ENHANCED RECOVERY AFTER SURGERY (ERAS) PROTOCOLS FOR GENERAL SURGERY

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ABSTRACT

Enhanced Recovery After Surgery (ERAS) protocols has been utilized within the past decade to improve patient recovery, reduce mortality risk, and reduce length of hospital stay. ERAS protocols varies from hospitals to hospitals, however the common goal of ERAS is to optimize patients for surgery in the best capacity and maintaining normal body homeostasis throughout the perioperative period. The cessation of cigarette smoking, maintaining normal nourishment and fasting at only recommended intervals prior to surgery has been shown to improve surgical outcomes and lead to better patient recovery. Additionally, the practice of carbohydrate loading 2 hours prior to surgery has been shown to prepare patients physiologically to undergo stressful surgical stimuli. Intraoperative, the use of regional anesthetic technique can help reduce use of opioids. This helps alleviate the opioid pandemic, but more importantly, helps reduce postoperative ileus. Perioperative glucose management is also important to be maintain within patient's normal limits as both excessive and insufficient circulating glucose level lead to metabolic stress. Perioperative fluid management allows for patients to be rehydrated sufficiently in order to carry out normal metabolic processes. Appropriate mechanical ventilatory settings is also indicated as an ERAS protocol as inappropriate settings can lead to release of cytokines to initiate the inflammatory cascades. Finally, maintaining normal body temperatures allows for patients to optimally carry out homeostatic metabolic processes.

INTRODUCTION

Enhanced Recovery After Surgery (ERAS) program is an evidence-based, multidisciplinary, and collaborative approach to ensuring patients are optimized best during the pre-operative, intra-operative, and post-operative periods. These protocols are designed to ensure patient comfort from pain, reduce opioid administration, reduce hospital stay, and overall decrease postoperative complications (Anesthesia Patient Safety Foundation, 2019) As the field of medicine continues to develop new drugs and technologies, any healthcare professional need to participate in Enhanced Recovery After Surgery (ERAS) protocols. Particularly for anesthesia care providers since their role in the perioperative period is vital in ensuring patients are optimized for surgery, stabilizing patients throughout surgery, and after surgery pain management. Anesthesia providers have the necessary training in managing patients during physiologically stressful events, secure airway and applying appropriate mechanical ventilatory settings, and run advanced cardiac lifesaving protocols when necessary.

Enhanced Recovery After Surgery (ERAS) was developed by Dr. Henrik Kehlet who was a colorectal surgeon and medical pathophysiologist in the 1990's. Dr. Kehlet was revolutionary in his time as he developed different practices within his clinical practice that he has found help improve patient outcomes. As a pathophysiologist, Dr. Kehlet focused on studying the effects of surgery on the human body based on three tenets: state of catabolism to mobilize energy resources, fluid retention to ensure preload of the heart, and inflammatory cascades to fight off any offending agents (Ljungqvist et al., 2017).

CARBOHYDRATE LOADING

Understanding the importance of having sufficient energy supply within the body prior to surgery, a study by Hausel et al. (2001) found that a practice known as carbohydrate loading prior to surgery helps optimized patients for surgery. The practice recommends that patient drink a bottle of carbohydrate drink that is clear, such as Gatorade, 2 hours prior to scheduled surgery. The results showed that patients who have done so have shorter length of hospital stays, improved recovery, and better surgical outcome. The author suggests that fueling the body with carbohydrate prior to surgery after a typical 8 hour NPO status helps alleviate metabolic stress prior to surgery, which allows the body to prepare and compensate better for surgical stress perioperatively.

REGIONAL ANESTHESIA

The opioid pandemic caused by excessive prescription of opioids back in the 1990's have increased economic costs of healthcare. Uncontrolled use of opioids causes constipation, sleep-disordered breathing, fractures, hypothalamic-pituitary-adrenal dysregulation, and overdose. (Baldini et al., 2012). Furthermore, chronic use of opioids lead to tolerance, thus requiring more dosage to achieve the same effects than before. Ultimately, opioid use can lead to a condition known as opioid-induced hyperalgesia (OIH), which leads to patient to become overly sensitive to stimuli and perceived as pain (Mercadante et al., 2019). While opioids are effective at treating pain intraoperatively and postoperatively, there is a growing trend within the field of anesthesia to move away from the perspective of treating pain solely with opioids. A multi-modal approach has been favored in recent years as newer drugs and anesthetic techniques have been found more effective in managing pain perioperatively (Mancel et al., 2021).

