Horseshoes and Hand Grenades:

Complication Avoidance and Optimizing Risk Factors Before, During, and After Spine Surgery

Kristen Jones MD, FAANS
Assistant Professor, Department of Neurosurgery
Adj Assistant Professor, Department of Orthopaedic Surgery
Goal of this talk:
The Real Answers as to How to Avoid Complications in Spine Surgery……
The Real Answers as to How to Avoid Complications in Spine Surgery......
Overview

**MN Preoperative Risk: Identify & Optimize**
- Checklist for Care Pathway and Management Strategy

**MN Intraoperative Risk: Mitigate**
- Briefing the Room, Setting Expectations, Managing Disasters

**MN Postoperative Risk: Prevent**
- Strategies for Decreasing Postoperative Complications
Rule #1 - Have good indications for surgery.
Literature-based evidence that a systemic, collaborative approach to preoperative workup reduces patient complications in complex spine surgery.

- **Preoperative Risk Factor Optimization**
  - **Standardizing Care for High-Risk Patients in Spine Surgery**
    - The Northwestern High-Risk Spine Protocol
      - Ryan J. Halpin, MD, *et al.*
      - Study Design: Review of current literature on the preoperative evaluation and preoperative management of patients undergoing high-risk spine operations and a presentation of a multidisciplinary protocol for patients undergoing high-risk spine operations.
      - Objective: To provide evidence-based guidelines of modifiable risk factors and give an example of a multidisciplinary protocol with the goal of improving outcomes.
      - Summary of Background Data: Protocol-based care has been shown to improve outcomes in many areas of medicine. A protocol to evaluate patients undergoing high-risk procedures may ultimately improve patient outcomes.
      - Method: The English language literature to date was reviewed on modifiable risk factors for spine surgery. A multidisciplinary team including hospitals, critical care physicians, anesthesiologists, and spine surgeons from surgery and orthopaedics established an institutional protocol to provide comprehensive care in the pre-, peri-, and postoperative periods for patients undergoing high-risk spine operations.
      - Results: An example of a comprehensive pre-, peri-, and postoperative high-risk spine protocol was provided, focusing on the preoperative assessment of patients undergoing high-risk spine operations and modifiable risk factors.
      - Conclusions: Standardizing preoperative risk assessment and care may improve outcomes after major spine operations. A high-risk spine protocol may help patients by having dedicated physicians in multiple specialties focusing on all aspects of a patient's care in the pre-, peri-, and postoperative periods.
    - Key words: spinal deformity, risk stratification, spine surgery, spine protocol. Spine May 15/30/2012-2014.

- **Surgical Deformity**
  - **Spine Deformity**
    - Clinical Series
      - The Seattle Spine Team Approach to Adult Deformity Surgery: A Systems-Based Approach to Perioperative Care and Subsequent Reduction in Perioperative Complication Rates
        - Rajiv K. Sethi, MD, *et al.*
        - Study Design: Retrospective consecutive case review pre- and postintervention.
        - Objective: Characterize the effects of the intervention.
        - Summary of Background Data: Complication rates in adult spine deformity surgery are unacceptable. Systematic approaches are necessary to improve patient safety. This group reported on the dual-attending surgeon approach, a multidisciplinary perioperative screening conference, and the intraoperative protocol for the management of coagulopathy. The outcomes were demonstrated by complication rates before and after the implementation of the protocol.
        - Methods: Forty consecutive patients in Group A were managed without the 3-pronged approach. A total of 124 consecutive patients in Group B had a dual-attending surgeon approach, were present and cleared by a live multidisciplinary perioperative conference, and were managed according to the intraoperative protocol.
        - Results: Group B had an average age of 62 years (range, 39-84 years). Group B had an average age of 64 years (range, 18-84 years). Most patients in both groups had histories from 9 to 15 levels. Complication rates in Group B were significantly lower (16% vs. 25%) (p < 0.05). Group B also showed significantly lower rates of wound infection requiring debridement (1.6% vs. 7.5%), lower rates of deep vein thrombosis (3.2% vs. 10%), and lower rates of postoperative neurological complications (0.5% vs. 2.5%) (not significant). Group B had significantly lower rates of urinary tract infection requiring antibiotics (9.7% vs. 32.5%) (p < 0.05).
        - Conclusions: These data suggest that a team approach consisting of a dual-attending surgeon approach in the operating room, a live perioperative screening conference, and an intraoperative protocol for managing coagulopathy will significantly reduce perioperative complication rates and enhance patient safety in patients undergoing complex spinal reconstructions for adult spinal deformity.
A patient is determined "High Risk" when:

