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Division of Orthopedic Anesthesia Stony Brook University Medical Center

## **Peri-Operative Anesthesia Protocol for Spine Surgery.**

### **Most Commonly performed spine procedures that include SSEP/MEP Monitoring:**

- 1-Decompression procedures especially at the cervical and thoracic levels
- 2-Stabilization procedures
- 3-Oncologic or vascular spine procedures
- 4- Spine trauma

### **Main Anesthetic Concerns:**

- 1- Prone position** implications: Most spine cases are performed with the patient in the prone position except Anterior Cervical Discectomy and Fusion (ACDF) procedures
- 2- Cervical vertebral instability:** Patients presenting for spine surgery may have vertebral instability, significant central canal stenosis or abutment of the neural structures by intervertebral discs, spondylolisthesis or other spine pathology. These problems may indicate that special care is needed during intubation (e.g: Fiberoptic intubation for cervical instability). Also evaluate for shoulder and elbow range of motion related to final position in prone position.
- 3- Blood loss** and transfusion especially for stabilization procedures
- 4- Anesthetic medication:** Use of the anesthetic medication with minimal effect on the processing of neuro-monitoring data (i.e. MEP and SSEP).
- 5- Rapid emergence:** Anesthetic technique should allow for a rapid emergence if neurologic evaluation is needed.
- 6- Possible Visual loss**

## **Preoperative evaluation:**

**1. Discuss the case** with the surgeon preoperatively; the discussion should include the following:

A. Whether somatosensory (SSEP) or Motor Evoke Potentials (MEP) monitoring will be used.

B. Patient positioning; (e.g. access to upper extremities during the case)

C. Estimated duration of the case,

D. Estimated blood loss & Cell saver availability

E. Desired and possible mean arterial blood pressure level, and need of invasive BP monitoring.

**2. Discussion with the patient** should include all the potential adverse effects of the planned procedure; including but not limited to the risk for possible visual loss (especially in high risk patients like Patients going for multilevel prolong procedure in the which massive blood loss is expected).

**3. History and physical exam:** Close evaluation of respiratory and cardiac function, baseline neurologic function and renal function. Neuromuscular disorders and congenital heart diseases should be ruled out in scoliosis patients.

## **4. Diagnostic Studies:**

**a. Laboratory values:** Hct, Chem 8 and coagulation studies, especially when significant blood loss is anticipated as in stabilization procedures, multilevel fusion with instrumentation.

**b. PFT, EKG** and echocardiography are highly recommended for severe scoliosis patients.

## **Anesthetic Preparation for patients undergoing spine surgery:**

- 1- Discuss with the nursing team if the table in the OR is the correct one for the planned procedure. For example, the OR table may need to permit intra- operative radiologic evaluation. The Jackson spinal table is therefore frequently used.

- 2- Make sure the availability of advanced airway management equipment (fibro-optic and video-laryngoscope) for the cases of cervical spine with symptoms of nerve impingement.
- 3- IV Line preparation is dependent on the anticipated blood loss, 2 large bore IVs should be adequate. If IV access is poor or non existent consider central access.
- 4- An arterial line set up is highly recommended except for patients undergoing short decompression and chronic pain procedures.
- 5- Confirm the information with the surgical team whether any evoke potentials will be used.
- 6- Confirm that blood products are available when transfusion is likely, setup blood warmer and check forced air blanket availability.
- 7- Cell saver setup and technician availability especially in scoliosis and multilevel fusion/ instrumentation cases, or in high risk patient.
- 8- BIS monitoring.

### **Anesthesia Technique:**

Routine Anesthetic management with close attention to the following:

**Induction and Maintenance:** Induction is performed before positioning the patient prone on the OR table, except in ACDF cases. Induction and placement of all intravenous as well as invasive monitoring lines will therefore occur while the patient is supine still on the transport bed. The stomach contents should be drained with an OG tube and a bite block should be placed and secured in position during the entire case. We prefer two bite blocks on each molar side in order to prevent the patient from biting down on the endotracheal tube and tongue laceration during MEP monitoring. Oropharyngeal temperature probe is recommended for temp monitoring.

