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Review article:

Review of evidence and clinical practice on preoperative fasting times

Revisión de evidencia y práctica clínica sobre los tiempos de ayuno preoperatorio

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Resume

Introduction: preoperative fasting is a period of time in which no food can be ingested in order to minimize perioperative risks. **Objective:** The objective is to gather evidence on fasting times in order to define an optimal duration, as well as to identify which adjuvants can improve outcomes such as patient stay, feelings of hunger and thirst, or risk of bronchial aspiration. **Methods:** A literature review was conducted using articles in English or Spanish, employing keywords in databases such as PubMed, Web of Science, Taylor & Francis, Scopus, and ScienceDirect. **Results:** 59 articles were identified from which 47 were selected that met the assigned inclusion and exclusion criteria. Many clinical practice guidelines recommend less prolonged fasts than the traditional ones. Within the perioperative period, the moment of greatest risk for bronchial aspiration is the anesthetic induction, the main risk factors for bronchial aspiration being a full stomach, abdominal pain, diabetes, trauma related to hypomotility and intestinal obstructions. **Conclusions:** a preoperative fasting period of 6 hours for solids is recommended for both adults and children, 2 hours of liquids for adults and 1 hour for children. In infants it is advisable to administer breast milk for up to 4 hours and formula milk for up to 6 hours. In addition, the administration of a carbohydrate drink 2 hours before anesthetic induction.

Keywords: Fasting. Diet. Fasting preoperative.

Introduction

In 1946, Curtis Mendelson described a set of clinical manifestations related to pulmonary aspiration of gastric contents in 66 cases, giving rise to what would later become known as Mendelson's syndrome(1). This discovery marked a milestone in the understanding of the risks associated with bronchoaspiration during surgical procedures. In response to this concern, medical professionals began implementing preventive measures such as preoperative fasting.

Preoperative fasting is defined as a period of time prescribed by medical order during which no liquids or solids may be ingested prior to the procedure, with its main objective being to minimize risks such as bronchoaspiration of gastric contents(2). However, with new evidence scientifically, the need to adapt and make preoperative fasting times more flexible has been recognized, leading to a revision of this practice.

Recently, renowned medical societies have acknowledged the need to review the traditional guidelines for preoperative fasting. According to the latest ESPEN (European Society for Clinical Nutrition) guideline, the intake of solids is advised up to 6 hours before surgery, and together with ASA (American Society of Anesthesiologists), they recommend clear fluids up to 2 hours before surgery. In addition, as part of a comprehensive approach, they recommend the administration of adjuvants in patient preparation(2,3).

Nevertheless, it remains controversial among healthcare professionals whether to maintain prolonged fasting or a shorter fasting period. According to a study published in the Saudi Journal of Anaesthesia, where a survey was conducted among anesthesiologists, 75% of them advise patients to stop eating after midnight (more than 6 hours of fasting), and 45% allow the intake of liquids up to 2 hours before surgery(4). In some cases, patients choose to strictly adhere to conventional fasting guidelines and fast from midnight(5,6), which highlights the variety of current approaches and preferences.

These differences in practice underscore the ongoing importance of the discussion regarding preoperative fasting times.

The objective of the study is to gather evidence on different preoperative fasting durations for solids and liquids in both children and adults, in order to resolve the dichotomy between prolonged fasting and short fasting. In addition to determining how many hours one should fast, it also seeks to identify which adjuvants may be used preoperatively to improve patient outcomes or hospital stay.

Methods

To address the present literature review, keywords such as "fasting," "preoperative," "surgery" were used, and Boolean operators such as AND, OR, and NOT were employed to refine the results.

An exhaustive search was carried out in several academic databases such as PubMed, Web of Science, Taylor & Francis, Scopus, and ScienceDirect. In this way, 59 articles were identified, but after applying the inclusion and exclusion criteria, the number of articles was reduced to 47.

The selected articles that met the inclusion criteria were those published in Spanish or English and published in journals ranked within a quartile according to the SJR (Scimago Journal Rank) database.

The articles that did not meet the inclusion criteria were those not conducted in humans, those that did not provide new information, and those that did not reach conclusions related to preoperative fasting.

Key points

1. Recommendations for preoperative fasting times and adjuvants vary depending on the source consulted.

2. Preoperative fasting is a common preoperative practice.

3. The results of this study may improve preoperative care and reduce patient risk.

4. Clear recommendations are needed regarding fasting times applicable in practice.

5. Fasting time may be associated with the risk of bronchoaspiration.

Resultados

Bronchoaspiration of gastric contents

There are two types of consequences of

bronchoaspiration of gastric contents. The first is aspiration pneumonia, which is more frequent in the elderly and produces acute inflammation caused by microorganisms, while the second is aspiration pneumonitis, characterized by pulmonary injury directly caused by stomach acid. The exact frequency of pulmonary aspiration events remains unknown, although it is presumed to be infrequent, being more common in pediatric and obstetric patients(7).

