

REVIEW PAPERS

PREOPERATIVE FASTING – IS IT REALLY NECESSARY?

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For over several decades of the twentieth century preoperative fasting was one of the inviolable canons of medicine. The recommended time to refrain from eating and fluids was at least 6-8 hours, however, in clinical practice it lasted 12 hours and more. Thanks to the use of medicine based on reliable clinical studies (evidence-based medicine), we observed the ease of restrictive guidelines and changes in the recommendations of leading scientific societies. However, their introduction into clinical practice is still not widespread and encounters numerous problems.

The aim of the study was to answer the question whether preoperative fasting is really necessary, based on available literature data and our own experience.

Fasting and surgical stress

Surgery, similarly to trauma or acute stress induces a multidirectional neuroendocrine response, which significantly influences the body metabolism (1). As a result, there is a burst of hormones of the hypothalamus-pituitary system, and ensuing increase of anti-insulin hormones (catecholamines, cortisol, growth hormone, glucagon), which results in hyperglycemia. This leads to the mobilization of substrates (through gluconeogenesis, glycogenolysis and proteolysis) and reduction of peripheral tissues response to insulin (2). This is a crucial mechanism of adaptation, where in spite of normal or elevated insulin levels, its effect on muscle tissue (to a lesser extent

adipose tissue) is reduced. This natural mechanism known as insulin-resistance occurs in response to trauma, stress, and starvation. It enables to provide and maintain the supply of the most important energy substrate for the brain-glucose, unfortunately, at the expense of shifting homeostasis towards catabolism and increased proteolysis. In situations when substrates supply is limited, insulin-resistance might ensure survival. However, in case of a patient after uncomplicated surgery this phenomenon seems less beneficial, and in light of existing data must be regarded as downright harmful (3, 4).

Physiologically, the human body is subjected to a daily hormonal cycle, where the catabolic activity of cortisol predominates, both at night and in the morning, while during the day the anabolic effect of insulin is more pronounced. Physiologically, the morning meal enables to switch the metabolism from night fasting to morning satiety and increased insulinemia (60-70 $\mu\text{U/ml}$), with additional sensitization of peripheral tissues to its activity (3).

Historical recommendations

In contrast to the above-mentioned considerations, one may observe the traditional method of preparing for surgery-fasting, which was already recommended in 1848, that is two years after the introduction of general anesthesia. This was in response to the first report concerning a young female patient, sated be-

fore anesthesia, who suffered from aspiration pneumonia and died (3). It should be emphasized that the British surgeon John Lister, probably the first author of recommendations concerning preoperative fasting, highlighted the differences between the consumption of solid and liquid foods. Common sense advocated the administration of tea or beef broth several hours before the surgical procedure (5), however, considering clinical practice, such management remained until the end of the XIX century at the latest. During the first half of the twentieth century routine fasting before surgery became the mandatory rule of surgery and anesthesia, worldwide. In 1946, Curtis L. Mendelson established the above-mentioned syndrome associated with the aspiration of stomach contents into the lungs during obstetric anesthesia (6). The author recalled after many years his own incident of aspiration, due to moderation failure, however, did not specify the type of consumed diet. Similarly, the existing at that time recommendations comprised fasting before surgery without the distinction of liquid and solid foods (6).

It was not until the late eighties of the past century, based on available literature data, that the traditional method of preparation for surgery was challenged, being considered as outdated and causing unnecessary discomfort in most patients, prior to elective surgical procedures (3). As a result, during the next decade, in many countries (Norway, Sweden, Denmark, USA, Great Britain) one observed changes in the recommendations concerning fluid intake (water, tea, coffee without milk, and juices), up to two hours before induction of anesthesia. This somewhat improved the situation, especially considering patient comfort, however, due to the low energy load clear fluids hadn't any effect on the perioperative metabolism.