**Prone positioning is a team effort:** Prone positioning is a shared responsibility of the whole OR team. The Anesthesiology team should guide and coordinate with the OR team regarding the positioning of the patient.

After turning the patient to the prone position respiratory status and vital signs should be immediately checked. All pressure points should be carefully examined (eyes, nose, chin, breasts, genitalia and nerve injury prone sties) and in cases where the upper extremities are free they need to be carefully positioned and shoulder joints should be in a <90 degree position. Frequent assessment of all pressure points should continue during the entire case, and document appropriately on anesthesia record. Also, reconfirmation of bite block position should occur at this time. always keep the stretcher nearby in case of accidental ETT malposition.

### **Medication Selection:**

If (SSEP and MEP) are planned the preferred anesthesia technique would be a TIVA without Neuro Muscular Blockade. Medication choices should be tailored to the technique. Many anesthetic medications affect the latency and amplitude of SSEP and MEP.

#### **1.Muscle relaxants:**

When MEP is planned, a short acting muscle relaxant such as succinyl choline (unless contra-indicated) may be used for intubation. A baseline SSEP and MEP recording will be obtained immediately after induction/intubation and positioned on OR table and the patient should therefore not be paralyzed at that time. After completion of MEP baseline recordings moderate muscle relaxation (2/4twitches) can be implemented and may be necessary during the first half hour at the time of incision and until the surgical exposure stage is completed. After this stage, muscle relaxants should not be given.

Muscle relaxants have a minimal effect on SSEP monitoring and can be given if MEP monitoring is not planned.

#### **2.Nitrous oxide:** SSEP: Amplitude suppression

MEP: Mild amplitude suppression.

#### **3.Volatile Anesthetics:**

SSEP: Increase latency and decrease amplitude in a dose dependent manner

MEP: Suppress MEP in a nonlinear dose-dependent fashion.

In the concentration range of 0.3-0.5 MAC, volatile anesthetics have a minimal effect on both SSEP and MEP.

However, **at our institution we prefer to use a TIVA technique** whenever neuro-monitoring is planned. In any case, the use of an inhalation agent should be discussed with the Neurophysiologists before the start of case.

**4. Propofol:** In infusion dosage of 100-150mcg/kg/min, there is minimal effect on SSEP and MEP.

**5. Etomidate:** Minimal effects on SSEP and MEP.

**6. Benzodiazepines:** Minimal effects on SSEP and MEP.

**7. Ketamine:** Minimal effects. Can be used to supplement the anesthetic Technique in patients who do not tolerate the desired sedative/hypnotic Dose of Propofol and Remifentanyl/Fentanyl in total intravenous anesthesia technique. **MAY INTERFERE WITH BIS RECORDING AND IT MAY BE DIFFICULT TO ASSESS ANESTHETIC DEPTH**

#### **Narcotics:**

Minimal effects on SSEP and MEP, Remifentanyl is a synthetic potent opioid with a contextual half like that makes it an excellent choice for TIVA. Recommended infusion rate is 0.05 to 0.2 mcg/kg/min. Furthermore, Remifentanyl's short half-life allows for neurological evaluation more rapidly at the end of the procedure. It also allows for a wake up test if needed during the case.

Alternately Fentanyl 1-2 mcg/kg/hr infusion can be used safely during TIVA technique.

**Tranexamic Acid:** IV: immediately after induction: *Adults* 2gram loading dose followed by 100mg/hr during surgery and 5 hours post op.

Consider topical if systemic contraindications to Tranexamic Acid: 250-500mg in 50 mL saline right before closing.

**(Needs Discussion with surgeon)**

**Dexmedetomidine( Precedex)**

The recommended dosage range is 0.2-0.7 mcg/kg/hr, In this dosage range it doesn't significantly effect Neuro-Monitoring, However may cause significant bradycardia and hypotension. Consider bolus dose of 1.5mcg/kg/hr for first 20 min.

**Dexamethasone:** consider a dose of dexamethasone after consultation with the surgeon.

**Blood pressure control:** Agreement between the anesthesiologist and the surgeon in regards to the desired intra-operative blood pressure level must be established before the start of the case. Typically, a **MAP of 70 -80 mmHg** is desirable. The goal is to provide a balance between minimizing intraoperative bleeding, providing an optimal surgical field while minimizing the risk of postoperative visual loss. *However, the MAP should not be reduced more than 20 percent of its pre-operative value.* A Nicardipine infusion is an excellent choice for controlling hypertension and maintaining the MAP in the desired range.

