

Guidelines for Anesthesia Management of Enhanced Recovery Patients at PinnacleHealth

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Introduction: The delay until a patient has fully recovered after major surgery has been greatly improved by the introduction of an evidence-based protocol covering the perioperative period. It reduces surgical stress, maintains postoperative physiological function, and enhances mobilization after surgery. This has resulted in reduced rates of morbidity, faster recovery and shorter length of stay in the hospital.

Many segments of the enhanced recovery protocol directly involve anesthesia care such as pre-operative education, fasting and nutritional supplementation, intra-operative anesthetic management, multimodal pain management, nausea and vomiting prophylaxis, fluid management, and temperature control.

This paper represents the guidelines to be followed by the anesthesiologists and CRNAs under the supervision of an anesthesiologist when caring for a patient within the enhanced recovery protocol at PinnacleHealth.

It is understood that significant patient variability in age, body habitus and health requires that there be the ability to alter portions of the anesthetic management to account for such differences, and these changes will be at the discretion of the anesthesiologist caring for the patient.

Patient Education: During the pre-operative period, the patients will receive detailed information about the anesthesia management in order to obtain informed consent as well as to diminish fear and anxiety. The educators will be members of the department of anesthesiology as well as individuals trained in the ability to discuss the anesthetic care. This will be accomplished by face-to-face personal discussions or discussions by phone; but may also include pamphlets, leaflets or other informational items. The information given will include the anesthetic plan, procedures to be performed by members of the anesthesia team, as well as an overview of the potential risks involved with the anesthesia care. Questions will be answered to the satisfaction of the patient and family.

Fasting: The practice of fasting patients from midnight is used to lessen the risk of pulmonary aspiration during elective surgery; however, there is evidence that questions the necessity of such a prolonged fasting period. Studies have shown that extended pre-operative fasting increases metabolic stress, hyperglycemia and insulin resistance which the body is already prone to during the surgical process. Improving the metabolic state of patients by shortening preoperative fasting not only decreases insulin resistance, but reduces protein loss and

improves muscle function. Furthermore, intra-operative fluid imbalance is lessened. Many studies have shown that there is no evidence to suggest that a shortened fluid fast results in an increased risk of aspiration, regurgitation or related morbidity compared to the standard fasting from midnight policy. A fasting policy allowing the patient to take solids up to 8 hours preoperatively and clear fluids up to 4 hours at pinnacleHealth will allow for improved nutritional and hydration balance during the peri-operative period. This will also allow for nutritional loading as described below. This fasting guideline may always be altered at the discretion of the anesthesiologist based on patient physiology and pathology.

Pre-operative Nutritional Supplementation: The stress response during surgery is initiated by a variety of physical insults such as tissue injury, infection, hypovolemia and hypoxia. Enhanced recovery is aimed at attenuating the body's response to surgery. The use of carbohydrate loading attenuates postoperative insulin resistance, reduces nitrogen and protein losses, preserves skeletal muscle mass and reduces preoperative thirst, hunger and anxiety. It involves the use of clear carbohydrate containing drinks the day prior to surgery and up to 4 hours before. The anesthesiologists agree that there is benefit to this practice. The nutritional drink should be no more than 400 ml in volume.

Intra-operative Anesthesia Care: A specific type of anesthetic has not been described for enhanced recovery. It would be prudent, however, to use short-acting induction agents such as propofol as well as limited short-acting opioids. Short-acting muscle relaxants can be titrated using neuromuscular monitoring. Maintaining a deep neuromuscular block during surgery helps facilitate vision and surgical access, but that has to be balanced by the need for complete reversal at surgical completion. Reversal of neuromuscular blockade should be considered. Anesthesia can be maintained using short-acting inhalational anesthetics in an oxygen-enriched environment. Alternatively, total intravenous anesthesia (TIVA) can be utilized at the discretion of the anesthesiologist.

Especially in the elderly population, there is increasing evidence that too deep an anesthetic can be harmful and can increase the risk of postoperative confusion. Using a device that interprets the patient's electroencephalogram (EEG) can be considered to titrate the depth of anesthesia to a minimum required especially in susceptible patient populations. Furthermore, its utilization may lead to a reduction in anesthetic depth and the amount of anesthetics used which can shorten the time to anesthesia emergence. The benefits of intraoperative EEG analysis for depth of anesthesia are still under study therefore its use is at the discretion of the anesthesiologist.