Warner and collaborators, in their study, included more than 172,000 adults undergoing procedures requiring general anesthesia. It was observed that aspiration of gastric contents occurred in approximately 1 out of every 3,216 procedures, with an overall mortality rate due to bronchoaspiration of about 1 in every 71,829(8). Additionally, in Maryland, United States, a study analyzing 318,880 surgical procedures showed that aspiration occurred in 1% of cases, mainly in airway surgeries(9). In the context of Australia, it was observed that most aspiration cases occurred during elective procedures with general anesthesia and during the induction period(10).

Gastric emptying in adults

In a study of 90 surgical patients with cancer and without risk factors that could prolong gastric emptying, it was observed that after administering beverages such as water, apple juice, and oral rehydration solution, no differences were found in the residual volume of the stomach(11).

Gastric emptying in pediatrics

In a study conducted by Gridneva that included a population of 27 full-term infants, the phenomenon of gastric emptying was investigated in the context of breastfeeding. In addition, a correlation was identified between the volume of food ingested, the prolongation of gastric emptying time, and the increase in residual volumes(12).

Perella and others observed that complete gastric emptying was frequently more significant in infants whose feeding was distributed at 3-hour intervals compared to those fed every 2 hours. The volumes of food ingested varied, with a median of 13 ml/kg in the 2-hour interval group and 20 ml/kg in the 3- hour interval group(13).

In another study by Perella and others, conducted in preterm newborns, it was observed that after adjusting for differences in feeding volume, the residues of fortified foods in the 2-hour feeding intervals were comparable to those of non-fortified foods. In contrast, the residues of foods fortified with fortified milk 85 were significantly higher, with an average of 2 ml more. Similarly, for the 3- hour feeding intervals, the residues of foods fortified with fortified milk 85 were also significantly higher, with an average of 1.1 ml more. Fortification has a minimal effect on slowing gastric emptying and seems unlikely to cause clinical problems related to related to feeding tolerance(14).

Du and collaborators observed in 48 individuals

between 8 and 14 years of age that gastric emptying times ranged from 90 to 180 minutes for apple juice, from 90 to 210 minutes for milk, and from 90 to 240 minutes for Ensure Clear(15).

Administration of anesthesia

In 1937, Guedel described the stages that a person goes through under the effect of ether-oxygen, although today there are drugs that modify this sequence, it can still be useful. Four stages are described below(16):

In the first stage, induction-analgesia, the processes that occur from the administration of anesthesia until loss of consciousness are described.

In the second stage, known as excitement, irregular breathing, increased heart rate, and even arrhythmias can be observed. This is a dangerous period for the patient since muscle relaxation can cause airway obstruction, laryngospasm, or even bronchoaspiration of gastric contents.

The third stage is known as surgical anesthesia proper, which is subdivided into four planes, but in general, it is a period where vital signs remain more stable than during induction.

The final stage is bulbar paralysis, where respiratory arrest, coma, and death occur. This stage could be reached by an accident from excessively deep anesthesia.

The first two stages constitute induction, which is when the greatest risk for aspiration of gastric contents occurs — one of the complications that preoperative fasting aims to prevent(16).

Risk factors

In the ESPEN guideline, risk factors such as undernutrition or malnutrition were identified, which

can increase the incidence of complications and mortality(3). In an article published in BJA (British Journal of Anaesthesia) reviewing pediatric fasting guidelines, the main risk factors for bronchoaspiration were found to be: full stomach, abdominal pain, diabetes, trauma related to hypomotility, and intestinal obstructions(17).

AdjuvantsBang and collaborators, through the APAIS evaluation (Amsterdam Preoperative Anxiety and Information Scale), observed that in women undergoing gynecological surgeries, chewing gum (mean APAIS score of 20.9 [5.7]) before the procedure reduced anxiety compared to the control group (mean APAIS score of 17.8 [5.5]) without increasing gastric volume or producing changes in pH(18).Akbuğa and other researchers, in a randomized controlled clinical trial aimed at determining whether a carbohydrate drink before arthroscopic surgery improved symptoms, found that the administration of this adjuvant improved blood glucose levels and reduced postoperative thirst. However, it should be noted that it did not improve fatigue(19).

Table 1 Compilation of guideline recommendations on the use of adjuvants in preoperative fasting.

