

MINIMIZING BLOOD LOSS IN SPINE SURGERY

Feb 2018

Park City, UT

Michael S. Chang, MD

Sonoran Spine Center

Assistant Professor of Orthopaedic Surgery, University of Arizona

Associate Clinical Professor, Mayo Clinic -Scottsdale



**COLLEGE
OF MEDICINE
PHOENIX**

BLOOD LOSS = BAD

- Large blood loss
 - Fluid shifts
 - Coagulopathy
 - Antibiotic dilution
 - Transfusion complications
 - Suppresses T cell proliferation
 - Increased infection rates after lumbar spine surgery
 - SSI: x1.9 to x4.0
 - UTI: x2.5



ECONOMICS OF BLOOD LOSS

- Cost of transfusions
- Increased OR time
- Post op complication rate x1.6
- 30 day return to OR x1.7
- 1 u pRBC ↑ LOS odds x2

STRATEGIES



- Pre-op
 - Controlling risk factors
 - Medications
- Intra-op
 - Cell salvage
 - Anesthetic Techniques
 - Medications
 - Surgical Techniques
- Post-op
 - Drains

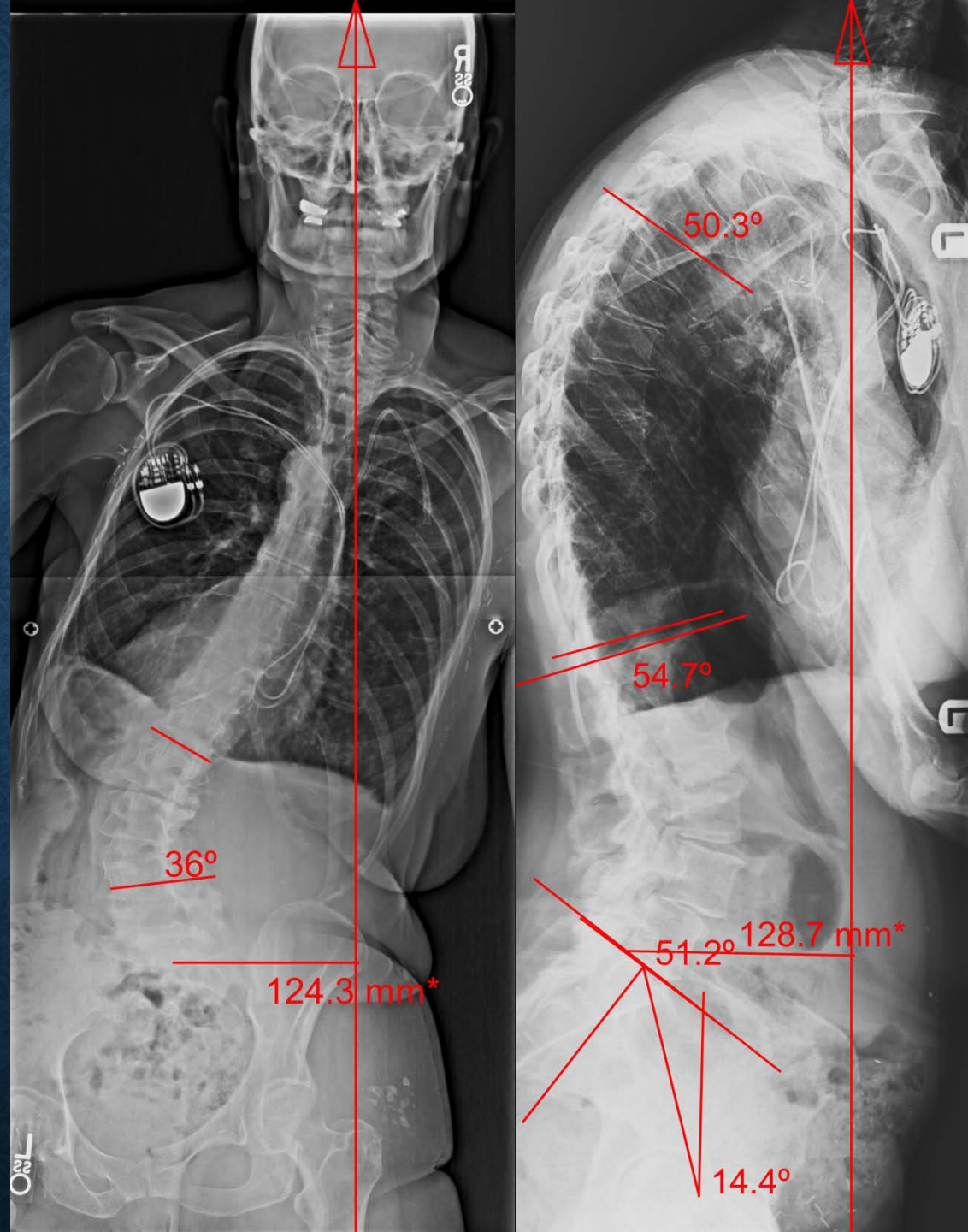
PRE-OP

- Pre-op risk factors
 - Surgery size
 - Spinal levels