- Surgical High Risk factors are present (determined by Surgeon)
- Medical High Risk factors are present (determined by internists)
- 6 hours anticipated surgery time in OR
- 6 levels of thoracolumbar surgery
- Surgery is staged
- Surgeon Designates "High Risk"
  - Surgeon designates case to be "High Risk" based on professional opinion

High Risk Spine Protocol Initiated

High Risk Spine - Pre-Operative Process

1. Surgeon will initiate a formalized work-up including patient history and designate level of surgical risk.
   - Office nurse will complete pre-op testing order form and direct to the Pre-op Clinic.
   - Office nurse will designate "High Risk" on surgery scheduling form ("Special Needs") section.
   - Office nurse will send discharge care needs to Discharge Planning.

2. Once case is designated "High Risk" - patient is introduced to designated internist and a series of Pre-Operative tests are initiated (specific detail on next page).

3. All pre-op information will be gathered and centralized in a virtual admission file supported through surgeon's office and Epic/EpicChart.

4. Anesthesia reviews Surgeon's work-up, reviews test results, and prepares recommendations to take to "Spine Conference".

University of Minnesota
Complex Spine Preoperative Care Pathway

- protocol developed to identify preoperative patients at high risk
- standardized pre-operative workup imaging and lab checklist initiated by surgeon
- consultation with Preoperative Assessment Center (PAC)
- further workup performed as needed
- Multidisciplinary Complex Spine Conference held monthly; decisions on operative plan made collaboratively
Preop Risk Factors in Spine Surgery

- Age
- Medical co-morbidities
  - Cardiac, Pulmonary, Renal, Hepatic; Anti-coagulation usage; Cancer

- Bone health/healing
  - Osteoporosis, vitamin D deficiency, diabetes, steroid-usage, nicotine

- Soft tissue health/healing
  - Obesity, protein malnutrition, nicotine, rheumatoid arthritis, DMARDs, scar tissue

- Perception of pain/functional outcome
  - Depression, long-term opioid dependency, workman’s compensation claim, nicotine
Preop Risk Factor Evaluation in Spine Surgery

- Age
- Medical co-morbidities
  - Cardiac, Pulmonary, Renal, Hepatic; Anti-coagulation usage; Cancer

- Bone health/healing
  - DEXA and 25-OH vitamin D level
  - Osteoporosis, vitamin D deficiency, diabetes, steroid-usage, nicotine

- Soft tissue health/healing
  - BMI, albumin, prealbumin, Hgb A1C, Nutrition consultation, Pre-Hab
  - Obesity, protein malnutrition, nicotine, rheumatoid arthritis, DMARDs, scar tissue, cancer

- Perception of pain/functional outcome
  - Mental Health and Chronic Pain Referral/Evaluation
  - Depression, long-term opioid dependency, workman’s compensation claim, nicotine
Preop Risk Factor Management in Spine Surgery

- **Age**
- **Medical co-morbidities**
  - Cardiac, Pulmonary, Renal, Hepatic; Anti-coagulation usage; Cancer

- **Bone health/healing**
  - DEXA and 25-OH vitamin D level
  - T-score < -2.5 or BMD <0.6, anabolic osteogenic medication
  - 25-OH D <30 needs preop supplementation

