Adult Spinal Deformity

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Knowing the Source...

• Undergraduate: Utah State University

• Medical School: Penn State

• Residency: Vanderbilt, orthopaedic surgery

• Fellowship: Adult and Pediatric Comprehensive Spine Fellowship Columbia University, New York

** No financial disclosures relevant to this talk
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Adult Spinal Deformity

• Basic Definitions/Diagnosis

• Epidemiology

• Clinical Presentation

• Conservative Care

• Surgical Indications
Definitions/Diagnosis

- **Scoliosis:**
  - Lateral deviation/curvature of the spine in the coronal plane
  
  - More precisely: a 3-dimensional spinal deformity which includes coronal, sagittal, and rotational deformity of the spine and trunk.
  
  - Adam’s forward bend test may indicate presence of scoliosis/rotational deformity
  
  - Primarily a radiographic diagnosis, made on full spine or “scoliosis” series x-rays
Definitions/Diagnosis

• Spinal Deformity:
  • Deformity of the spine in any plane that interferes with a patient’s ability to stand upright and maintain normal truncal balance
  • Head centered over the pelvis in both coronal and sagittal plane when the patient stands upright with straight/locked knees?
  • If not, there is a likely to be some degree of spinal deformity
Neuromuscular
- Associated with various neuromuscular syndromes
  - i.e. spina bifida, muscular dystrophy, Friedrich’s ataxia, cerebral palsy, and others
- Non-ambulatory patients
- Can have severe truncal deformity

Idiopathic
- Cause unknown, likely complex genetic
- Otherwise normal/healthy patient
- Typically diagnosed in pre-adolescence or adolescence
- More common in females
- Wide variation in severity

Degenerative
- Most common in older adults
- Progression of mild idiopathic curves due to disc degeneration
- Frequently a cause of back pain and radiculopathy
- Symptoms depend on overall balance

Iatrogenic
- Fusion of the growing spine: tumor, trauma, infection, congenital scoliosis
- “Flatback” caused by lumbar fusion with inadequate lordosis
- Often results in the need for multiple spine operations
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Adult Degenerative Scoliosis

Etiology

- Multi-factorial cause

- Disc degeneration, idiopathic scoliosis, compression fractures, asymmetric facet disease, osteoporosis, lateral listhesis

- Asymmetric disc space collapse, leading to asymmetric degeneration/incompetence of the facet joints
  - → lateral and rotational deformity results
  - → Joint hypertrophy, ligamentum flavum thickening, and disc bulging all combine to cause varying degrees of neurologic compression

- Often difficult to tell whether a case of degeneration of previously scoliotic spine or development of de novo scoliosis
Adult Degenerative Scoliosis

Epidemiology

- Exact incidence poorly defined
- Many patients asymptomatic
- Studies report adult scoliosis present in 1% to 68% of adults... depending on definitions and screening methods
- Certainly incidence of symptomatic cases has increased with growing number of elderly patients
Adult Degenerative Scoliosis

Natural History

• In general, the larger the curvature the more likely it is to worsen over time

• Curve of 30 degrees or more: 1-2 degree per year rate of progression
  • Highly dependent on bone quality, “stiffness,” patient mobility, etc

• Curves may progress, symptoms may not

• Curve angle of 30 degrees or more typically thought to be risk for progression
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Clinical presentation

- Wide range: from no symptoms to severe, debilitating back and leg pain
- Duration of symptoms average 3-30 years in some studies
- Patients typically seek attention with development of:
  - Neurologic symptoms → stenosis, claudication, radiculopathy
  - Severe imbalance → cannot stand upright
  - Losing walking/standing endurance
  - Progressive back pain
Adult Degenerative Scoliosis

Clinical presentation – Neurologic

- Stenosis/claudication – i.e. “Shopping cart sign”
  - Typically no focal strength or sensory deficits on exam

- **History is the key element:**
  - Buttock/leg pain that is worse with walking, relieved with sitting or when stooped forward

- Careful of vascular claudication:
  - pain with walking but may linger longer after sitting
  - Associated with severe peripheral vascular disease/smoking

- **UP to 33% of adult spinal deformity patients will have concurrent cervical spinal stenosis causing myelopathic symptoms!**
Adult Degenerative Scoliosis

Clinical presentation – Postural/Structural

- Flatback/loss of lordosis:
  - Unable to stand upright without pain
  - Walks pitched forward, back fatigues easily
  - When asked to stand upright, bends knees and rocks pelvis back in order to maintain forward gaze

- Coronal imbalance:
  - Head/shoulders pitched off to one side
  - Rib cage often impinges on iliac crest
Fixed Sagittal Imbalance

• Inability to stand upright due to loss of lordosis in the lumbar spine:
  • Iatrogenic Flatback (“fused flat”)
  • Degenerative flatback
  • Post-traumatic

• Patients missing the amount of lordosis they “need” to stand are often the most symptomatic

• Everyone “needs” a different amount of lordosis
  • Depends on pelvic tilt/orientation
  • Mick Jagger vs. Jennifer Lopez
Fixed Sagittal Imbalance

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Fixed Sagittal Imbalance
Clinical presentation

• Not every spinal deformity patient has a problem!

• Case example:
  • 68 YOF with severe spinal deformity since childhood
  • Had in-situ fusion as a child
  • Currently asymptomatic
    • Active in an adult softball league
    • No back or leg pain
    • Noticable deformity, but otherwise doing very well
Clinical Assessment

- ID the Chief complaint!
  - Neurologic (stenosis or radiculopathy) symptoms unlikely to improve with PT alone

- Back pain/fatigue? May be highly amenable to physical therapy, weight loss, aerobic exercise regimen

- Medical comorbidities are paramount
  - CAD, COPD, Obesity, smoking, renal disease
  - Is the patient healthy enough for treatment?

