



ARTICLE OF THE MONTH

Perioperative Care of Patients Undergoing Major Complex Spinal Instrumentation Surgery: Clinical Practice Guidelines from the Society for Neuroscience in Anesthesiology and Critical Care

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Happy Fall and welcome to the November 2021 SNACC Article of the Month. This month we present the work of Dr. Samuel Blacker et al with their practice guidelines in complex spine surgery. Our commentary is courtesy of Drs. Julio Montejano and Daniel Janik from the University of Colorado School of Medicine.

Dr. Julio Montejano is currently a fellow in neuroanesthesia at the University of Colorado, where he also completed his anesthesiology residency. Dr. Daniel Janik completed his MD from Uniformed Services University of Health Sciences, Internship and Anesthesiology Residency at Wilford Hall USAF Medical Center, and a fellowship in neuroanesthesiology and neurophysiologic monitoring at the Mayo Clinic. In 2001 he retired from the Air Force and joined faculty of University of Colorado School of Medicine, currently Professor of Clinical Anesthesiology and Vice Chair for Faculty Development Department of Anesthesiology.

As always, we encourage our readers' input on this topic on the SNACC [Twitter](#) feed, or on [Facebook](#).

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Commentary

Dr. Julio Montejano and Dr. Daniel Janik

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Major complex spine surgery, defined as surgery involving two or more levels of the spine, is associated with high degrees of morbidity and mortality including cardiopulmonary adverse events, stroke, wound infection and deconditioning, and increased hospital length of stay (HLOS) These surgeries are also associated with high disability scores post-operatively¹ requiring intensive post-admission rehabilitation. These undesirable outcomes are impacted by various modifiable risk factors including patient BMI, perioperative glycemic control, frailty and nutrition optimization, preoperative anemia, and patient smoking status^{1,2}. Other factors such as treatment of intraoperative and post-operative pain can also impact HLOS and perioperative pulmonary complications. Institutions around the world aim to reduce the impact of these factors on patient outcomes by implementing early recovery after surgery pathways (ERAS).

To date there has been no consensus statement or expert opinion reported on the perioperative management of patients undergoing major complex spine surgery with these outcome measures in mind. The aim of this study was to compile the best available evidence based on a systematic literature review to serve as a scaffold for providing care to these patients. Topics discussed include preoperative optimization, anesthetic technique, management of intraoperative and postoperative pain, hemodynamic monitoring and goal directed volume resuscitation and transfusion therapy, glycemic control, venous thromboembolism prophylaxis as well as post-operative care and destination.

Protocol and results

A systematic literature review was performed using MEDLINE (OVID), Scopus, and Cochrane Library databases. The review included articles from January 1, 2010 to July 31, 2019 and focused primarily on literature published on the management of patients undergoing elective major thoracic and/or lumbar spine surgery. Cervical spine surgery was excluded due to the added complexity of airway management and preoperative neurologic status of these patients. Three layers of content review were performed; initially, screening abstracts and then full body text to include a total of 244 articles that were personally reviewed by two authors.

Comments and Analysis

In this systematic literature review great care was taken to search broadly for quality research performed on the topic of management of patients undergoing major complex spine surgery. From the evidence collected a thorough and organized set of recommendations was derived. The best evidence available was for topics such as preoperative optimization of patient modifiable factors such as cardiopulmonary fitness, nutrition and frailty, glycemic control, and patient smoking status. When available the authors recommend multidisciplinary planning including input from surgery, anesthesia, and nutrition as well as pre-habilitation strategies to reduce preoperative risk indices as much as possible².

Intraoperative recommendations for management of these patients included choice of anesthesia technique to synergize with intraoperative neuromonitoring (IONM). It was recommended that the anesthesia, surgical and IONM teams practice open and closed loop communication to avoid inadvertent patient harm. Of note propofol TIVA was recommended for optimization of SSEP and MEP signals, however the use of volatile anesthetics (<0.5 MAC) and other adjuncts such as dexmedetomidine (<0.8mcg/kg/hr) and lidocaine (<1.5mg/kg/hr) were deemed acceptable.

Pain control was discussed in depth, including the use of various multimodal approaches aimed at reduction of opioid consumption, improved pain scores, improved patient satisfaction and reduction of post-operative pulmonary complications. Narcotic infusions were discussed though no official recommendation was made for agent choice. High dose remifentanyl infusions (<0.8mcg/kg/min) should be used with caution in this patient population due to its well-known hyperalgesic effects and ability to suppress SSEP signals. Ketamine and methadone were recommended to reduce the overall opioid consumption. Infusion rates of ketamine <0.1 mg/kg/h have not been shown to effectively reduce postoperative opioid requirements^{4,5}. NSAID use has been associated with nonunion or failed spinal fusion in patients who smoke and should therefore be discussed with surgical teams after careful patient selection. The use of regional anesthesia in these patients was discussed as well and it was concluded that the usefulness of techniques such as paravertebral blocks and erector spinae blocks is not well established. Intrathecal opiates showed some benefits and are considered safe adjuncts^{6,7,8}. While it is recommended that some type of multimodal regimen should be implemented to treat postoperative pain there is not enough evidence to recommend specific agents.

Techniques to improve spinal cord perfusion such as intraoperative volume administration, blood pressure management and transfusion were discussed at length. No specific recommendations were made regarding the choice between

crystalloid and colloid solutions. It is however recommended that patients' volume status should be monitored using various non-invasive, minimally invasive, and invasive techniques. No specific transfusion thresholds were discussed or recommended, only that transfusion resources should be available to patients identified at high risk for major bleeding and that hemoglobin should be monitored regularly throughout the procedure³. The use of antifibrinolytics, such as tranexamic acid, was recommended to reduce intraoperative blood loss. Hemodynamic management to a blood pressure target could not be recommended based on the available evidence although some data suggests that achieving a MAP >85 is optimal for spinal cord perfusion and has shown a reduction in the incidence of post-op kidney injury. It is however important to bear in mind that use of high dose vasopressors can be detrimental to the perfusion of the spinal cord and other major organs⁹.

Based on the available evidence the authors of this review were able to compile a comprehensive and cohesive set of recommendations while clearly stating where the data for their recommendations came from and discussing where the data is inadequate or lacking to make strong recommendations for specific interventions. As mentioned in the conclusion of the review, it is paramount that as these recommendations be updated frequently and in response to both new emerging data and patient outcomes at individual institutions.

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