

Progress in the study of the effect of preoperative oral carbohydrates on postoperative delirium in elderly patients

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Abstract: As the population ages, the number of elderly patients who choose to undergo surgical procedures is gradually increasing, but the incidence of postoperative delirium in elderly patients is gradually increasing due to their physiological changes, preoperative malnutrition, and prolonged preoperative fasting. The role of preoperative carbohydrates as a contemporary element of the rapid recovery surgery (ERAS) paradigm in preventing the onset of postoperative delirium has become a clinical research hotspot. A full understanding of the safety and feasibility of preoperative oral carbohydrates for elderly patients will help to reduce the incidence of postoperative delirium and promote early recovery of elderly patients. This paper presents a review of the effects of preoperative oral carbohydrates on POD in elderly patients.

Keywords: preoperative oral carbohydrate, postoperative delirium, accelerated rehabilitation surgery, elderly patients

1. Introduction

Postoperative delirium (POD) refers to delirium that occurs within 1 week after a patient has undergone a surgical procedure and is mainly characterized within 24h to 72h postoperatively [1, 2]. Although POD is usually self-limiting, if neglected clinically and not treated and managed appropriately, it can last for months or years, eventually leading to limitations in daily life and the ability to work [3]. Enhanced recovery after surgery (ERAS) was first introduced in 1997 by Professor Henrik Kehlet in Denmark and is based on evidence-based clinical pathways to optimize perioperative management through multidisciplinary collaboration between surgery, anesthesia, nursing, nutrition, and other departments to reduce the length of stay and total hospital costs. [4]. Preoperative oral carbohydrate intake is one of the central mechanisms of the concept of accelerated recovery surgery. Numerous studies have shown that reduced preoperative intake (presence of dehydration, and electrolyte disturbances) is an independent risk factor for the development of postoperative delirium. This article gives an overview of preoperative oral carbohydrates and postoperative delirium, the interrelationship between preoperative oral carbohydrates and postoperative delirium, and their management to provide a reference for the implementation of preoperative oral carbohydrates and the prevention of postoperative delirium in the future.

2. Overview of postoperative delirium

2.1 Epidemiology of postoperative delirium

In general, delirium is common in elderly patients, especially those with pre-existing neurological and psychiatric comorbidities before surgery. Epidemiological surveys have shown that the incidence of postoperative delirium fluctuates from 26% to 52%. Depending on the type of surgery, timing of surgery, and diagnostic criteria. The incidence varies widely between reports, the incidence of postoperative delirium after gastrointestinal surgery was as high as 54%^[5]. Because postoperative delirium is characterized by drowsiness, silence, quiet immobility, and cognitive dissociation, about 50% of delirium is not easily detected and is often overlooked by clinicians^[6].

2.2 Susceptibility factors for postoperative delirium

Postoperative delirium is a non-specific cortical damage [7]. So far, most of the pathophysiological mechanisms of delirium are hypothetical. Comprehensive domestic and international studies show that the onset and regression of postoperative delirium are subject to the combined effect of several factors, mainly related to the following factors.

Age Advanced age is an independent susceptibility factor for postoperative delirium. It has been found that with increasing age, especially above 65 years, not only does the organ function and metabolic function of the patient decrease but also the incidence of postoperative delirium increases significantly [8].

Cognitive dysfunction Patients with preoperative dementia, cognitive impairment, depression, anxiety, and other cognitive impairments are more likely to develop postoperative delirium [9]. Study Shows Linear Relationship Between Low-Scoring Cognitive Dysfunction and Risk of Postoperative Delirium [10].

Reduced preoperative intake Patients with preoperative weakness, dehydration, electrolyte disturbance, malnutrition, vitamin D deficiency, etc. are prone to postoperative delirium [11, 12]. With the aging of society, malnutrition has become common and the number of hospitalizations and necessary surgical treatments for elderly and particularly frail patients has increased significantly. The proportion of malnutrition in this patient population has reached 70%, and multiple studies have shown that malnutrition is considered an independent risk factor for postoperative delirium [13-15].

3. Overview of Pre-Oral Carbohydrates

3.1 Preoperative oral carbohydrate concept

Preoperative oral carbohydrate is an accepted management measure in modern anesthesia and surgical practice. This usually involves altering the patient's fasting and abstinence by administering an appropriate amount of carbohydrate beverage orally 2 hours before surgery in patients who are proposed for elective surgery. ASA guidelines recommend that clear water, such as water, black coffee, black tea, and fruit-free juices.