A regional anesthetic block can be considered in addition to general anesthesia during surgery to minimize the need for postoperative intravenous opioids and to allow for a more rapid awakening from anesthesia which can facilitate early enteral intake and mobilization on the day of surgery. In open abdominal surgery or extensive lower extremity surgery, the use of epidural analgesia has proven to be superior to opioid-based alternatives for several important outcomes including pain, PONV and complications. In laparoscopic surgery and

less invasive peripheral surgery, studies indicate that alternative methods such as spinal anesthesia and peripheral nerve blockade may be equally effective to opioid-based anesthetic techniques. There are many contraindications to regional techniques so their utilization will also be based on patient physiology and pathology.

Goal Directed Fluid Management: Fluid therapy plays a vital part in achieving optimal outcomes after surgery. Intravascular volume is one of the key determinants of cardiac output and therefore oxygen delivery to the tissues. Intravascular hypovolemia can lead to hypoperfusion of vital organs and the bowel, which can lead to complications. However, administering too much fluid can lead to bowel edema and increased interstitial lung water, which can also lead to complications. During surgery, fluid delivery should be targeted against physiological measures and mean arterial pressure should be maintained using fluids (type at the discretion of the anesthesiologist) and then vasopressors once normovolemia has been established so that overload of salt and water is avoided. Minimally invasive monitoring should be considered especially in the sicker patient population, and when extensive surgery is planned with significant fluid shifts and blood loss expected. Invasive monitoring and access should also be considered as a viable option when the potential for rapid blood loss and the need for rapid fluid administration are present.

Multi-modal Pain Management: The optimal management of surgical pain using multimodal analgesia is a key component of enhanced recovery. Pain hinders postoperative recovery, including prolonging the time to recovery milestones and length of hospital stay. Furthermore, the use of opioids in postoperative analgesic regimens results in adverse effects such as sedation, postoperative nausea and vomiting, urinary retention, ileus, respiratory depression and even death. Therefore, multimodal analgesia which is the use of more than one analgesic modality to achieve effective pain control while reducing opioid-related side effects, has become the cornerstone of enhanced recovery. The use of peri-operative non-opioid analgesics such as NSAIDs, acetaminophen, gaba analogs, ketamine, local anesthetics (IV, regional); as well as regional techniques should be considered in conjunction with sparingly used opioid analgesics. The utilization of a specific pain management modality will be at the discretion of the anesthesiologist based on patient physiology and pathology.

Nausea and Vomiting Prophylaxis: Post operative nausea and vomiting (PONV) affects a significant number of surgical patients and is a leading cause of patient dissatisfaction and delayed discharge from the hospital. The etiology of PONV is multifactorial. It is known that female patients, non-smokers and those with a history of motion sickness are at particular risk. The use of opioids increases the risk significantly as well. Patients will be stratified using a PONV scoring system such as the Apfel score, and the antiemetic prophylaxis regimen will be tailored based on the perceived pre-operative risk.

Antiemetics that will be utilized can be classified into four main pharmacological subtypes depending on the receptor system they act upon: cholinergic, dopaminergic, serotonergic (5-hydroxytryptamine type 3 (5-HT₃)) and histaminergic (H₁). Newer antiemetic drugs such as

neurokinin-1 (NK₁) receptor antagonists can be utilized, as well as dexamethasone which has been shown to be beneficial. Each of the classes is superior to placebo in reducing the risk of PONV. The potency of the antiemetic effect is enhanced if ≥ 2 antiemetics are used in combination.

Prevention of Intra-operative Hypothermia: Maintaining normothermia is important to maintain normal body homeostasis. Patients that become hypothermic (definition: $<36^{\circ}\text{C}$) have been shown to have higher rates of wound infection, cardiac events and bleeding. In recovery, there is a higher risk of shivering in patients who are hypothermic which increases oxygen consumption. Pain scores are also better in patients who are not hypothermic. Therefore, it is important to maintain the patient's temperature. Maintaining temperature during the procedure can be achieved by using active warming devices as well as a warmed operating environment. In addition, intravenous fluids should be warmed if large volumes are given. Active warming should be continued into the postoperative period until the patient's temperature is $\geq 36^{\circ}\text{C}$. The patient's temperature should be monitored to enable warming to be adjusted and to avoid hyperthermia which also may occur in prolonged procedures.

Conclusion: Enhanced recovery involves many components and therefore many individuals and departments. The department of anesthesiology will, therefore, also assist as needed with those components not directly involving anesthesia care when appropriate.

This paper has been agreed upon by the anesthesiologists providing care for enhanced recovery patients at PinnacleHealth with the understanding that every patient is unique and individualized care is vitally important to patient safety and surgical outcomes.