

Results of Complications in the Elderly

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


- Spine Patient(s)

Population Over 65yo

- 2007 over 37 million people over the age of 65 in the United States
- 2020 over 54 million people will be older than 65.
- 2015 est. 1.5 million hospitalizations for spine issues



Challenges of Operating on the Aging Spine

<p>RISKS</p> <ul style="list-style-type: none"> • Elderly • MULTILEVEL • Spinal deformity • Comorbidities <ul style="list-style-type: none"> • PVD • Organ failure • DM • Inflammatory conditions • Lower Bone density • Cardio-pulmonary issues • Nutrition • Medication Use- ie. Steroids, narcotics • Pain Management <ul style="list-style-type: none"> • Meds • SCS, pain pump • Obesity • Habits • Beliefs • Social situation 		<p>BENEFITS</p> <ul style="list-style-type: none"> • Improved /Maintain Function • Less Pain • Slow / Stop Progression • Psychosocial Issues <ul style="list-style-type: none"> • Self Esteem
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Pre-Operative Considerations

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



Pre-Operative Considerations Obesity

- **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:
 - **< 35kg/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 - **pseudarthrosis**.
 - ↓ 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**.

Clinical Frailty Scale®

1 Very Fit – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

2 Well – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are **very active occasionally**, seasonally.

3 Managing Well – People whose medical problems are **well controlled**, but are **not regularly active** beyond routine walking.

4 Vulnerable – While **not dependent** on others for daily help, often **experiences** brief activities. A common complaint is being “**loved up**”, and/or being tired during the day.

5 Mildly Frail – These people often have **more evident slowing**, and need help in **high order ADLs** (finances, transportation, heavy housework, medications). Typically mildly frail progressively requires shopping and walking outside alone, meal preparation and housework.

6 Moderately Frail – People need help with **all outside activities** and with **heaping** house loads, they often have problems with stairs and need help with **bathing** and might need minimal assistance (e.g., standby) with dressing.

7 Severely Frail – **Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

8 Very Severely Frail – **Completely dependent**, approaching the end of life. Typically they could not recover even from a minor illness.

9 Terminally Ill – Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise evidently frail**.

Scoring frailty in people with dementia
The degree of frailty corresponds to the degree of dementia. Common symptoms in **mild dementia** include forgetting the details of a recent event, though still remembering the event itself, requiring the same questionnaire and social withdrawal. In **moderate dementia** recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting. In **severe dementia**, they cannot do personal care without help.

* J. Canadian Society on Health & Aging Research 2008.
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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

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Pedicle Subtraction Osteotomy for the Treatment of Fixed Sagittal Imbalance

Surgical Technique

By Kevin H. Boonen, MD, Suzanne J. Lewis, MD, MCh, FRCS, Anthony Rowlinson, MD, Lawrence G. Lenka, MD, Gregory B. Lewis, MD, and Robert Blawie, RN
In cooperation with the Department of Orthopaedic Surgery, Barrow Neurological Hospital and Washington University School of Medicine, St. Louis, Missouri
The original scientific article to which the surgical technique was presented was published in JBJS Vol. 85-A, pp. 454-463, March 2003

- PITFALLS: The principal problems that we have had with the procedure are:
 - (1) neurologic deficit
 - (2) pseudarthrosis
 - (3) blood loss
 - (4) proximal junctional kyphosis.

JBJS Volume 32, Number 20, pp 2247-2252
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Neurologic Complications of Lumbar Pedicle Subtraction Osteotomy A 10-Year Assessment

Jacob M. Buchowski, MD, MS, Keith H. Bridwell, MD, Lawrence G. Lenka, MD, Craig A. Kahoe, MD, Ronald A. Lehman, Jr, MD, Youngjung J. Kim, MD, David Stewart, BS, and Chris Baldus, RN

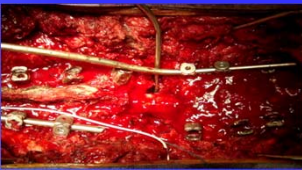
- Deficits thought to be due to combination of
 - **subluxation**
 - **residual dorsal impingement**
 - **dural buckling**.
- prior laminectomy may be more prone to developing a neurologic deficit

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 arthrodesed
 - Mean arterial pressure
 - Platelet / coagulation abnormalities
 - Dilutional coagulopathy
 - Primary fibrinolysis



Methods aimed at decreasing bleeding

- *Good Relationship with Anesthesia*
- **Hemodynamic**—
 - Controlled hypotension
 - Hemodilution
 - **Local vasoconstrictors**
- **Chemical/biological**:
 - Systemic:
 - **Antifibrinolytics**
 - Aminocaproic acid
 - **Tranexamic acid**
 - Aprotinin
 - Recombinant factor VIIa/RifVIIa
 - Desmopressin
 - Local:
 - Bone Wax
 - Hemostatic “sponges” (gelatin, collagen, cellulose)
 - Fibrin sealants
 - Bipolar sealer- **Aquamantis**
 - **Patient positioning**

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Blood Loss in Major Spine Surgery

Are There Effective Measures to Decrease Massive Hemorrhage in Major Spine Fusion Surgery?

