



Preoperative Fasting for Patients Undergoing Elective Surgery

A Clinical Practice Guideline developed by the University of Toronto's Best Practice in Surgery in collaboration with the University of Toronto's Department of Anesthesia

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Section 1. General Information

Aim

The aim of this guideline is to make recommendations on the appropriate duration of fasting preoperatively for patients undergoing elective surgical procedures under general anaesthesia.

Outcomes of interest

Decreased complications, enhanced recovery, increased patient comfort and satisfaction.

Target population

All patients undergoing elective surgical procedures under general anaesthesia. Patients with comorbidities which make them prone to pulmonary aspiration including gastroesophageal reflux disease, dysphagia symptoms or other gastrointestinal motility disorders should be assessed individually. Similarly, patients having emergency surgery should be assessed individually with the risk of aspiration balanced against the risk in delay of surgery.

Intended users

Anaesthesiologists, surgeons, residents, nurses and individuals who provide pre-operative education including surgical secretaries and nurses in the Pre-Admission Unit

Rationale

Despite strong evidence supporting a shortened pre-operative fast, the current standard of care at many hospitals is that patients should fast beginning at midnight or 8 hours prior to surgery. Longer fasts have traditionally been recommended because of concerns around the risk of perioperative pulmonary aspiration due to a full stomach. On the other hand, with the adoption of Enhanced Recovery after Surgery Programs, patients who are euvoletic prior to surgery and require less fluid intra-operatively, appear to recover more quickly (CADTH).

Overview of process

A scoping review was performed to identify clinical practice guidelines, systematic reviews and/or meta-analyses on perioperative fasting. An electronic search of Medline was conducted using the Medical Subject Headings "surgery", "operative" "fasting" and "clinical practice guideline" or "systematic review" or "meta-analysis". This resulted in the identification of 5 clinical practice guidelines from recognized healthcare organizations including the American Society for Parenteral and Enteral Nutrition (2015)¹, Canadian Anesthesiologists' Society (2016)², Royal College of Nurses (2005)³, European Society of Anaesthesiology (2011)⁴, and the American Society of Anesthesiologists (2011)⁵ and a Cochrane Review (2003)⁶. All of the guidelines and systematic reviews provided very similar recommendations for pre- and post-operative fasting. Thus, these recommendations are based largely on the evidence provided in these guidelines as well as consensus from local experts at the University of Toronto. Each recommendation and the primary supporting evidence were reviewed by a panel of experts in order to reach consensus. This panel then made recommendations based on best current evidence which they tailored to the U of T affiliated hospitals. The evidence was assessed in adherence to GRADE recommendations (<http://www.gradeworkinggroup.org/>).

Section 2. Guideline recommendations

1. Preoperative fasting recommendations

- 1.1 Patients should be assessed for gastroesophageal reflux disease, dysphagia symptoms, or other gastrointestinal motility disorders preoperatively as they may require individual recommendations for perioperative fasting (Level of evidence: Low)
- 1.2 Patients should be encouraged to drink clear fluids up to 2 hours before anesthesia administration. Clear fluids include coffee and tea (without milk), and drinks that are high in carbohydrates (i.e. apple juice and pulp-free orange juice) (Level of evidence: High)
- 1.3 Patients can consume breast milk up to 4 hours prior to anesthesia administration (Level of evidence: Low)
- 1.4 Patients should be allowed to eat solid foods until midnight the night before surgery (Level of evidence: High)
- 1.5 The routine use of antiemetics, antacids, H2 blockers and gastric stimulants are not recommended (Level of evidence: Low)
 - 1.5.1 These medications should be considered when GI motility is impaired or patients are not NPO but require an urgent surgical intervention.

Section 3. Guideline recommendations and supporting evidence

1.1 Patients should be assessed for gastroesophageal reflux disease, dysphagia symptoms, or other gastrointestinal motility disorders preoperatively as they may require individual recommendations for perioperative fasting (Level of evidence: Low)

While there are no controlled trials that assess the impact of preoperative assessment for gastroesophageal reflux disease, dysphagia symptoms, or other gastrointestinal motility disorders, the American Society of Anesthesiologists strongly suggests that this assessment should be performed as part of the patients' preoperative evaluation.⁵ This recommendation is based on these patients having an increased risk for reflux and aspiration.