- **Soft tissue health/healing**
  - BMI, albumin, prealbumin, Hgb A1C,
  - Nutrition consultation, Pre-Hab

- **Hard Stops:**
  - BMI >40 in elective surgery, albumin <3.5 or prealbumin <15, Hgb A1C >7.5

- **Perception of pain/functional outcome**
  - Mental Health and Chronic Pain Referral/Evaluation
  - plan by Chronic Pain team for perioperative pain management strategy, and clearance from Mental Health provider
Nutrition
Controllable Risk Factors in Spine Surgery

Normal or obese weight does NOT mean someone has normal or “extra good” nutrition

“Malnutrition”- Serum albumin <3.5g/dL or total lymphocyte count less than 1500-2000 cells/mm^3

Direct relationship between surgical complexity and caloric/protein requirements for healing


albumin, pre-albumin, total protein, transferrin, and the absolute lymphocyte count were investigated before surgery and at various time points after surgery.

RESULTS: Forty-four patients (Group A) with an average 6.4 fusion levels returned to their preoperative baseline nutritional values by 6 weeks after surgery, whereas 13 patients (Group B) with a statistically increased number of fusion levels of 13.8 (P = 0.0009) took 12 weeks or longer to return to their preoperative baseline.

Risk factors: increased total number of fusion levels, especially 10 or more (P < 0.05); patients undergoing circumferential fusions (P < 0.05); and, to a lesser extent, older patients undergoing multiple fusion levels (P = 0.055).

Malnutrition increased risk for infection and wound dehiscence


METHODS: 114 patients, elective lumbar fusion, retrospective review

preoperative nutritional status was an extremely significant independent predictor of postoperative complications in patients undergoing elective lumbar spinal fusion (P = 0.0018).

25% of patients undergoing elective lumbar spine surgery are nourished inadequately at surgery. This number is higher (42%) in older patients.
**Nutrition**

Controllable Risk Factors in Spine Surgery

**Dx:** Serum albumin <3.5g/dL or total lymphocyte count less than 1500-2000 cells/mm³

**Rx:** preoperative nutritional supplementation to achieve per day intake:

- 1 gram protein/kg/day

**Perioperatively:** 1.5-2 g/kg/day

---


Escott-Stump S. Nutrition and Diagnosis-Related Care. 7th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011.
Obesity
Controllable Risk Factors in Spine Surgery

10,387 patients; retrospective cohort analysis of prospectively collected data using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2005 to 2010.

4.5% anterior fusion, 17.9% posterior fusion, 6.3% TLIF/PLIF, 40.7% discectomy, and 30.5% decompression.

OUTCOME MEASURES: 30-day postsurgical complications (UTI, PE, DVT, wound infection). Secondary outcomes were time spent in the operating room, blood transfusions, length of stay, and reoperation within 30 days.

RESULTS: On multivariate analysis, BMI >35 patients had a significantly increased risk of wound complications. BMI >40 patients had a statistically increased risk of having increased time spent in the operating room, an extended length of stay, pulmonary complications, and having one or more complications (all p<.05).

CONCLUSIONS: Patients with high BMI appear to have higher complication rates after lumbar surgery than patients who are nonobese. However, the complication rates seem to increase substantially for BMI >40. These patients have longer times spent in the operating room, extended hospital stays, and an increased risk for wound, urinary, and pulmonary complications and for having at least one or more complications overall. Surgeons should be aware of the increased risk of multiple complications for patients with BMI greater than or equal to 40 kg/m(2).

Obesity
Controllable Risk Factors in Spine Surgery

You CAN definitively tell your patients that obesity is associated with increased complications after spine surgery.

- Morbid obesity (BMI >40) is prohibitive for elective spine surgery at our institution due to risk-benefit stratification

Management Strategies:
- Referral to Nutrition/Dietary
- Referral to Weight Management; potential for Bariatric Surgery referral
- Referral to Physical Therapy for exercise regimen
- Set weight goals and check-ins (Accountability!)
Intraoperative Risk Mitigation

- Checklists are utilized throughout medical care to enhance process adherence and standardization.