Modulation of the perioperative metabolism

The easiest way to improve metabolism and reduce morning insulin-resistance is to eat breakfast, which turns out to be impossible in case of a patient directed for elective surgery. Instead, the patient can receive intravenous or oral carbohydrates, which corresponds to a light meal and improves the perioperative metabolism reducing insulin resistance of tis-

sues (7, 8). In addition, combining other elements of contemporary perioperative care enables the synergistic influence on the patients' metabolism, which is reflected by improvement of outcomes. These elements include: avoidance of postoperative pain, the use of epidural anesthesia, minimally invasive surgery, early oral or enteral nutrition, early patient's mobilization, and limitation of intravenous fluids. The first model where such care was introduced (the so-called *enhanced recovery after surgery (ERAS)*) concerned colon surgery (9, 10).

Randomized studies on colorectal surgery have shown that the use of oral carbohydrates is safe and well-tolerated (11), has a positive effect on postoperative metabolism, modulates hormonal response, reduces insulin-resistance (12), and improves protein balance (13, 14). The clinical manifestation of the above-mentioned is faster recovery of gastrointestinal functioning, and shorter hospitalization (11, 15) along with the improvement of patients' well-being (16). Recent study meta-analyses with the use of oral carbohydrates in case of elective surgery confirmed shorter hospitalization in case of patients subjected to major abdominal operations (17). Accordingly, the meta-analysis using the full ERAS protocol considering colorectal surgery showed shorter hospitalization by an average of 2.5 days, and influence on possible complications nearly proportional to the number of introduced elements of care (18). Interestingly, it has been shown that the most important of these elements are the use of preoperative oral carbohydrates and avoidance of overhydration (19).

Types of preparations

It has been proven that the oral intake of water and clear fluids (tea, coffee, apple or orange juice) up to two hours before elective surgery does not increase neither the volume of fluids in the stomach, nor its acidity. Due to the very low energetic output the above-mentioned are not able to exert an effect other than hydration. On the contrary, a carbohydrate solution containing maltodextrin seems useful (carbohydrate oligomers not interfering with gastric emptying). A 12.5% solution contains 200 kcal standardly used before surgery, which amounts to 400 ml. Such a volume is easily

emptied from the stomach within two hours preceding the procedure (20) leading towards increased insulin secretion to values observed in case of a normal meal and improving glucose utilization up to half (13). Attempts of preoperative use of other solutions (glutamine or soya proteins) have also been undertaken, initially confirming their safety. However, further studies are required to assess their potential impact on metabolic response or insulin resistance (21). The detailed composition of the oral carbohydrate solution used in many countries, including Poland, was presented in tab. 1.

Non-colorectal surgery

The role of the ERAS protocol, including the use of preoperative carbohydrates in colorectal surgery is undeniable and confirmed (17, 18). However, there are more and more reports concerning the use of modern preoperative care in case of surgery, other than colorectal (21). Their number has been incomparably smaller, showing shorter hospitalization in case of patients subjected to upper gastrointestinal tract procedures (esophageal and stomach resections) (22, 23), after liver resections (24), radical cystectomies (25) and hysterectomies (26). Additionally, lower morbidity and mortality was observed in patients after esophagectomies (22), as well as smaller re-hospitalization rate after laparoscopic stomach resections (23). In some of the studies, eg. concerning hepatectomies, one observed the use of preoperative carbohydrates. However, data concerning their use in upper gastrointestinal tract surgery are very limited (27). Considering their potential benefits in case of patients with good gastrointestinal passage, those without stenosis or gastric emptying disturbances, they seem to have interesting perspectives. There are still some unresolved issues, such as the use of carbohydrate solutions in obese patients, as well as those with GERD and diabetes mellitus (27). Further studies are required.

Current recommendations

In 1999, the American Society of Anesthesiologists revised their recommendations about preoperative fasting, shortening the period of not drinking clear fluids up to two

Table 1. Preoperative carbohydrates preparation preOp®N.V. Nutricia, Zoetermeer, Holanda contents