1.2 Patients should be encouraged to drink clear fluids up to 2 hours before anesthesia administration. Clear fluids include coffee and tea (without milk), and drinks that are high in carbohydrates (i.e. apple juice and pulp-free orange juice) (Level of evidence: High)

Early research in the role of preoperative fasting determined that for passive regurgitation and pulmonary aspiration to occur during anaesthesia, a certain gastric volume must be present. It has been assumed that a minimum of 200 mL of residual volume is required for regurgitation.^{7,8} Numerous studies have reported that in most patients, the preoperative mean gastric fluid volume is in the range of 10-30 mL and 120 mL is rarely exceeded irrespective of intake of clear fluids.^{9,10} With this in mind, many trials have been performed to confirm this observation. A Cochrane Review on preoperative fasting for adults to prevent perioperative complications has provided the most thorough compilation of work and has served as justification for many of the modern day fasting guidelines.⁶ The review was undertaken in 2003 and included 22 individual randomized controlled trials with a total of 2270 participants.

With regards to optimum duration of fast for fluids, none of the trials that were included in the Cochrane Review noted an increased occurrence of aspiration or regurgitation in any of the investigational groups. Individual trials examined gastric content by measuring gastric residual volume and pH as surrogate markers. They compared a standard fast with a fast that allowed some fluid intake up to 90min, between 120-180min or 180min or longer preoperatively. The volume of allowed fluid that was compared was 150 mL or between 300-450 mL. They noted no differences in gastric content or pH values between those having a standard fast or a shortened fast. In regards to thirst, all groups that received fluids preoperatively recorded a reduction in thirst and dryness of mouth; however, postoperatively there was no difference in thirst among the groups. There were also no significant differences in regards to preoperative hunger, nausea, or vomiting between any of the groups.

The Cochrane Review also assessed the impact of different volumes of fluid classifying them into low (≤ 150 mL), high (> 150 mL), and unlimited volumes. There were no reported differences in the rates of aspiration or regurgitation nor gastric content volume or pH levels. They did note that participants who received a high volume of fluid reported a decrease in thirst in the preoperative period but not in the postoperative period. In addition, patients in the trials that allowed unlimited fluids preoperatively had significantly less thirst both preoperatively and postoperatively. None of the clinical practice guidelines that were reviewed specify the amount of fluid that patients may consume preoperatively. However, ASPEN suggests "an unlimited amount of water".¹

The Cochrane Review also assessed the impact of different types of liquid and included trials that compared 1) water to the standard fast; 2) coffee to the standard fast, and 3) water, pulp-free orange juice, apple juice, carbohydrate drink, coffee or tea to the standard fast. The trials that examined only

water found a statistically significantly lower volume of intraoperative gastric contents in the participants permitted preoperative water ($p=0.02$) compared to standard fast. However, this difference was not considered clinically significant. In regards to the other 2 interventions (comparing coffee to standard fast and water, pulp-free orange juice, apple juice, carbohydrate drink, coffee or tea to the standard fast), there was no difference in the volume of gastric contents between the treatment and the standard fasting groups⁶. Of note, all guidelines that were reviewed broadly define clear liquids as water, pulp-free juices, tea, coffee, carbonated drinks and clear carbohydrate-rich drinks¹⁻⁵.

The European Society of Anesthesiology Guidelines provide support for encouraging the consumption of a clear fluid (water, pulp-free juice, and coffee and tea without milk) prior to surgery as they believe this practice is not only safe, but that a prolonged fast is in fact inappropriate in preparing patients for the stress of Surgery⁴. Thus, they encourage patients, especially children and the elderly, to keep drinking until 2 hours prior to surgery.

All reviewed CPGs support this recommendation for adults, as well as children, infants, and neonates. Additionally, a Cochrane Review was conducted in 2010 to assess the effects of different fasting regimens on the impact of perioperative complications on children and included 25 studies with 47 randomized controlled comparisons involving 2543 children who were at normal risk of regurgitation or aspiration. These studies compared a shortened fast of differing times to a standard fast (nil-by-mouth-from-midnight). Overall, the authors found that children who were permitted fluids up to 2 hours preoperatively, regardless of the volume, did not experience higher gastric volumes or lower gastric pH levels than those who fasted. The authors did note that children who were permitted fluids were less thirsty and hungry, better behaved and more comfortable than those who fasted. Thus, due to the safety of reduced fast with no increased complications, and increased patient comfort and satisfaction, the recommendations are deemed applicable to children¹¹.

The rationale for encouraging patients to consume drinks high in carbohydrates (CHO) is to enhance the patient's outcome by minimizing the adverse effects of starvation and decreasing the effects of surgical stress. Additionally, it has been hypothesised that CHO drinks may reduce insulin resistance and glycogen depletion and may attenuate loss of muscle mass, hunger, thirst, anxiety, nausea as well as surgical complications leading to reduced length of hospital stay.