- Defining roles for each team member in the Operating Room helps each person work to their maximal capacity.

- Checklists for each personnel role encourage accountability and increase safety in stressed environments.

---

The Implementation and Efficacy of the Northwestern High Risk Spine Protocol

Carine Zeeni1, Leanne M. Carabini2, Robert W. Gould3, John F. Bebawy1, Laura B. Hemmer4, Natalie C. Moreland5, Tyler R. Koski5, Antonia Koh5, Michael F. Schafer, Stephen L. Ondra1, Dhaneesh K. Gupta2,3

OBJECTIVE: The aim of this study was to determine the efficacy and feasibility of implementation of the intraoperative component of a high risk spine (HRS) protocol for improving perioperative patient safety in complex spine fusion surgery.

METHODS: In this paired availability study, the total number of red blood cell units transfused was used as a surrogate marker for our management protocol efficacy, and the number of protocol violations was used as a surrogate marker for protocol compliance.

RESULTS: The 504 patients 204 traditional vs. 264 HRS protocol were compared in all demographics, coexisting diseases, preoperative medications, type of surgery, and number of postoperative levels instrumented. However, the surgical duration was 70 minutes shorter in the new group (range, 32–108 minutes shorter; P < 0.0001), and the new protocol received a median of 1.1 units less of total red blood cell units (range, 8–2.6 units less; P = 0.008). There were only 7 (2.6%) protocol violations in the new group.

CONCLUSIONS: The intraoperative component of the HRS protocol, based on two De-Confirm checklists that focused on (1) organized communication between intraoperative team members and (2) active maintenance of oxygen delivery and homeostasis appears to maintain a safe intraoperative environment and was readily implemented during a 3-year period.

1-Department of Neurosurgery, American University of Beirut Medical Center, Beirut, Lebanon, and Departments of 2Neurosurgery, Neurological Surgery, Radiology, and 3Anesthesiology, Northwestern University, Feinberg School of Medicine, Chicago, Illinois, USA.

*Correspondence should be addressed to Dhaneesh K. Gupta, MD; E-mail: dhaneesh.gupta@northwestern.edu

Glaxo: World Neurosurg. 2014
DOI: 10.1016/j.wneu.2014.06.014

Available online: www.worldneurosurgery.org

Intraoperative Risk Mitigation in Spine Surgery

Intraoperative Risk Mitigation in Spine Surgery

- Dual-surgeon approach for complex cases
- Tranexamic acid and Cell-Saver for reduced EBL
- My discussion with Anesthesia before EVERY case start:
  - Anticipated blood loss and operative time
    - any decision points or critical portions of case
    - “I’d like the attending anesthesiologist to be in the room for…”
  - Blood product availability, lab timing, Transfusion thresholds
  - Neuromonitoring usage, pharmacologic paralytic strategy
  - Goals of blood pressure for case
    (reduction to minimize EBL vs. elevation for cord perfusion)
Intraoperative Risk Mitigation: The In-Room Brief Prior to Patient Arrival

Purpose:
Organize the entire team for a shared vision on the surgery

DiGeorge Syndrome
Irradiated blood
Calcium issues
Prior head surgery
[Notify orthopedics, O.R. nurse, and OR
Foley
Halo already on (cutslot in face pillow)
Prop 4 poster
Tx = 25'
Prepare drape
Exposure T2-L5
0 Am Stealth
Place screws (see map)
Temporary distraction rod
DECISION POINT
If no, close (12 HU), leave HACU

Smith Peterson osteotomies x T10-L4
Possible vertebral resection L1/T2/L2
Alligator 90-120C crushed 1cm vacancy
1/8" Hemovac
Closure
Pedo ICU
Intraoperative Risk Mitigation

Patient Positioning Pearls
Intraoperative Risk Mitigation
Room Setup to Maximize Work Flow and Minimize Traffic
Intraoperative Risk Mitigation

