Vitale checklist

After a literature review of risk factors and recommendations for responding to IONM changes, 4 surveys were administered to 21 experienced spine surgeons and 1 neurologist experienced in IONM. Areas of equipoise were identified and the nominal group process was used to determine items to be included in the checklist. The authors reevaluated and modified the checklist at 3 face-to-face meetings over 12 months, including a period of clinical validation using a modified Delphi process. The group was also surveyed on current IONM practices at their institutions. This information and existing IONM position statements were used to create the IONM best practice guideline.

Consensus was reached for the creation of 5 checklist headings containing 26 items to consider in the response to IONM changes. Consensus was reached on 5 statements for inclusion in the best practice guideline; the final guideline promotes a team approach and makes recommendations aimed at decreasing variability in neuromonitoring practices.

The final products represent the consensus of a group of expert spine surgeons. The checklist includes the most important and high-yield items to consider when responding to IONM changes in patients with a stable spine, whereas the IONM guideline represents the group consensus on items that should be considered best practice among IONM teams with the appropriate resources ¹⁾.

1. verify that the change is real. Technical considerations include:

a) rule out 60 Hz interference from other equipment (OR table, C-arm, microscope... anything with a plug)

b) check connections

c) verify that stimulating electrodes & recording leads are making good contact

- 2. place OR on alert status
- a) announce intraoperative pause and stop the case
- b) eliminate possible distractions (music, unnecessary conversations...)

c) "muster the troops": the attending anesthesiologist, senior neurologist or neurophysiologist and experienced nurse are called to the room. Consult a surgical colleague if necessary (even if by phone)

- d) if special imaging (CT, MRI, angiogram...) may be required, alert appropriate personnel
- 3. anesthetic/metabolic considerations

a) optimize mean arterial pressure (MAP usually > 85 mm Hg preferred). Raising the MAP alone restores monitoring loss in 20% of cases

- b) check hematocrit for anemia (could contribute to cord ischemia)
- c) optimize blood pH (rule out acidemia) and pCO2

d) normalize patient body temperature

e) check anesthetic technical factors: assess extent of paralytics, inhalational agents...

f) discuss possibility of "Stagnara wake up test" with attending anesthesiologist and scrub nurse

4. surgical considerations (maneuvers are restricted to those that do not destabilize the spine):

a) visually check patient position on table: arms, legs, shift in torso, malfunction of positioning frame; reverse step that immediately preceded change in potentials (if feasible).

b) remove traction if used

- c) decrease distraction or other corrective forces
- d) remove rods
- e) remove screw that could correlate with the change, and re-probe for breach
- f) perform intra-op X-ray to rule out shift in patient position
- g) rule out spinal cord and/or nerve root compression
- 1. as a result of instrumentation

2. in scoliosis, consider resecting the apical pedicle or reducing the scoliosis

3. in patients with spinal stenosis, consider emergently decompressing the spinal cord (for cervical stenosis) or cauda equina (for lumbar stenosis) if not already done

- h) check for nerve root compression at osteotomy sites
- i) obtain intraoperative axial imaging (e.g., CT or O-arm) if available
- j) consider staging operation if practical
- 5. perform Stagnara wake-up test if feasible
- 6. consider IV steroids

Other considerations that may be helpful that are not part of the Vitale checklist: 1. knowledge of neuroanatomy and comparison to the deficit pattern can be helpful in narrowing down the source of the problem. Examples: loss of MEPs from the vastus lateralis (innervation: L2, 3 & 4) during an L4-5 TLIF cannot be caused by a surgical site complication (hematoma, screw malposition...) and other etiologies should be sought. Loss of motor potentials in the hands during surgery on thoracic or lumbar spine: consider repositioning the arms to avoid traction on the brachial plexus or compression of ulnar nerves at the elbows 2. dynamic spinal cord mapping can also be used to localize the problem area when MEPs decrease or are completely lost.

Ideally, prior to beginning the procedure, a baseline is obtained by sequentially inserting a percutaneous monopolar electrode between lamina above and below the level of the surgery, and responses are recorded in distal musculature (they used sciatic nerves and popliteal fossa). During

the operation, electrodes are placed on 2 adjacent spinous processes and the monitoring is performed continuously. If a change in monitoring occurs, an epidural stimulus is applied at individual levels until the level of the conduction loss is localized

3. for unexplained global loss of spinal cord function with a level caudal to the level of surgery, check for abdominal compression by bolsters on the OR table (increased intraabdominal pressure may increase venous pressure transmitted to the spinal cord, impairing blood flow to the cord) 4. loss of function in 1 limb: reposition the limb or padding if distal pulses are diminished

1)

Vitale MG, Skaggs DL, Pace GI, Wright ML, Matsumoto H, Anderson RC, Brockmeyer DL, Dormans JP, Emans JB, Erickson MA, Flynn JM, Glotzbecker MP, Ibrahim KN, Lewis SJ, Luhmann SJ, Mendiratta A, Richards BS 3rd, Sanders JO, Shah SA, Smith JT, Song KM, Sponseller PD, Sucato DJ, Roye DP, Lenke LG. Best Practices in Intraoperative Neuromonitoring in Spine Deformity Surgery: Development of an Intraoperative Checklist to Optimize Response. Spine Deform. 2014 Sep;2(5):333-339. doi: 10.1016/j.jspd.2014.05.003. Epub 2014 Aug 27. PMID: 27927330.

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