- Screen for “Red Flag” symptoms:
  - New-onset severe back pain
  - Worse at night
  - Fevers/chills, weight loss, anorexia
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Physical Exam

- Thorough neurologic exam
  - Check strength/sensation in both upper and lower extremities
    - Strength typically normal, reflexes often hypoactive

- Examine gait and balance
  - Ask patient to stand with knees straight
  - Note position of head
  - Check hips and knees for lost range of motion

- Test for myelopathy: Romberg, tandem gait, Hoffman

- Peripheral vascular exam is important
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- Asymmetric flank crease
- Coronal imbalance
- Knees flexed
- Pelvis tilted back ("Retroverted")
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Imaging/Other Studies

- Plain radiographs are primary tool to assess spinal alignment
  - Patient standing with knees straight
  - Full-length spine (36 inch) films are best
  - Evaluate global alignment
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Imaging/Other Studies – MRI

- Lumbar MRI signs/symptoms of stenosis or radiculopathy that are refractory to conservative care
- Non-contrast MRI is appropriate
- Cervical MRI indicated with signs/symptoms of myelopathy
- Red flags = MRI
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Imaging/Other Studies

- Bone mineral density testing
- Osteoporosis will impact treatment options and patient outcomes
  - i.e. Surgery for patients with severe osteoporosis is often contra-indicated
- Osteoporosis should be treated when identified to reduce risk of fracture, curve progression
Treatment Options
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Goals of Treatment

• Pain relief

• Maintain mobility

• Any means to Safely achieve this goal is reasonable treatment!

• Avoid long term narcotics!!!
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Treatment

• No evidence that non-surgical management will alter natural history

• Regardless, non-surgical treatment is paramount, if only to identify who will truly benefit from major spinal reconstruction
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Treatment Options

- Regular aerobic Exercise
- Physical Therapy
- Stretching/Yoga
- Massage
- Acupuncture
- Treat underlying metabolic bone disease
- Epidural/Facet injections
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Exercise

- No evidence to prove efficacy for spinal deformity

- Clear/obvious evidence that regular aerobic exercise can:
  - Improve cardiovascular health
  - Improve flexibility/mobility
  - Decrease pain

- “Pre-habilitation” can aid in recovery when surgery is indicated
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Bracing/Orthoses

- Some efficacy to slow curve progression in the growing spine
- Does not stop curve progression in adults
- May be considered for symptom relief
  - Limited efficacy
- Watch for skin problems
- Discourage use 24/7
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When is it time for surgery?

• No defined consensus
• Wide range of options/approaches/techniques
• Highly dependent on patient variables/symptoms

• **My general rule:** Patient has to “prove” that surgery is indicated:
  • Exhausted non-surgical measures
  • Quality of life severely limited
  • Patient healthy enough to tolerate major operation

• Optimization of correctable variables:
  • BMI, smoking, diabetes, narcotic use, bone density
  • Much evidence that outcomes are improved with optimization of these factors
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When is it time for surgery?

• Progressive deformity interfering with quality of life
• Worsening neurologic function
• Worsening pain refractory to conservative measures
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Goals of Surgery

• Improve pain
• Restore global alignment
• Improve mobility/walking endurance
• Improve quality of life
• Avoid major complications
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Surgical Options

• Wide spectrum of surgical options
  • Simple decompression
    • Smaller, less invasive procedure
    • Less surgical risk
    • Targeted decompression of nerves
    • Does not treat deformity
    • Patient may require later surgery for deformity correction if symptomatic
Adult Degenerative Scoliosis

Surgical Options

• Wide spectrum of surgical options

  • Simple decompression $\rightarrow$ limited fusion
    • Appropriate where deformity correction is not needed, but bony resection needed to decompress nerves
    • Severe foraminal stenosis
    • “Top down” foraminal stenosis
    • Still less risk than major reconstruction
    • Potential for deformity decompensation
    • Revision surgery may be more challenging
Adult Degenerative Scoliosis

Surgical Options

• Wide spectrum of surgical options

  • Simple decompression → limited fusion → major spinal reconstruction

  • Extensive operation to correct body posture, spinal alignment

  • 20-25% “all-cause” complication rate

  • Risk profile must be minimized

  • Positive results with good technique

  • Potential for devastating complications

  • High cost ($75-100k cost of surgery/implants/hospital stay)
Adult Degenerative Scoliosis

Surgical Options

• Decision depends on:
  • Chief complaint (simple decompression for isolated stenosis)
  • Overall/global alignment
  • Patient comorbidities
  • Patient goals
Adult Spinal Deformity

• Complex problem, Increasing with aging population

• Emphasis on:
  • Optimizing comorbidities
  • Increasing aerobic activity
  • Treating metabolic bone disorders
  • Avoiding narcotics

• Non-surgical care must be fully explored/exhausted

• Good surgical options available for those with treatable spine pathology and who are healthy enough for surgery
Case Examples
65 YOF, recently retired CRNA

CC: Longstanding back pain, progressive deformity, worsening unilateral leg pain radiating to the right foot

Prior Rx:
• Physical therapy
• Facet injections
• Epidural injections
• Yoga
• Massage
• Accupuncture
• Chiropractic care
• NSAIDs
65 YOF, recently retired CRNA

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Visceral “Squish” Improved
66 YOF, otherwise healthy

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Thank you!
References