Infection Reduction Pathway

- Utilize frequent wound irrigation
- Change gloves at set intervals
- Re-dose IV antibiotics prior to half-life
- Use intrawound topical antibiotics for open posterior fusions
- Minimize operative time and blood loss
- Minimize traffic through room
Intraoperative Risk Mitigation

Neuromonitoring Alert Checklist Protocol

- Entire room has “Hard Stop” and is informed of Alert

- Turn off ambient music and focus attention on checklist

- Checklist posted in room for easy viewing

- Many alerts are false positive, but the routine is the same

Postoperative Risk: Prevention!!!

- Actually starts far before the time of surgery
- Enhanced Recovery After Surgery (ERAS) pathway
  - early ambulation/mobilization
  - nutrition supplementation (protein; vita A/C/D/E/zinc/calcium)
  - tight glucose control (goal <110)
  - multimodal pain management, not just opioids
    - IV Tylenol, gabapentin, IV lidocaine, liposomal bupivicaine
Postoperative Risk: Prevention!!

- Early identification of concerns: nursing hotline, outpt workup
  - can use CRP trend at about 7-8 days postop if infection concern
- Clear communication with patient about medications
  - anticoagulants, NSAIDs, steroids, DMARDs
  - importance of continuing protein supplementation and vitamins
  - involvement of PCP with postop medication strategy

University of Minnesota
Result of Collaboration Between:
- Orthopaedic Spine Surgery
- Neurosurgery
- Anesthesiology
- Critical Care Medicine
- Pain Management Service
- Internal Medicine
- Pharmacology
- Nursing
- IT Dept
- Epic Support Staff
- Physical and Occupational Therapy
University of Minnesota ERAS Pathway-Complex Spine

PRE OP and DAY OF SURGERY MANAGEMENT

Nursing

Follow Surgical Management of the Adult Perioperative Patient - UAMS Guideline.

Encourage patient to void within 30 minutes of going to the OR. (Document time of void).

Insert indwelling urinary catheter (Foley) in the DR.

Place Pneumatic Compression Device (PCD) and forced air warmers (SWR) on patient. Do not use compression stockings.

Give PO meds and medications as ordered.

Continuous epidural on the day of surgery and document dose and time of home epidural.

Leave femoral, (SILMAZED) patches in place during surgery and document dose and time of patch placed at home.

If vasoconstriction (VANDOCIN) ordered, start Infusion in F rag CP no later than 30 minutes before scheduled surgery start time to ensure infusion has time to complete prior to incision.

Anesthesia

Limit benzodiazepines unless warranted.

INTRA-OPERATIVE MANAGEMENT

Surgeon

Pen-isocresol injection administered at end of case. Surgeon will inject 1% of base tissue and 1% below the fascia in the paraspinal muscles. NOTE: Pen-isocresol injection is surgeon or case dependent. **** Pen-isocresol injection is surgeon or case dependent. ****

Document dose (DECAODRON) 10 mg of the start of case ONLY if approved by Surgeon. (Reserved use by Anesthesia MCT should Surgeon is aware of and request administration.

Use forced air warming device to maintain body temperature greater than 30 C.

Surgical Management:

- Magnesium Sulphate: 2 gm IV over 30 minutes for hypertensive crisis and postoperative pain.
- Induction of propofol or etomidate.
- Paralysis for induction and positioning UNLESS baseline MEPs needed. Limit induction dose of Rocuronium to 0.6 mg/kg (IDEAL BODY WEIGHT). Do not dose patient if prone position.
- Ketamine (KETALAR): 0.2 mg/kg Titrate (IDEAL BODY WEIGHT) followed by 5-10 mg/hr infusion. Continue infusion UNINTERRUPTED the PACU (continue OR infusion pump and PCA pump available on POU).

- Volatile agent as allowed by neuroanesthesia.
  - Propofol (DIPRIVAN) 26 - 150 mcg/kg/min, (TOTAL BODY WEIGHT). Titrate to BIS between 40 and 60. AVOID burst suppression.