 - Revision
 - Tumors
 - Trauma
 - High bmi
 - Advanced age
 - Bleeding disorders

59 F

- LBP, Coronal Imbalance
- Multiple Sclerosis
 - 4/5 LTA, 5-/5 LLE
- Lymphangiomyomatosis (LAM) lung disease
- Pacemaker for arrhythmia

- PI = 51.2°
- PT = 14.4°
- LL = 54.7°
- SVA = 12.9 cm
- Cobb = 36° L2-4
- C7-CSVL = 12.4 cm



MEDICATIONS

- General rule is d/c for >7 days
- NSAIDS: Reversibly inhibit COX (needs 1-7 days)
 - Usually normalized platelet function in 3 days
 - Piroxicam is longest at 7 days, Ibuprofen is shortest at 1 day

ASA IN SPINE

- **ASA: Irreversibly inhibits COX (needs 7)**
 - Higher EBL d/c <7 days
 - No difference between never taking ASA and d/c 7 days prior
- **PeriOperative Ischemic Evaluation-2 trial**
 - >10,000 non-cardiac patients
 - ↑ risk of major bleeding x1.2
- **Baby ASA:**
 - 1.5x bleeding complications (metaanalysis of 49,590 pts)
 - Cessation of baby ASA responsible for 10% increase in CAD, stroke, PAD