An advancement within spinal anesthesia is the use of liposomal bupivacaine. Liposomal bupivacaine, currently trademarked under the name Exparel, is an effective drug to lengthen the duration of action of spinal anesthesia. Bupivacaine along is a long acting local anesthetic and is only metabolized by the liver. However, with newer drug carrier technology, the use of liposome to surround bupivacaine molecules lengthens the effective as the body has to first metabolize the liposomal sac prior to the bupivacaine taking effect. This technology is not necessarily what increases the duration of action, however Exparel is able to clump these liposome-surrounded bupivacaine molecules into a sphere-like structure. This allows for the outer layer of liposomal bupivacaine to be digested first and applied to the nerve slowly. Exparel has been shown to lengthen analgesia for up to 1 week, depending on the type of spinal anesthesia (Vyas et al., 2016).

PERIOPERATIVE GLUCOSE CONTROL

Glucose is a six-carbon carbohydrate molecule that is necessary for the human body to digest and use to carryout metabolic processes. Low glucose level, or hypoglycemia, is a condition where the body is either not consuming enough glucose sources or an abnormal adrenal condition leading the increased insulin activity. Regardless, hypoglycemia can lead to uncontrolled tachycardia, fatigue, anxiety, diaphoresis, confusion, seizures, and loss of consciousness. A high glucose level, or hyperglycemia, on the other hand is a condition where the body is consuming too much glucose sources or not producing sufficient insulin to counteract increased glucose level, as typically seen in diabetics. Hyperglycemia can lead to nausea and vomiting, shortness of breath, weakness, abdominal pain, and even coma. Ultimately, hyperglycemia can lead to ketoacidosis, which compromises the metabolic processes of the body.

In either case, the goal of ERAS in glucose management is to maintain patient within their normal range of glucose throughout the perioperative period. A study by Duggan et al. (2017) found that in particular to surgery, hyperglycemic states can impair neutrophil function, cause an overproduction of reactive oxygen species, free fatty acids and inflammatory mediators. These pathophysiological changes ultimately damages cells, causing vascular and immune dysfunction. The study combined recent data's pointing to controlling glucose level below 200mg/dL perioperatively improves patient recovery, surgical outcome, and reduces length of hospital stay. A cited study Ghandi et al. (2007) noting that glucose levels above 120mg/dL has a 30% increase in occurrence of adverse complications, however. That said, a separate study to maintain blood glucose level between 80-100mg/dL perioperatively actually found that this practice increases mortality risk, reduced patient recovery and surgical outcome. As such, the goal of maintaining blood glucose level is determined by patient's normal blood glucose level prior to surgery.

PERIOPERATIVE FLUID MANAGEMENT

A study by Zhu et al. (2019) recognizes that the goal of ERAS on perioperative fluid management is to maintain euvolemia perioperatively. One way to determine euvolemia fluid resuscitation is the zero-balance fluid regiment. Zero-Balance Fluid Regiment utilizes patient's body weight and takes into account maintenance fluid, fluid deficit, third spacing, and surgical blood loss. Another method to determine euvolemia fluid resuscitation is through measuring cardiac output and maintaining blood pressure, also known as goal-directed fluid therapy. Traditionally, cardiac output can only be measured via an invasive pulmonary artery catheter (PAC) thermodilution method. With newer technology arising, non-invasive cardiac output monitors (NICOM) has been more frequently utilized to measure cardiac output without risking infection or thromboembolic events. For example, the Flo-Trac/Vigileo Cheetah NICOM, which measures the rise in chest volume through four electrodes and the arterial pressure waveform to formulate cardiac output. Knowing the cardiac output or stroke volume allows for anesthesia providers to titrate the appropriate amount of fluid perioperatively.

MECHANICAL VENTILATION

One way to avoid administering excessive volume and pressure on the mechanical ventilation is to use the pressure support ventilation mode. This ventilatory mode allows for the appropriate pressure required to adequately ventilate alveolar volumes without causing barotrauma and volutrauma. Additionally, use of positive end expiratory pressure (PEEP) alongside PSV ventilatory mode effective prevents atelectrauma of the alveoli. Overall, appropriate mechanical ventilatory settings should be utilized perioperatively to reduce physiological stress of the body, which eventually leads to patients recovering better and shortening length of hospital stay.

BODY TEMPERATURE MANAGEMENT

While increase in temperature is indicative of a pathophysiological cause, such as malignant hyperthermia and septic shock, the more common concern in the operating room is hypothermia as the operating room environment are typically kept at low temperatures. In a study by Wong et al (2007), hypothermia is found to increase risk of susceptibility of perioperative wound infection by causing vasoconstriction and impaired immunity. The author further describes that vasoconstriction lowers the partial pressure of oxygen, which lowers the resistance to infection. Other adverse effects of hypothermia leads to shivering, prolonged duration of drug action, coagulopathy, and myocardial ischemia.

The perioperative ERAS goal is to maintain normal body temperature perioperatively to enable normal homeostasis to occur under surgically stressful situations. The use of an esophageal temperature probe and BairHugger, a body warming device, is highly recommended throughout the perioperative period to maintain normal body temperature.

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