- Optimal Management:
  - Sublurate (SURVENTA) infusion beginning at 0.2 mcg/kg/min (titrate as needed), based on IDEAL BODY WEIGHT. Titrate infusion as indicated by hemodynamic and respiratory parameters. Sublurate 5 mcg IV PRN as indicated by hemodynamic and respiratory parameters through end of surgery. Terminate sublurate infusion 30 - 40 minutes prior to end of surgery (approximately at beginning of skin closure).
  - Antibiotics: Administer WITHIN 60 minutes of incision.
    - ceFazolin (ANCEF): 2 gram bolus prior to incision, repeat 1 gram every 2 hours.
    - vancomycin (VANDOCIN): 1 gram administered over 30 minutes to finish prior to incision, repeat 1 gram every 8 hours or as indicated by pharmacy.

Follow Surgical Management of the Adult Perioperative Patient - UAMS Guideline.

PONV Prevention: ondansetron (ZOFREM) 4 mg IV if not given earlier in the case.

Transcranial Doppler (TCD) monitoring. Discuss with Surgeon. Do NOT use if there is high risk of cerebrovascular or CVA.

High dose: 30 mg/kg IV bolus followed by 10 mg/kg/hour

Low dose: 10 mg/kg IV bolus followed by 5 mg/kg/hour

Blood drawn on schedule:

- Hemoglobin and coagulation every 2 hours.
- Fibrinogen 110 hours. TEA (qHr) or clinically indicated. TEG to be performed prior to infusion of any coagulopathy product (platelet, cryoprecipitate, fresh frozen plasma)

- Blood and Factor Replacement:
  - Cell saver in the operating room for any expected exposure of more than 3 liters or anticipated EBL of over 500 cc.
  - Platelet red blood cells transfused to maintain intra-operative Hg greater than 90 mm Hg.
  - Factor replacement as determined by TEG (or in 1:1 ratio with blood products starting with the second unit of transfused PRBC if TEG is not available). Cryoprecipitate infused if fibrinogen is LESS than 150.

POST-ANESTHESIA RECOVERY UNIT (PACU)

Nursing – PACU

- EVERY patient receives Sequential Compression Device (SCD) Nursing will verify placement and confirm the machine is on with each pulse check.
- Hb0 and Hemodynamic (EVT) parameters unless otherwise directed by Surgeon.
- Clear liquids as tolerated: Enteral PO intake.
- LTR at 125 mL/hr until reaching adequate oral intake, IV alone if necessary, if fluids needed to maintain UOP, adjust Enteral.
- Anesthesiologist to discuss with PACU RN anesthetics management, preference is for fentanyl (SILMAZED), or HYDRODROBUS (DORAL) boluses.
- Assess adequacy of analgesia.
- Prior to POU transfer, administer 5 mg PO any COXIDS and...
University of Minnesota ERAS Pathway-Complex Spine

975 mg PO acetaminophen (TYLENOL). Do NOT exceed 4 gm of acetaminophen (TYLENOL) in 24 hours.
- **PONV treatment:**
  - ondansetron (ZOFRAN) 4 mg q6h PRN
  - prochlorperazine (COMPazine) 5-10 mg IV q6h PRN
  - metoclopramide (REGLAN) 10 mg IV q6h PRN
  - POCT BC q8h if patient on insulin infusion. Discontinue insulin infusion prior to PCU transfer, if possible.
  - Transition to corrective SQ insulin until tolerating PO. Refer to *Glycemic Management of the Adult Perioperative Patient - UMMC* Guideline.
- XR ordered by Surgeon if needed.

**Anesthesia / Nursing / Surgery**
- Transfusion trigger at Hgb of 7 g/dL. Notify surgery of any intention to transfuse and include nursing and Anesthesia.

