“I would rather take the RISK dying from surgery than continue to live like this”

- Spine Patient(s)
Challenges of Operating on the Aging Spine

**RISKS**

- Elderly
- Multilevel
- Spinal deformity
- Comorbidities
  - PVD
  - Organ failure
  - Inflammatory conditions
  - Lower extremity
  - Cardiopulmonary issues
  - Nutrition
  - Medication use (e.g., steroids, narcotics)
  - Pain management
  - Obesity
  - Habits
  - Beliefs
  - Social situation

- Previous surgery
- Pseudarthrosis
  - Neurological issues
  - Infection
  - Nonunion
  - Flat back

**BENEFITS**

- Improved/Maintained function
- Less pain
- Slow/Stop progression
- Psychosocial issues
  - Self-esteem

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**Pre-Operative Considerations**

- Manage Expectations
- Counseling of age-associated risks
- All Aspects of Care

**Obesity**

- Associated with worsened postoperative outcomes and increased costs.
- Surgical Considerations:
  - ↑ Risk of Infection (SSI)
  - ↑ Blood loss
  - ↑ Operative time
  - ↑ Reoperation rates
  - Venous thromboembolism
- BMI as an independent risk factor for perioperative complications.
- BMI threshold for surgery FHC:
  - ≤ 35 kg/m²
Pre-Operative Considerations

Diabetes Mellitus

- ↑ Risk infections (SSIs).
- ↑ Risk for other wound complications.
- Associated with longer hospital LOS.
- Treatment
  - focused on glycemic control.
  - Poor control = increased rates of perioperative complications
- FHC - HgbA1c > 7.5 – No surgery

Pre-Operative Considerations

Smoking

- Major risk - pseudoarthrosis.
- ↓ in local blood flow and angiogenesis.
- ↓ Reparative Cell Function
- ↑ Risk of wound complications and infection
  - temporary reduction in oxygenation and blood flow
- ↑ Risk of pulmonary and cardiovascular complications after surgery.

Pre-Operative Considerations

Smoking

YOU SMOKE OR USE TOBACCO=NO SURGERY
The Osteoporotic Spine: Conservative Treatment

- Calcium and Vitamin D
- Pharmacologic Agents:
  - Teriparatide – rPTH – Forteo
  - Bisphosphonates
  - Denosumab – Prolia
  - Calcitonin as an analgesic
    - reduce the pain associated with acute vertebral fractures.

Complications Associated with Osteoporosis

- Poor bone quality increases risk of:
  - Post-Operative Hardware Failure
  - PJK
  - Adjacent Segment Degeneration (ASD)
  - Vertebral Compression Fractures (even minimal trauma)
  - Pseudoarthrosis

Frailty

- Non-specific state of increasing risk
- Multidimensional syndrome
  - Loss of reserves (energy, physical ability, cognition, and health)
  - Frailty can occur without reaching disease status.
Clinical Frailty Screening

- Quantifies age-related health deficit accumulation.
- Can yield predictive information.
- Screening may identify robust elderly patients.
- Can identify the most frail and trigger clinical discussions regarding limitations of treatment.

The Clinical Frailty Scale ranges from robust health to complete functional dependence on others.

Edmonton Frail Scale

Evaluation of 9 “Domains” of Frailty using specific screening tools:
1. Cognition
2. Functional Performance
3. General Health Status
4. Functional Independence
5. Social Support
6. Pharmacological Condition
7. Nutritional Aspect
8. Mental Condition
9. Continence
How Old Is Too Old?

- At what age do the risks outweigh the benefits?
- Age itself is not a definite contraindication for spinal surgery.
- Global assessment of the patient is necessary:
  - Comorbidities
  - Overall Physical Health
  - Mental health
  - Social situation
  - Activity level/ambulation status

Deformity Correction: Complications

- Early
  - Death
  - Paraplegia
  - Myelopathy
  - Severe Neurological Compromise
  - Fatality
  - Respiratory failure
  - Paraplegia

- Late
  - Vertebral Body Compression Fracture
  - Adjacent Level Breakdown / Instability
  - Prominent/ painful hardware
  - Hardware Failure / Loosening
  - Non-union
  - Breakdown L5/S1 – Fusion Stopped at L5

Edmonton Frail Scale

Scoring:
- 0-5 = Not Frail
- 6-7 = Vulnerable
- 8-9 = Mild Frailty
- 10-11 = Moderate Frailty
- 12-17 = Severe Frailty

TOTAL /17
• PITFALLS: The principal problems that we have had with the procedure are:
  1. neurologic deficit
  2. pseudarthrosis
  3. blood loss
  4. proximal junctional kyphosis.

