

# Adult Complex Spine Deformity Surgery Anesthesia Protocol

## DEFINITION:

- > 4 level posterior spine fusion involving thoracic-lumbar-sacral spine
- Anticipated EBL > 2L

### HIGH BLOOD LOSS PREDICTORS:

- Osteotomies – PSO, VCR
- Bone based tumors
- Revision surgery
- Active Infection / osteomyelitis

### HIGH-RISK SURGICAL PATIENTS:

- CAD
- Carotid disease
- Renal Insufficiency
- Hepatic Insufficiency
- Abnormal coagulation

## PREOP HOLDING:

- Patients should take their AM opioid dose and AM gabapentin/pregabalin dose
- Acetaminophen 1000mg PO in preop, unless contraindicated
- Gabapentin 600mg PO in preop unless taking at gabapentin/pregabalin at home,
  - If taking gabapentinoids: ensure home dose was taken
  - (if home AM dose gabapentin lower than 300mg, may consider adding more in preop)

## MONITORING & IV ACCESS:

- Large bore IV access:
  - 2 PIVs that are 16G or larger – must be confident they work
- Low threshold for central venous access-
  - If PIVs difficult or fragile or limited
  - When anticipating need for high dose or prolonged vasopressors
  - When arms are tucked and not visible
  - IJV preferred site – SCV or Femoral sites are compressed when prone
- Arterial Line
- Consider using LiDCo if available
- Consider monitoring EEG with Sedline monitor if available
  - Note: IONM provider may also monitor EEG on their platform (not always)

## ANESTHETIC PLAN:

--Anesthetic is TIVA with possible use of up to 0.3 MAC of volatile agent

--Avoid volatile agents if pre-existing weakness or inadequate quality of MEP signals

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## MAINTENANCE ANESTHETIC INFUSIONS:

-- Most infusion doses based on using ideal body weight; propofol dosing usually based on total weight

## PROPOFOL:

- Initial Dosing: 80-125 mcg/kg/min infusion is typical but must adjust for each patient
- Maintenance: 50-100 mcg/kg/min – need to titrate down over time due to accumulation

## LIDOCAINE:

- Initial Load: 1-2 mg/kg IV bolus (typical 100mg dose used on induction counts)
- Maintenance: 1.5 - 2 mg/kg/hr

## KETAMINE

- Loading dose: consider load with 0.2 – 0.5 mg/kg
- Maintenance: 2-5 mcg/kg/min

## MAGNESIUM:

- Induction— Maintenance: 30mg/kg load after recovery from NMB, then 6 mg/kg/hr
- Generally, give 2 - 4gm max dose for a case; less for smaller patients

## OPIOIDS: SIGNIFICANT DISAGREEMENT ABOUT OPTIMAL OPIOID CHOICE AND DOSING

- Ideally, avoid remifentanyl as it is associated with worse postoperative hyperalgesia
- If using fentanyl infusion, strive for lowest dose (e.g. 1 mcg/kg/hr)
- Opiate tolerant patients (> 100 OME/day):
  - consider methadone IV: 0.2mg/kg or up to 20mg at induction
- Regardless: titrate longer acting opioid at end of case – hydromorphone or morphine

## ADJUNCTS:

- Dexamethasone: 0.15 mg/kg IV (up to 10mg) if OK per surgeons
- Tranexamic Acid: High-dose: 30 mg/kg IV load, then 3 mg/kg/hr (Max total dose 50 mg/kg)
  - Strong contraindication: Existing intravascular thrombus – active PE / DVT
  - RELATIVE contraindication: CAD, coronary stents – to be discussed with surgeon

## TIME OUT:

- Should include both anesthesia and surgery primary attending MD
- Blood Pressure targets
- Anticipated EBL
- Disposition: PACU vs. ICU

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## FLUID MANAGEMENT:

- Limit crystalloid to < 2 L (if this is our target, then hopefully will be <3 L when case is complete)
- Order 5% Albumin – typically 1000 – 2000cc - and have brought to OR
- GDFT: unlike ERAS pathways for complex abdominal surgery, “OPTIMAL” volume resuscitation in a spine patient does not occur when the patient’s stroke volume no longer increases by 10% with a fluid challenge. Pushing intravascular volume to this level may increase central venous pressure and thus elevate epidural venous pressure, leading to excessive bleeding.
  - Measure SPV and PPV on our monitor – target ~10 or less
  - Follow SVV if using the LiDCO CO monitor
    - Target 12% or less
  - Consider giving a small, e.g. 250ml, colloid bolus and observe responses
  - NOTE: volume status and blood pressure are not interchangeable;
    - if you think the patient is dry – give fluids regardless of BP
    - if BP is low but volume status seems OK, use vasopressors

## BLOOD PRESSURE AND CARDIAC OUTPUT MANAGEMENT:

### BLOOD PRESSURE GOALS:

- Generally, keep MAP within ~20% of baseline pre-induction BP
- Exceptions:
  - Controlled hypotension – to reduce EBL during exposure – may push BP up to 40% below baseline or MAP of 60mmHg (must be discussed with surgeon)
  - Spinal Cord compression: if tight canal, cord ischemia per MRI, or symptoms of myelopathy – should keep MAP within 10% of baseline at all times

### BLOOD PRESSURE MANAGEMENT:

- Assess volume status as above
- Phenylephrine infusion: 10-60 mcg/min is typical range
  - Compensating for vasodilatory effects of anesthetics
- Norepinephrine: 1-20 mcg/min
  - Indicated when phenylephrine dose is high
  - Use as primary agent if desire inotropy:
    - Low CO/CHF, CKD
  - Use if CO decreases per NiCO monitor
- Epinephrine: when other agents fail, consider early if sepsis of concern
- Vasopressin: consider if refractory hypotension with alpha agents, especially if patient using ACEI or ARB agents for BP control

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## TRANSFUSION AND BLOOD PRODUCT SELECTION:

- Crossmatch PRBCS – 4U -- Consider additional if positive Ab's on screen
- Order Fresh Frozen Plasma – 4U
- Platelets – not routinely ordered unless baseline Platelet count is low
  - Prep time is short and limited lifespan once pooled
- When blood is consumed – after 2U PRBCs given:
  - ensure blood bank remains ahead by at least 4 PRBCs and 4 FFP
- Consider activating Massive Transfusion Protocol if blood loss excessive
- Factor Concentrates: should be reserved for bleeding refractory to use of above blood products
  - KCentra® – 1000 Units; Recombinant Factor VIIa (NovoSeven® RT) – low dose, 1mg

## TRANSFUSION THRESHOLDS:

### **Hb < 8 gm/dL –**

- Transfuse PRBCs or cell saver blood
- Use higher Hb level (e.g. 9 or 10) if bleeding is brisk or co-morbidities warrant: e.g., CAD

### **INR > 1.5 –**

- Transfuse FFP

### **Platelets < 100K –**

- Transfuse pooled platelets

### **Fibrinogen < 150 – 200 mg/dL –**

- FFP: 1U = 600mg fibrinogen; (~300cc)
  - [Conc. is ~2gm/L]
- Cryoprecipitate: consider 5U or 10U
  - 1U = 250-300mg fibrinogen (~25cc)  
[Conc. is 12-14gm/L]

## LABORATORY TESTS:

### **Use intra-op order set:**

- OR ABG with lactate, Hb & iCa<sup>++</sup>
- CBC – includes platelets
- OR Coag panel – INR, PTT, Fibrinogen
- Consider POC Hb (Hemocue®)

### **Frequency:**

- Consider baseline ABG
- ABG after 1 L EBL or ~20% of estimated blood volume
- Repeat labs -intervals depending on rate of EBL: Consider ABG, Coags, CBC
  - after each additional 500-1000cc EBL
  - after every 30-60 minutes

- DO NOT FORGET: Calcium replacement (~every 500 mL EBL)

## TARGETS AT END OF CASE: YOU SHOULD SEND LABS DURING WOUND CLOSURE:

- Hgb: > 9-10 g/dL (expect postoperative blood loss with decrease of 1-2 g/dL Hgb)
- INR: < 1.6
- Fibrinogen: > 200 mg/dL
- Platelets: > 100K per  $\mu$ L