Energetic value (100 ml)	kcal	50
Carbohydrates, including:		
– monosaccharides and disaccharides	g	12,6
– lactose	g	2,1
– polysaccharides	g	0
% energy		10
Mineral contents		
Na	mg	50
K	mg	122
Cl	mg	6
Ca	mg	6
P	mg	1
Mg	mg	1
Osmolarity	mOsmol/l	240

hours before surgery (28). Four years later, Cochrane's database review comprising 22 randomized studies showed that drinking clear fluids up to 90 minutes before surgery had no influence on the increased risk of vomiting, aspiration or morbidity, regardless the amount of fluid (29). Currently, based on reliable data collected during the past decade, leading scientific societies, such as the European Society of Clinical Nutrition and Metabolism (ESPEN) (30, 31), European Society of Anesthesiology (ESA) (32), American Society of Anesthesiologists (ASA) (33), Scandinavian Society of Anesthesiology and Intensive Care Medicine (34), British Association for Parenteral and Enteral Nutrition (BAPEN) (35), Association of Surgeons of Great Britain and Ireland (35), Society of Academic and Research Surgery (35), American Academy of Pediatrics (36), Association for Clinical Biochemistry (35), Renal Association (35), Intensive Care Society (35) or Royal College of Nursing (37), recommend the use of oral carbohydrate solutions 2 to 3 hours before surgery. Table 2 presented the comparison of current recommendations of scientific societies, considering adult and pediatric patients.

When to take the precautions?

However, one should bear in mind that despite such a beneficial effect of oral carbo-

Table 2. Summary of current recommendations of scientific societies concerning preoperative fasting time depend on the type of meal

Age group	Solid foods	Fluids	Breast milk	Artificial milks
Infants < 6 months	–	2 h before (1-5)	4 h before (1-5)	6 h before (1-4) 4 h before (5)
Infants > 6 months and children <36 months	6 h before (1-5)	2 h before (1-5)	4 h before (1-5)	6 h before (1-4) 4 h before (5)
Remaining children	6 h before (1-5) (light meal)	2 h before (1-5)	–	–
Adults	6 h before (1-5)	2 h before (1-5)	–	–
Preoperative carbohydrates	<2h before surgery			

1 – American Society of Anesthesiology
2 – American Academy of Paediatrics
3 – European Society of Anesthesiology
4 – Royal College of Nursing
5 – Scandinavian Guidelines

hydrates, their use has its limitations. They must not be used in case of patients with gastric emptying disturbances, gastroesophageal reflux, gastroparesis and obstruction. In case of patients with morbid obesity and diabetes care should also be exercised. In the latter group their use is possible if type 2 diabetes is well-controlled, which was confirmed in randomized studies, including ours (38, 39). A clear demarcation between carbohydrate solutions and solids is also essential. In the latter case, the elapsed time between the meal and planned procedure should be at least 6 hours (tab. 1).

Own experience

In the center where the authors of the study are employed, oral carbohydrates before surgery have been used, since January, 2010. During this period 605 colorectal procedures were performed (including 453 resections), 112 gastric resections and gastrectomies, as well as 56 pancreatoduodenectomies or distal pancreatectomies. In case of elective colorectal procedures carbohydrates were used routinely (as an element of modern perioperative care), as well as in some patients subjected to gastric or pancreatic resections without gastric emptying disturbances. During the above-mentioned period not a single aspiration episode was noted, that might be related to the use of oral carbohydrates. The solution

was well-tolerated and accepted by the patients. Results concerning its use in case of patients subjected to colorectal procedures were presented at the 65-th Congress of The Society of Polish Surgeons in Łódź (40). On the basis of these positive experiences the use of oral carbohydrates was initiated in other departments, obtaining good preliminary results in patients under the age of 18 years subjected to orthopedic procedures (41). The very good cooperation with the centre's anesthesia team is worth noticing.

Conclusions

In conclusion, when avoiding preoperative fasting one may observe improvement in the patients metabolic condition and comfort, reduction of the complications risk, as well as shortening of hospitalization. Based on evidence-based medicine, current recommendations, and own experience, one can come to the conclusion that preoperative fasting in patients subjected to elective procedures is unnecessary. The use of oral carbohydrate solutions enables to safely avoid preoperative fasting exerting a beneficial clinical effect. However, one should not forget about patients from group of risks, absolute contraindications, and the need to maintain necessary precautions. Some issues require further investigations, however, perspectives for the use of oral carbohydrates are promising.

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