3.2 Preoperative oral carbohydrate safety

Carbohydrate-rich fluids typically contain about 12% carbohydrate, mainly in the form of maltodextrin, to limit osmotic pressure and prevent delayed gastric emptying [16]. One study showed that oral administration of 200 ml of carbohydrate 2 hours before surgery in elderly (>65 years) gastrointestinal patients did not increase the risk of reflux aspiration, although it increased gastric volume before anesthesia. In addition, the volume and pH of gastric contents were almost identical between conventional fasting and 2-hour preoperative fasting, and that both carbohydrate-rich solutions emptied within approximately 90 minutes. After careful study by the Cochrane Review, it was concluded that no cases of aspiration pneumonia were reported when the 2-hour clear liquid limit was used [17]. The American Society of Anesthesiologists, the Canadian Society of Anesthesiologists, and the European Society of Anesthesiologists are in general agreement in their recommendations for the management of preoperative liquid and solid fasting times, i.e., the recommended preoperative fasting time is 6 h and the recommended preoperative drinking time is 2 h. The European Society of Anesthesiologists (ESA) guidelines state that pregnant women who are obese, have gastroesophageal reflux or diabetes mellitus, and/or who have not delivered can safely consume liquids up to 2 hours before anesthesia [18]. All of these indicate the feasibility and safety of preoperative oral carbohydrate consumption.

3.3 Effectiveness of preoperative oral carbohydrates

Reduces insulin resistance and muscle preservation When carbohydrates are given orally 2 hours before surgery, the anabolic pathway takes the lead, restoring glycogen, increasing muscle uptake of glucose, elevating insulin, and stopping proteolytic metabolism. Pre-surgical carbohydrates have been shown to reduce insulin resistance [19]. DMII patients tolerate CHO without increasing insulin requirements or significantly affecting blood glucose levels or complications [20]. Preoperative oral carbohydrates reduce the amount of intravenous fluid input as well, stimulate insulin secretion more significantly, have lower gastric residuals, benefit the patient's cardiac function, and may have a positive

effect on the postoperative metabolic stress response [21].

Reduced length of stay A large meta-analysis (n = 1976) concluded that preoperative oral carbohydrates reduced the length of stay, but morbidity was not statistically significant [22]. A separate meta-analysis found that the total length of stay after major abdominal surgery was reduced by 30% to 50% [23].

Reduced preoperative subjective discomfort A comprehensive analysis based on the European Society of Clinical Nutrition and Metabolism (ESPEN) on perioperative care for colon surgery confirmed that oral carbohydrates in the postoperative period reduced subjective discomforts such as thirst, hunger, and anxiety [24, 25].

Improve patient satisfaction and well-being What has long been considered dogma, a period of prolonged fasting before anesthesia, has since been revisited and challenged. In addition to the advantages belonging to above, preoperative carbohydrate loading has been shown to improve patient satisfaction and well-being without increasing perioperative complications [26].

4. Relationship between preoperative oral carbohydrate consumption and postoperative delirium

The study analyzed 692 patients aged 65 years or older undergoing elective surgery and concluded that delirium can be prevented by perioperative nutritional interventions such as preoperative oral carbohydrates, and also confirmed that postoperative delirium is a common complication in frail elderly patients and that it contributes to long-term cognitive and functional decline outcomes in older adults [27]. A hip fracture study showed that patients who underwent a comprehensive preoperative geriatric evaluation that included a preoperative nutritional assessment not only reduced preoperative waiting time and total hospital stay but also increased the 48-hour surgery rate and reduced the incidence of postoperative delirium [28].

In geriatric non-cardiac surgery, mild malnutrition (PNI 45-50) does not increase the risk of postoperative delirium compared to patients with normal nutritional status (PNI \geq 50), whereas patients with moderate to severe malnutrition (PNI 40-45) and severe malnutrition (PNI < 40) are more likely to develop postoperative delirium [29]. Preoperative oral carbohydrates are an effective perioperative nutrition program to improve malnutrition, and this initiative can reduce the incidence of postoperative delirium by 30-50% [30]. However, a perioperative nutritional intervention in patients (\geq 75 years) undergoing elective general, gynecologic oncology, and orthopedic surgery showed less postoperative delirium in the group receiving the perioperative nutritional intervention, but it was not statistically significant [31]. According to the current literature, elderly patients have an impaired response to stressors and the risk of postoperative delirium can be reduced if early mobilization and nutritional support are provided during the perioperative period [32].

5. Preoperative oral carbohydrates and management of postoperative delirium

Preoperative oral carbohydrates have long been considered dogmatic as a contemporary element of accelerated rehabilitative surgery, and remain underappreciated by clinicians as a preoperative optimization measure to prevent postoperative delirium [26].

Due to Patients' lack of awareness of the benefits of oral carbohydrates before surgery resulted in the low clinical implementation of preoperative oral carbohydrates and patient compliance [16, 33]. Therefore, the implementation of management by a multidisciplinary collaboration of surgeons, anesthesiologists, and other medical staff is intertwined, which will increase the importance of perioperative nutritional management of patients by medical staff and benefit more patients and minimize the incidence of postoperative delirium.

6. Conclusion

There is a relative lack of knowledge and research on preoperative oral carbohydrates and postoperative delirium prevention nationally and internationally. Especially during the COVID-19 pandemic, the incidence of postoperative delirium increased subsequently due to the frailty of elderly patients and prolonged surgical waiting time. From our perspective, future directions aim to train professional delirium teams and study their better perioperative intervention strategies to improve perioperative nutrition and identify ideal preoperative nutritional interventions that respond to prevent

postoperative delirium, prevent functional decline, and allow older adults to return home with maximum independence.

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