**Fluid management:** Colloids are a good choice in long cases with major fluid shifts to minimize tissue edema. Foley catheter placement is highly recommended in these cases (SHOULD BE A MUST IF MAJOR BLOOD LOSS AND FLUID ADMINISTRATION IS ANTICIPATED). Consider transfusing with the cell saver units first.

**Temperature regulation:** Upper *and* lower body Bair Hugger for normothermia.

**Monitoring** of Hct/ lytes, urine output and pressure points should continue throughout the case.

**Emergence and Postoperative care:**

If Remifentanil was used during the case, consider titrating longer-lasting opioids at the end of the case so the patients wake up comfortably. Judgment should be used regarding what dose should be given, to also allow for the necessary immediate postoperative neurological evaluation. endotracheal leak test should be done before extubation as longer duration prone positioning tends to cause significant airway edema.

Post-operative Nausea and vomiting prophylaxis is highly recommended.

When they are finished monitoring potentials shut off all anesthetics and follow BIS and vital signs as the surgeons continue to close. If the patient needs additional anesthetic, use volatile agents at this time. Do not give additional propofol.

At conclusion of the case, flip patient back to supine with help of the surgical team. Emergence should occur as quickly as possible to assess neurological status and ETT should remain in place until patient can move both feet to command.

Tape should be removed from the eyes and ETT slowly to avoid skin breakdown.(most common complain)

Extubation should only be done after confirming with the surgical team that the neurological evaluation is complete and satisfactory and that there is no other indication for keeping the patient intubated.

Consider IV PCA for postoperative pain management after discussion with the surgical team.

Treat HTN aggressively to prevent postop bleeding into closed epidural space and resulting paralysis.

**This Protocol is designed from evidence based medicine but is clearly not the only way to manage the anesthetic component of these cases and appropriate adjustments to this protocol is advised in accordance with the clinical needs of each patient.**

**Postoperative Visual loss and inform Consent issue. Summary of the ASA Advisory on POVL:2006 report.**

- There is a subset of patients who undergo spine procedures while they are positioned prone and receiving general anesthesia that has an increased risk for development of perioperative visual loss. This subset includes patients who are anticipated preoperatively to undergo procedures that are prolonged, have substantial blood loss, or both (high-risk patients e.g Diabetics).
- Consider informing high-risk patients that there is a small, unpredictable risk of perioperative visual loss.
- The use of deliberate hypotensive techniques during spine surgery has not been shown to be associated with the development of perioperative visual loss.
- Colloids should be used along with crystalloids to maintain intravascular volume in patients who have substantial blood loss.
- At this time, there is no apparent transfusion threshold that would eliminate the risk of perioperative visual loss related to anemia.
- High-risk patients should be positioned so that their heads are leveled with or higher than the heart. In addition, their heads should be maintained in a neutral forward position (*e.g.*, without significant neck flexion, extension, lateral flexion, or rotation).
- Consideration should be given to the use of staged spine procedures in high risk patients.

**Summary of 2011 ASA Practice advisory update.**



**Advisory for Preoperative Patient Evaluation and Preparation:** Although the consultants and specialty society members agree that there are identifiable preoperative risk factors, at this time the **Task Force does not believe** that there are identifiable preoperative patient characteristics that predispose patients to perioperative ION. Further, the **Task Force believes** that there is no evidence that an ophthalmic or neuro-ophthalmic evaluation would be useful in identifying patients at risk for perioperative visual loss. **The Task Force believes** that the risk of perioperative ION may be increased in patients who undergo prolonged procedures, have substantial blood loss, or both. **Consider informing patients** in whom prolonged procedures, substantial blood loss, or both are anticipated that there is a small, unpredictable risk of perioperative visual loss. Because the frequency of visual loss after spine surgery of short duration is very low, the decision to inform patients who are *not* anticipated to be “high risk” for visual loss should be determined on a case-by- case.

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