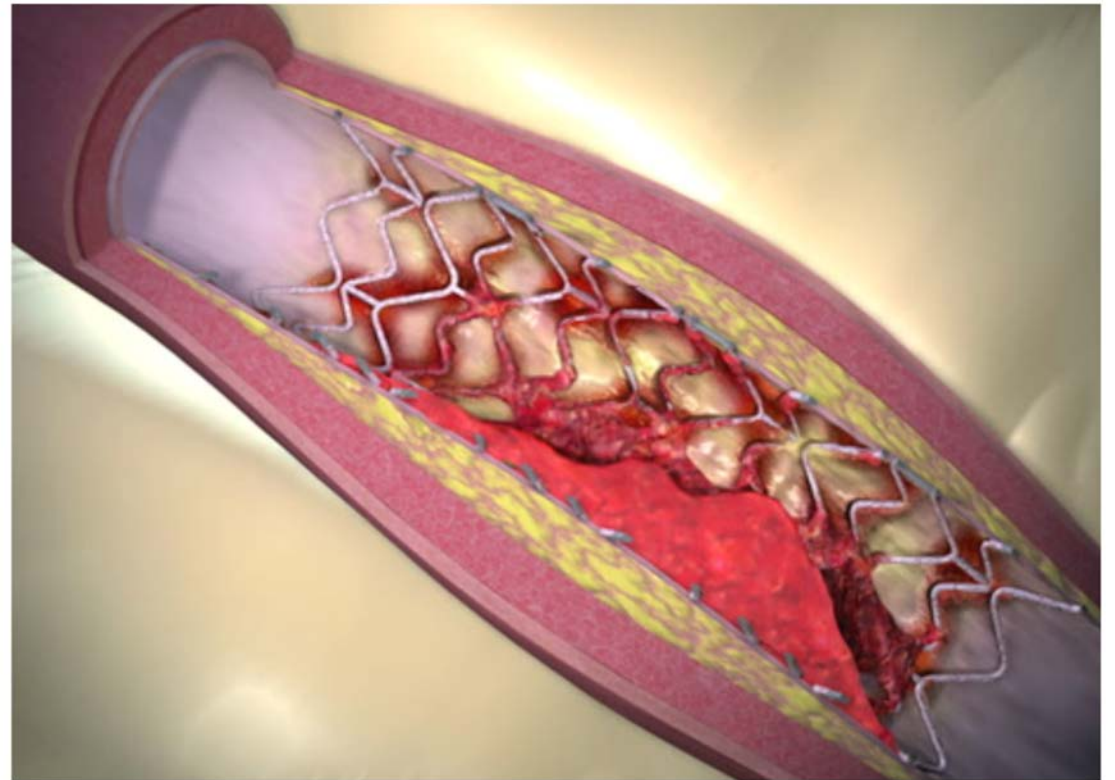
Devereaux PJ. *NEJM*. 2014;370(16):1494-1503

Burger w. *J Intern Med*. 2005;257(5):399-414

Park JH. *Spine*. 2013 38(18):1561-65

STENTS

- Stent thrombosis occurs average of 10 days (min 4 days) post ASA withdrawal
- Highest thrombotic risk post-stent placement
 - Min 6 wks for metal stents
 - 6-12 mo for drug-eluting stents
- Plavix and other Platelet ADP blockers (irreversible) (needs 5-14 days)
 - Stopped 7 days prior, resume 12- 24 hr post
 - Ticlopidine needs 14



MEDICATIONS

- Coumadin (5 days), irreversible
 - INR <1.4 prior to surgery
- Bridging
 - Afib
 - Heart valves
 - Recent Thromboembolism (<3 mo)
- Enoxaparin (1 day), 3 days before restarting
- Heparin (4-5 hours), 3 days before restarting

Supplements (14 days)

- Garlic
- Ginkgo
- Ginseng
- Fish oil
- Flax seed oil



AUTOLOGOUS BLOOD DONATION

- Iatrogenic anemia
- 1/3 potentially wasted
- Increases risk of transfusion

CELL SALVAGE

- Cost Effective?
 - ICS not cost-effective for 3 or less levels of fusion, or <500 cc EBL
 - Recovery rate is 38-40% in spine
 - <100mm Hg mercury
 - reclaim sponges
 - avoid blood clotting
 - limit irrigation
- Contraindicated in tumor/infection
- Risks
 - Hemoglobinuria
 - pulmonary reperfusion injury
 - Depletion of coagulation factors
 - 1u plasma per 1000cc returned

