure and potential cancer risks

• Physical therapy had not been shown to affect scoliosis.

• Bracing (rigid TLSO) works!

• Management of early onset scoliosis has been positively impacted by the MAGEC rod

• QVS initiatives are improving patient outcomes, reducing costs, and improving patient safety
Thank you