There is broad support for the consumption of clear, carbohydrate rich drinks as both the Canadian Anesthesiologists Society and the American Society of Anesthesiology recently published clinical practice guidelines that support the intake of clear fluid intake (including CHO drinks) two hours prior to induction^{2,5}. Additionally, the Canadian Agency for Drugs and Technologies in Health (CADTH) reviewed 5 systematic reviews and seven evidence-based guidelines on the clinical effectiveness of preoperative CHO loading in patients undergoing surgery under general anesthetic¹². Overall, the majority of the evidence showed no benefit with preoperative carbohydrate drinks but some studies showed modest effects for reduced length of stay, postoperative insulin resistance, return to GI function, and patient wellbeing. As well, these studies did find that use of CHO was safe as it did not increase the risk of postoperative complication such as aspiration. Thus, they concluded that while there is no strong evidence to support its use in terms of improved surgical outcomes, there is no evidence for potential postoperative complications, and this, CHO drink may be encouraged as it may improve the tolerability of the pre-surgical period.

Smith et al completed a Cochrane Review to assess the effects of preoperative CHO loading on postoperative recovery and insulin resistance in adult patients undergoing elective surgery¹³. Twenty-seven trials involving 1976 participants were included in the review. The trials included patients undergoing abdominal surgery (18), orthopedic surgery (4), cardiac surgery (4), and thyroidectomy (1). Overall, the consumption of preoperative CHO drinks as compared to fasting or a placebo was associated with a modest reduction in length of stay (MD – 0.30 days, 95%CI -0.56 to -.04). However, these results should be interpreted with caution as heterogeneity was high, except for patients undergoing

abdominal surgery. Patients undergoing abdominal surgery tended to have overall longer lengths of hospital, showed a larger decrease in LOS (MD -1.66 days, 95%CI -2.97 to -0.34). With regards to postoperative complications, 14 studies (913 participants) with low heterogeneity contributed to the analysis. The ingestion of CHO drinks did not affect the rate of postoperative complications (RR 0.98, 95%CI 0.86 to 1.11). Thirteen studies (n=789) reported on aspiration pneumonitis and there no instances of this reported. No evidence for insulin resistance was reported (MD -1.59, 95%CI -3.35 to 0.17). However, preoperative CHO treatment was associated with postoperative increased insulin sensitivity (MD 0.76 mL/kg/min, 95%CI 0.24-1.29). No evidence of treatment effect was found for postoperative nausea at 24 hours (MD -1.69, 95%CI -4.12 to 0.74) or postoperative vomiting (RR 1.25, 95%CI 0.77 to 2.04). With respect to return of bowel function, two studies found a reduction in mean time of 0.39 days (95%CI -0.70 to -0.07) however there was no effect for time to first bowel movement (MD -0.28 days, 95%CI -0.62 to 0.05). In sum, this review found that the intake of CHO treatment prior to surgery may lead to a small reduction in length of hospital. However, its use does not appear to have an effect on other postoperative outcomes.

There is much debate regarding carbohydrate loading in diabetic patients. Unfortunately, there is limited evidence available to support or refute a recommendation on this. To date, only one study has assessed preoperative carbohydrate loading in type-2 diabetes patients. This study was of low quality, compared 25 patients with diabetes to 10 health controls¹⁵. The patients in the experimental group were given a carbohydrate-rich drink (400 ml, 12.5% with 1.5g of paracetamol) that is not currently available in Canada. The authors found that peak glucose was higher in diabetic patients (13.4 +/- 0.5 vs. 7.6 +/- 0.5 mM; P<0.01), however glucose concentrations were back to baseline at 180 minutes for diabetic patients compared to 120 min in the control group (P<0.01). Gastric half-emptying time (T50) was also significantly different with it occurring at 49.8 +/- 2.2 min in diabetics compared to 58.6 +/- 3.7 min in the control (P<0.05). Despite these difference, the authors concluded that type 2 diabetic patients showed no signs of gastric emptying suggesting that the use of carbohydrate drinks may be safely administered prior to surgery. Most guidelines reviewed, as well as the European Enhanced Recovery After Surgery Guidelines, do not support providing CHO beverages to diabetic patients. However, the European Anesthesiology Guidelines recommend that "It is safe for patients (including diabetics) to drink carbohydrate-rich drinks up to 2 hours before elective surgery)⁴. At the University of Toronto affiliated hospitals, consensus has been reached that patients with diabetes should be able to tolerate the carbohydrate-rich drinks. However, due to limited evidence, the recommendation for carbohydrate loading does not include diabetic patients.

In summary, there is strong evidence that favours reducing preoperative fasting times and is supported by numerous worldwide guidelines. Reducing the fasting time to 2 hours for clear fluids and 6 hours for solids does not increase the risk of regurgitation or pulmonary complications in patients who are otherwise healthy. As such, adopting these practices should become the standard of care.