ANESTHESIA

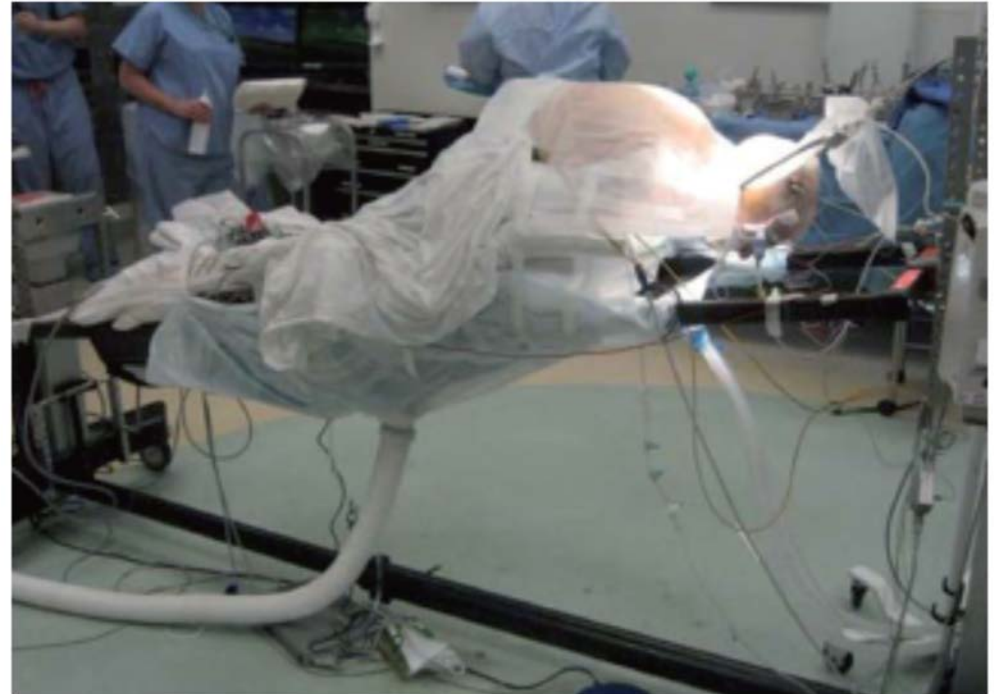
- Hypotension (SBP 50-80)
 - Reduces 55% EBL in AIS (ref 24)
 - Monitor end-organ perfusion (optic nerve/spinal cord)
- Core temperature control
 - ↓ 1° C → increases EBL by 16%, +22% risk of transfusion
 - Elevate room temp
 - Minimize skin exposure
 - Decrease surgery time
 - Forced-air warming blankets