Deficits thought to be due to combination of:
- subluxation
- residual dorsal impingement
- dural buckling.

Prior laminectomy may be more prone to developing a neurologic deficit.

Recommend:
- central canal enlargement
- careful osteotomy closure
- prevent/limit subluxation at osteotomy site
- performing a wake-up test after osteotomy closure
- examining all motor groups following surgery.

Excessive Blood Loss

Factors Affecting Blood Loss
- Type of anesthesia
- Patient positioning
- Operative time
- Patient temperature
- Invasiveness of procedure
- Number of vertebral levels addressed
- Mean arterial pressure
- Platelet / coagulation abnormalities
- Dilutional coagulopathy
- Primary fibrinolysis
Methods aimed at decreasing bleeding

- Good Relationship with Anesthesia
- Hemodynamic:
  - Controlled hypotension
  - Hypothermia
  - Inotropes
  - Vasoconstrictors
- Chemical/biological:
  - Systemic:
    - Antifibrinolytics
    - Aminocaproic acid
    - Tranexamic acid
    - Aprotinin
    - Recombinant factor VIIa/RhFVIIa
    - Desmopressin
  - Local:
    - Bone wax
    - Hemostatic “sponges” (gelatin, collagen, cellulose)
    - Fibrin sealants
    - Bipolar sealing - Aprotinin
    - Patient positioning

Blood Loss in Major Spine Surgery
Are These Effective Measures to Decrease Massive Hemorrhage in Major Spine Fusion Surgery?

- Measures to Decrease Blood Loss in Adult Spine Surgery:
  - Staged procedures
  - Antifibrinolytic agents reduce blood loss and need for transfusion

Blood Salvage
- Perioperative: Cell Saver
  - blood lost is recuperated and processed through a pump system
  - does not contain platelets or coagulation factors
  - About half of the lost red blood cells can be salvaged
  - Significant blood loss and return
  - Supplementation with FFP is required
  - Can cause dilutional or disseminated coagulopathy
Systemic

- Other systemic means
  - Aggressive warming – keep body temperature above 36.5

Local agents

- Hemostatic “sponges”
  - Gelatin-based – Gelfoam, Surgifoam
  - More quality than collagen-based
  - Bovine, porcine or equine origin
  - Sheets, powder, foam
  - MOA – physical
eudaequinasyndromes linked to the use of gelatin products in the spinal canal

Blood Loss Management

- Patient positioning
  - Inadequate positioning
  - Increased abdominal pressure transmitted to the IVC
  - Increased pressure epidural venous system
  - Increased bleeding
  - Wide frames decreases IAP in prone position compared to supine position after induction of GA.
Effect of an Irrigating Bipolar Radiofrequency Device on Blood Loss

- Spine
  - Decreases surgical time and blood loss per level fused
  - Improve visibility in the surgical field

(PJK)

- Natural phenomenon vs rigid fixation
  - Increased biomechanical demands?
- Geriatric patients
  - Higher tendency to develop PJK.
- PJK in these patients likely driven by sagittal plane overcorrection.

Proximal Junctional Kyphosis
The prevalence of PJK at 5+ years postop was 39%.

- PJK progressed
  - Older age (>55 years)
  - Combined anterior and posterior

SRS Outcome Data adversely affected if PJK>20 degrees
OUTCOME AND COMPLICATIONS OF PEDICLE SUBTRACTION OSTEOTOMY IN CASES WITH SINGLE VERSUS TWO ATTENDING SURGEONS

Sassan, Keshavarzi; Vedat, Christopher
University of California San Francisco, Ca

RESULTS: 75 PSOs
- 36 single surgeon
- 38 two surgeon
- mean # of levels: posterior spinal fusion (8.82 vs 8.05)
- EBL (mean)
  - single surgeon: 4604 ml
  - two surgeons: 1970 ml (P-value<0.0001)
- Average surgical time:
  - single surgeon: 432 min (7.21 hrs)
  - two surgeons: 291 min (4.85 hrs) (P-value<0.0001)

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Conclusion:
- 2 experienced surgeons working simultaneously
- reduces operative time and blood loss
- decreased infection and other medical complication
- less stress

The Osteoporotic Spine: Surgical Considerations

- More points of fixation.
- Larger Diameter of Pedicle Screws?
  - Advantage: increase stability and fixation
  - Disadvantage: risk of pedicle fracture
- Laminar Hooks and Sublaminar Wires?
- Post-Operative Bracing
- Post-Operative Bone Growth Stimulators
- Cement Augmentation?
Conclusion

• Increasing elderly population
• Plenty of complex degenerative deformity
• Continue to look for better and more cost effective ways to screen and treat this population
• New Technology/MIS

Thank You