Preoperative Carbohydrate Loading: Weaponizing Your Patients for Surgery.
Considering the metabolic challenges faced by patients during surgery and the perioperative period, good clinical practice dictates metabolic optimization in the preoperative, intraoperative and postoperative periods. This would include optimization of fluid and electrolyte status and implementation of measures to prevent depletion of nutrient stores, which consist mainly of hepatic glycogen, fat contained in fat cells and protein in muscle tissue.

The objective of this Newsletter is to discuss the role of and evidence for preoperative carbohydrate loading. In a separate Newsletter, we discussed the paradigm shift (with supporting evidence) from the practice of overnight fasting before surgery to the current recommendation of limiting the period of fasting to 6 hours before surgery for solid foods and allowing intake of clear liquid for up to 2 hours before a scheduled surgery.

The Enhanced Recovery After Surgery (ERAS) programs, are evidence-based perioperative care protocols that utilize a multi-model approach, consisting of about 20 elements, which when implemented in the management of patients undergoing surgery have been shown to reduce hospital length of stay by more than 30% and reduce postoperative complications by up to 50%\(^1\). The first ERAS protocol was published in 2005 for patients undergoing colorectal surgeries. Since then, several evidence-based protocols for other surgeries have been developed and are being used internationally (see www.erassociety.org). One of the elements of these protocols is preoperative “carbohydrate loading”, using 800 ml of 12.5% of complex carbohydrate solution the evening before surgery and 400 ml 2 hours before the surgery. This practice has been determined to be safe\(^2\)-\(^4\), with no increased risk of aspiration. Ulf O et al (2011), looked at the impact of 12 of the ERAS elements on postoperative symptoms, complications and length of stay in a multiple regression analysis and demonstrated that intravenous fluid management and preoperative carbohydrate drink were 2 major independent predictors of postoperative outcomes\(^5\). Preoperative carbohydrates administration was found to significantly reduce postoperative symptoms (in particular nausea and vomiting, pain, diarrhea and dizziness) by 44% (OR, 0.56; 95% CI, 0.40-0.77), and significantly reduced the risk of postoperative wound dehiscence by 84% (OR, 0.16; 95% CI, 0.0 - 0.50)\(^5\).

Overnight fasting predisposes patients undergoing surgery to dehydration with increased risk for hypotension during anesthesia and surgery, and increased need for intravenous fluid for volume support. For each additional liter of fluids given for volume support during the day of operation, the risk of postoperative symptoms causing delay in recovery increased by 16%; the probability of postoperative complications increased by 32% and the risk of cardiorespiratory complications increased by 20%\(^5\). Provision of adequate oral hydration preoperatively as discussed above, using complex carbohydrate solution,
reduces the need for intravenous fluids during the day of surgery thus reducing postoperative symptoms and complications.

Additionally, patients subjected to overnight fasting report overall discomfort, hunger, thirst and headaches all of which may aggravate anxiety in the preoperative period.

Several benefits of preoperative carbohydrate loading have been documented in different studies and they are summarized below:

- Faster recovery from surgery and shorter length of hospital stay
- Decreases insulin resistance with reduced risk of hyperglycemia in the perioperative period; insulin resistance or reduced insulin sensitivity and perioperative hyperglycemia are independent predictors of complications following surgery: a study by Sato et al demonstrated that a 50% reduction in insulin sensitivity (as obtained with laparotomy procedures), results in 5-6-fold increase in risk of complications and 10-fold risk for infection
- Improves comfort and well-being in the preoperative period with reduction in thirst, headache and hunger sensation
- Reduces postoperative nausea and vomiting
- Enhances return of bowel function following surgery
- Improves postoperative food intake
- Mitigates catabolic stress with protein sparing effect; preserves lean body mass and muscle strength and prevents immunodepression
- Improves well-being: headache, hunger and thirst
- Maximizes glycogen reserve to support glucose production through surgery; decreases protein breakdown and improves muscle strength
- Reduces insulin resistance through surgery; helps postoperative glucose control and enhances return of bowel function

In conclusion, preoperative carbohydrate loading, the evening before and 2 hours before surgery is supported by literature evidence as safe and effective. It is a simple and relatively inexpensive intervention. It promotes faster recovery following surgery with shorter hospital length of stay; promotes anabolic state and mitigates the catabolic stress of surgery through preservation of glycogen storage and lean body mass.
Relevant Professional Guidelines:

American Society of Anesthesiology: Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures

European Society of Anesthesiology: Perioperative Fasting in Adults and Children: Guidelines From the European Society of Anesthesiology

Surgical Nutrition Summit Report: Summary Points and Consensus Recommendations From the North American Surgical Nutrition Summit

British Association of Parenteral and Enteral Nutrition: Perioperative Nutrition

European Society of Clinical Nutrition and Metabolism (ESPEN):


References:

5. Ulf O. Gustafsson, MD, PhD; Jonatan Hausel, MD; Anders Thorell, MD, PhD; Olle Ljungqvist, MD, PhD; Mattias Soop, MD, PhD; Jonas Nygren, MD, PhD ; Enhanced Recovery After Surgery Study Group. Adherence to the enhanced recovery after surgery protocol and outcomes after colorectal cancer. Arch Surg. 2011;146(5):571-577