**PATIENT CARE UNIT (PCU) MANAGEMENT**

**Nursing on Patient Care Unit (PCU)**
- Encourage Incentive Spirometry (IS).
- Advance diet as tolerated. Nursing may advance diet per protocol without Surgeon order.
- Discontinue PCA on morning of POD 1 or as soon as the patient tolerates oral meds.
- Discontinue Foley in AM on POD 1, or POD 2 if patient received intrathecal morphine, or if ICU patient. Order bladder scan F if patient unable to void by 4 hours postprocedure or post-Foley removal. Bladder scan every 6 hours if no voiding. Start catheterize if bladder scan is greater than 500 mL. OR use bladder scanner and intermittent straight catheterization per unit / population specific criteria or specific provider order. If straight catheterization is required for greater than 48 hours, notify Surgeon.
- Discontinue antibiotics at 24 hours post surgery.
- Vital Signs every 15 minutes X2, 30 minutes X2, every 1 hour X2 then per unit routine.
- Maintenance fluids of weight-based mL/hr until PO intake greater than 500 mL/hr. After this point may saline lock IV.

**Bowel Management:**
- HOLD all meds if patient has loose stools.
  - docusate sodium (COLACE) 200 mg BID scheduled.
  - polyethylene glycol (MIRALAX/GLC/COLO-LAX) 17 gm GD scheduled.
  - bisacodyl (DULCOLAX) suppository PRN if no bowel movement has occurred 48 hours after surgery.
  - phosphate (FLEET) enema at Surgeon discretion if no bowel movement after bisacodyl (DULCOLAX).
  - sena-docusate (SENOKOT-G, PERICOLACE) PRN.

**Nutrition:**
- Amount of fluid intake as tolerated. Supplements only if adequate intake is not met.
- Avoidance of clear fluids if patient is nauseated or vomiting.
- Give Ensure shakes BID if patient has serum albumin less than 4 g/dL.

**Cold Therapy:**
- Administer ice packs as needed. Do NOT get wound wet.

**Pain Medications:**
- ketamine (KETALAR) infusion at starting dose of 5 mcg/min for 24-36 hours.
- No NSAIDs or ORAL IV STEROIDs for any fusion patient without direct Surgeon order.
- Discontinue IV pain medication within 48 hours of surgery to facilitate transition to oral pain management.
- Oral acetaminophen (TYLENOL) 150 mg q8h scheduled for 3 days.
- Oral acetaminophen (TYLENOL) 650 mg q4h PRN after last scheduled dose.
- Oral oxycodone (ROXICODONE) immediate release 5-10 mg q8h PRN for breakthrough pain.

**Ambulation/PT/OT:**
- No brace unless otherwise directed by Surgeon.
- WBAT for every patient unless otherwise directed by Surgeon.
- First session, full weight bearing, afternoon or evening of POD 0.
- Out of bed day of surgery if patient tolerates. Otherwise dangle feet at bedside day of surgery.
- Patient mobilized out of bed to chair TID.
- PT sessions 2 x per day.
- PT session on AM of discharge if possible.
- OT session 1 x per day.

**Discharge:**
- Discharge from Patient Care Unit (PCU) when patient tolerating regular diet, passing gas (no need to have a stool), is mobilized and cleared PT/OT, and pain is controlled on an oral regimen.
- Need for TCU or Rehab placement per PT/OT recommendations.
- Glucose management, if needed, per Surgeon/Hospitalist.
- Post-operative visit scheduled by clinic if pre-operative visit and should not be rescheduled unless per patient/surgeon request.
- Perform Standing Radiographs PRIOR to discharge if ordered.
Spine Surgery at the University of Minnesota

- Team approach to patient care and research

“...the more eyes that come from different viewpoints, the more that can be seen.”

What happens inside the operating room is just one small piece of surgery.

Spine Surgery requires far more than surgeons: PT/OT, PM&R, radiology, pain specialists, research team, clinic staff, nurses, operating room staff, anesthesia, primary care team, hospitalist team, administrative team.
Thank You!!!

kejones@umn.edu