1.3 Patients can consume breast milk up to 4 hours prior to anesthesia administration (Level of evidence: Low)

There is limited evidence on the impact of ingesting breast milk prior to surgery. The ASA made its recommendation based on observational findings that suggested equivocal findings of gastric volumes and pH levels when healthy neonates and toddlers ingested breast milk 4 hours prior to surgery⁵. There is insufficient evidence to comment on the incidence of emesis/reflux or pulmonary aspiration. Thus, this recommendation is largely based on consensus from the ASA.

1.4 Patients should be encouraged to eat solid foods until midnight the night before surgery (Level of evidence: High)

There is very little evidence available that allows an evidence based recommendation for solid intake. The current guidelines all support a fast of 6 hours following a light meal. This recommendation is based on

the estimated physiologic gastric emptying time for healthy patients. An ultrasonographic study by Soreide et al. showed that 4 hours of fasting was required to guarantee complete emptying of solid particles after a light breakfast.¹⁶ Factors such as smoking, functional dyspepsia, psychological stress and female hormones may further prolong gastric emptying times for solids.^{17,18} Combining this set of information, and allowing a sufficient margin of safety, all of the international and national guidelines recommended that the fasting period after intake of solids should not be less than 6 hours.^{1-4, 18-20}

From the 2003 Cochrane review on preoperative fasting, the only available data that were reviewed on shortened solid fast compared to a standard fast were two trials that were conducted in 1983. The participants randomized to the treatment group received a small preoperative breakfast (mean of 249min or 199min prior to induction). In both trials, there was no difference in the intervention groups compared to the groups who received a standard fast of midnight before surgery in regards to gastric residual volume or gastric pH values. These trials had very small sample sizes, and thus, very little can be concluded from their results.

1.5 The routine use of antiemetics, antacids, H₂ blockers and gastric stimulants are not recommended (Level of evidence: Low)

These medications should be considered when GI motility is impaired or patients are not NPO but require an urgent surgical intervention.

The American Society of Anesthesiologists developed a guideline for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration for patients undergoing elective procedures. In this guideline, the American Society of Anesthesiologists found inconclusive evidence to evaluate the effect of gastrointestinal stimulants, histamine-2 receptor antagonists or proton pump inhibitors, antacids, and/or antiemetics on the incidence of emesis, reflux or pulmonary aspiration.⁵ The European Society of Anesthesiology mirrors this recommendation for antacids, metoclopramide and H₂ blockers for all elective surgery with the exception of obstetrics. They strongly recommend that an H₂ blocker should be given the night before and morning of an elective caesarian section and that an IV H₂ blocker should be given prior to emergency caesarian section with 30ml of 0.3mol l⁻¹ sodium citrate if general anesthesia is planned.

Table. 1 Summary of fasting recommendations from International Anesthesiology Societies

| | CAS, 2016 | European Society of Anesthesia, 2011 | American Society of Anesthesiology, 2011 | ASPEN, 2015 |
|---|-----------|--------------------------------------|--|-------------|
| Anesthesia may be safely administered: | | | | |
| 2 hrs after clear fluids | X | X | X | X |
| 4 hrs after ingestion of breast milk | X | | X | |
| 6 hrs after a light meal | X | X | X | X |
| 8 hrs after a heavy meal | X | X | | X |
| Patients should not have their surgery cancelled or delayed because they chewed gum, sweets, or smoked immediately prior to induction | | X | | X |
| Patients with obesity, gastro-oesophageal reflux and diabetes and pregnant women who are not in labour can safely follow these recommendations | | X | | |
| Insufficient evidence of clinical benefit to recommend use of ant-acids, metoclopramide or H2-receptor antagonists before elective surgery in non-obstetric surgery | | X | X | |
| Safe for patients (including diabetics) to drink carbohydrate rich drinks up to 2 hours before elective surgery | | X | | |

Section 4. Implementation strategies

All hospitals will already have a preoperative fasting guideline in place. Despite this, many hospitals continue to extend the preoperative fasting period for much longer than is necessary which leads to decreased patient satisfaction and worse clinical outcomes. Thus, it is essential that these guidelines be updated to reflect the best-available evidence.

The following implementation strategies are suggested for implementing these guideline recommendations.

- ◆ Make the recommendations part of the electronic/standardized patient orders
- ◆ Update patient education materials to reflect the changes
- ◆ Provide education to the preadmission staff, surgical secretaries, anesthesia staff, surgical staff and residents and fellows
- ◆ Have a Preadmission Nurse Champion
- ◆ Have reminders/posters for the new fasting times on display in the preadmission unit

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