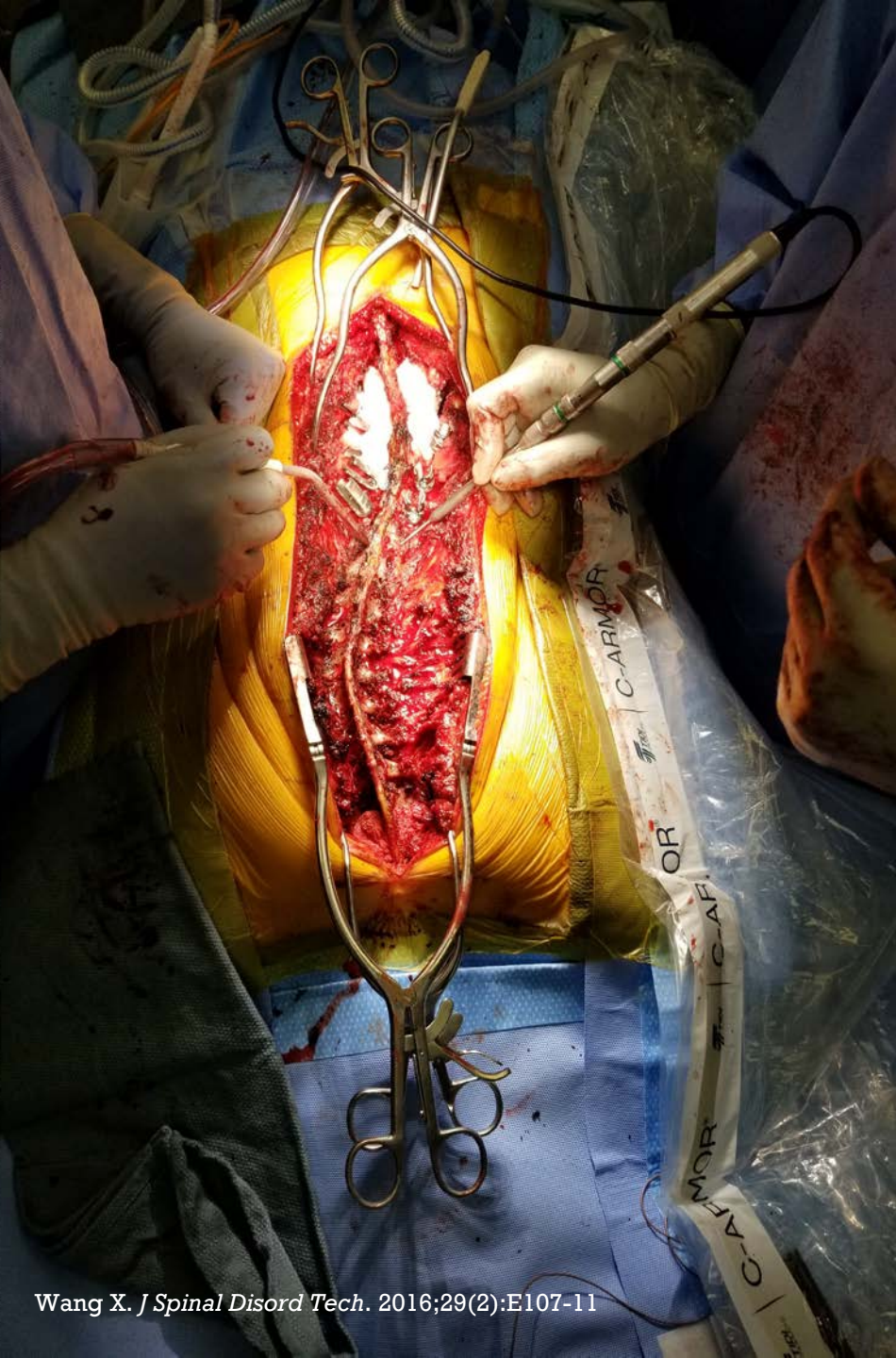
ANTIFIBRINOLYTICS

- Tranexamic acid (TXA), E-aminocaproic acid (EACA), Aprotinin
 - ? Optimum dose (i.e. 10mg/kg + 1/mg/kg/h vs. 100mg/kg + 10mg/kg/h)
 - TXA > EACA > Placebo
 - 11 RCT in 644 pts, more effective than placebo but no significant increase in risk
 - 17 RCT in 1191 pts, effective with no significant increase in risk

POSITIONING

- Reverse Trendelenburg
- Jackson table
- Wide pads → Lower EBL





SURGICAL TECHNIQUE

- Peri-incisional epinephrine
- Meticulous hemostasis
- Subperiosteal dissection
- Radiofrequency bipolar hemostatic sealers
 - 42% EBL reduction, increases cost \$493
- Thrombin soaked-sponges
- Bone wax/gelatin/cellulose/collagen products

POSTOP

- Drains
 - AIS: 43% vs 22% postop pRBC
 - Meta-analysis: No difference
- Ketorolac
 - 27 RCT: no significant increase in post-op bleeding (2.5 vs 2.1%)
- Allogeneic Blood Transfusion
 - (7 g/dL Hb vs 10 g/dL Hb), no difference in complication