Hossein Elgafy, MD, FRCSd, FRCSc,* Richard J. Bransford, MD,† Robert A. McGuire, MD,† Joseph R. Dettori, MPH, PhD,§ and Dana Fischer, DDS, MSD, MSc,§

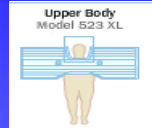
- Measures to Decrease Blood Loss in Adult Spine Surgery:
 - **Little or no evidence supporting use of:**
 - Recombinant factor VIIa
 - Activated growth factor platelet gel
 - Cell Saver technology
 - Normovolemic hemodilution
 - Hypotensive anesthesia
 - Staged procedures
 - **Antifibrinolytic agents 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
 - **better quality clot than collagen-based products**
 - bovine, porcine or equine origin
 - sheets, powder, foam
 - **MOA –physical**
cauda equina syndromes linked to the use of gelatin products in the spinal canal



- Lentschener C. (1999) Anesth Analg 89:590-597
- Lattocca H, McNab T (1974) J Bone Joint Surg Br 56:549-550
- Alander DV, Stauffer ES (1995) Spine 20:970-971
- Bellen P (1992) ActaOrthopBelg 58:236-239

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



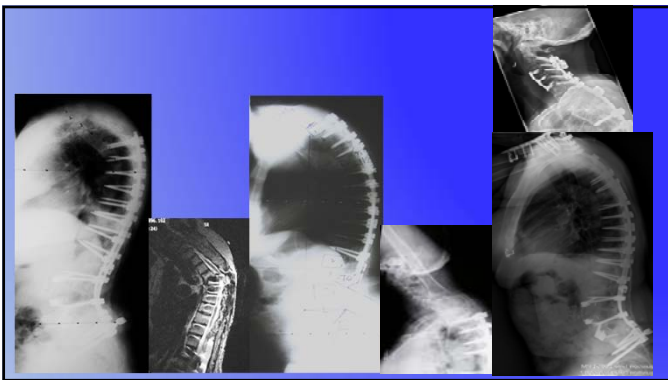
(PJK)

- *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








Spine (Phila Pa 1976). 2008 Sep; 15(3):269-273. doi: 10.1097/SPS.0b013e31817c0428.

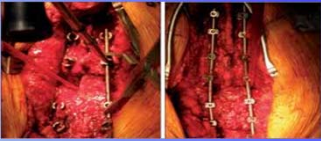
Proximal junctional kyphosis in adult spinal deformity after segmental posterior spinal instrumentation and fusion: minimum five-year follow-up.

Kim YJ, Rodwell KH, Lenke LG, Ghasem CB, Rizvi S, Cheh G, Washington University Medical Center, St. Louis, Missouri, USA.

- 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; Deviren, Vedat; Ames, 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<0.0003)
- **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

Complication rate in adult deformity surgical treatment: safety of the posterior osteotomies

Giovanni Andrea La Matta¹, Francesco Lucarelli², Francesco Galbani³,
Marcello Ferraresi⁴, Miguel Hernandez⁵

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Top 10 Surgical Pearls to Maximize Outcomes of Spine Surgery in Patients with Osteoporosis

Prevention of osteoporosis is the most important principle in the management of the condition.

Fracture repair is an endosteogenic for preoperative optimization is recommended.

Longer fusion constructs and avoiding constructs that start or end at the cervicothoracic or thoracolumbar junction may protect against junctional or segmental failure.

At least three fixation points above and below the apex of the deformity should be used.

Hybrid constructs (pedicle screws, hooks, wires) may improve fixation strength. Bilateral and/or sacral fixation in long fusion constructs is recommended, when feasible, to maximize stability.

Anterior column support increases load-sharing, decreases strain on constructs, and should be used whenever possible.

The direction of pedicle screw insertion affects pullout strength, and purchase in subchondral bone (eg, sacral promontory) is recommended to maximize fixation.

Underlapping increases the insertion torque and pullout strength of pedicle screws.

Hubbing of pedicle screws adversely affects pullout strength and should be avoided.