SUMMARY

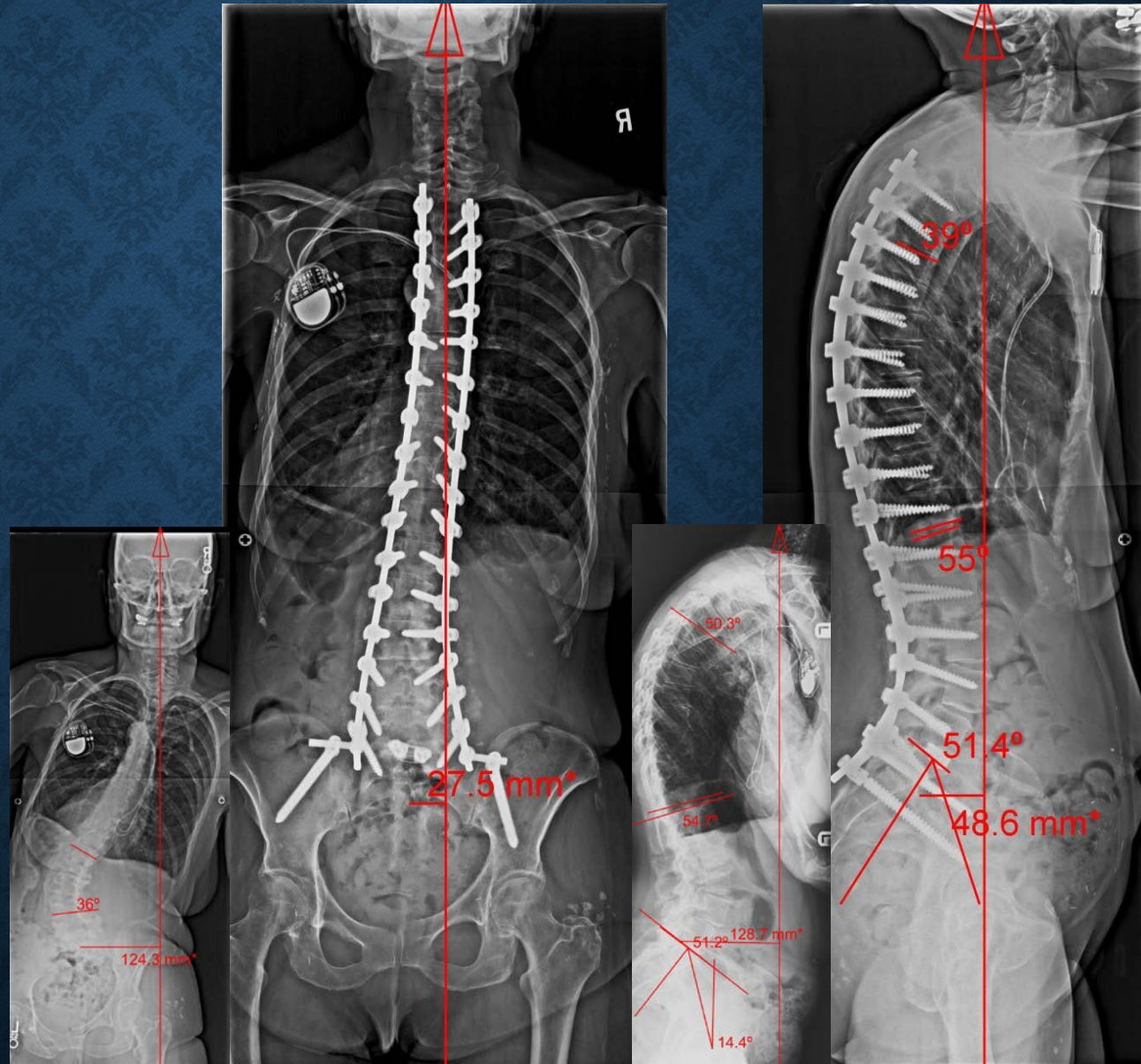
- D/C problematic drugs 7 days prior
- Cell-salvage for larger expected EBL
- TXA
- Hypotensive anesthesia
- Jackson in reverse Trendelenburg
- Meticulous dissection
- Pack-off non-active areas

T3-PELVIS, L5-S1 TLIF, MULTILEVEL SPOS

- PI = 51° → 51°
- PT = 14° → 16°
- LL = 54° → 55°
- SVA = 12.9 cm → 4.9 cm

- Cobb = 36° → 11°
- C7-CSVL = 12.4 cm → 2.8 cm

- EBL: 450
- No intra- or post-op pRBCs



Thank you!

Michael S. Chang, MD
Sonoran Spine Center
Assistant Professor of Orthopaedic Surgery
University of Arizona
Phoenix/Scottsdale, AZ



COLLEGE
OF MEDICINE
PHOENIX