Guide	Year	Adyuvants
ASA[2,20]	2017	• Gastrointestinal stimulants should not be administered routinely, except in patients at higher risk of bronchoaspiration. • Gastrointestinal secretory blocking medications should not be administered routinely, except in patients at higher risk of bronchoaspiration. • Do not postpone surgery if it is confirmed that the patient was chewing gum. • Administer a carbohydrate drink two hours before surgery in adults.
ESPEN[3]	2021	• It is recommended to administer a carbohydrate drink two hours before surgery to reduce perioperative discomfort. • In major surgery patients, a carbohydrate load can be administered to reduce the impact of insulin resistance. • Parenteral nutrition with glutamine or Omega-3 is recommended in patients who cannot be fed through enteral nutrition • Oral nutritional supplements are recommended in patients who do not meet their energy requirements in the preoperative period.
ESAIC[21]	2022	• Chewing gum is recommended. It does not significantly increase the risk of aspiration. • It is recommended not to cancel surgery if patients are found chewing gum
ESA[22]	2011	• The consumption of carbohydrate drinks in patients, including diabetics, two hours before surgery is safe. In addition, drinking carbohydrate-rich fluids improves subjective well-being, reduces thirst and hunger, and decreases insulin resistance. • It seems safe to consume glutamine with carbohydrates three hours before the operation.

Abbreviations
ESA: *European Society of Anaesthesiology*

Marquini and others in a prospective randomized study conducted on gynecological patients where the aim was to see if reducing fasting with a drink rich in carbohydrates and proteins 4 hours before the procedure decreased the incidence of nausea and vomiting, found that although the presence of these symptoms in the group exposed to the drink was lower compared to the literature, it could not be asserted that this was due to its intake(23).

Zhang and collaborators divided gynecological patients into two groups, one group received a drink of 800 ml of carbohydrates the night before the intervention and 400 ml two hours before, while the other group did not receive any type of drink since the previous night. There were no significant differences in terms of discomfort, nor were there differences in the values of blood markers and insulin resistance before surgery, although after surgery the values of the second group were significantly higher(24).

Short fasting

Many of the guidelines reviewed in this research recommend shorter fasting periods, which are summarized in Table 2. These recommendations come from scientific societies such as ASA, ESPEN, ASIPP (American Society of Interventional Pain Physicians), ESAIC (European Society of Anaesthesiology and Intensive Care), CAS (Canadian Anesthesiologists' Society), APAGBI (Association of Paediatric Anaesthetists of Great Britain and Ireland), ESPA (European-Society for Paediatric Anaesthesiology) and ADARPEF (L'Association Des Anesthésistes-Réanimateurs Pédiatriques d'Expression Française). For its part, the ERAS (Enhanced Recovery After Surgery) guideline in one of its 2021 publications on preoperative care in cardiac surgery mentions that promoting fluid intake 2 hours to 4 hours before the procedure is a recommendation common to all ERAS protocols except in the case of cesarean sections. In addition, it states that at present there are several clinical trials showing that a 6-hour fast for solids is safe(3).

Recommendations were found that even advise further reducing the fasting time for fluids suggested by the most renowned guidelines, for example, in a review published in 2020 the researchers concluded that many times a 2-hour fast ends up being extended even beyond 12 hours, increasing patient discomfort and the risk of iatrogenesis. In addition, the rapid gastric emptying of clear fluids is mentioned, which can result in negligible volumes after half an hour, and the low risk of bronchoaspiration in adults without comorbidities as arguments to recommend a 1-hour fast(25).

Table 2 Compilation of data from guidelines regarding fasting times for solids, clear fluids, and others before surgery and/or administration of anesthesia

		Fasting times		
Guide	Year	Solids	Clear liquids	Others
Adultos				
ASA[2,20]	2017, 2023	Six hours	Two hours	
ESPEN(3)	2021	Six hours	Two hours	
ASIPP(26)	2019	Light meal: four hours	Two hours	
Pediátricos				
ASA[2]	2023		There is not enough evidence to reduce fasting from two hours to one hour.	• Non-human milk: six hours • Breast milk: four hours • Formula milk: six hours • Breast milk: three hours • Formula milk: four hours
ESAIC[21]	2022	Six hours	One hour	• Light breakfast of solids/unclear liquids: four hours • Breast milk: four hours
CAS[27]	2023	• Hearty meal with proteins: eight hours • Light meal: six hours	One hour	• Formula and non-human milk: six • hours Formula milk: six hours
APAGBI, ESPA, ADARPEF[28]	2018	Six hours	One hour	• Breast milk: four hours

Hewson and collaborators in a 2020 review mention that international guidelines recommend that adults consume solid foods only up to 6 hours before the procedure and drink liquids up to 2 hours before(29).

Frykhokm and others in a study where the current guidelines of preoperative fasting in pediatric patients were analyzed, the authors concluded that many times children undergo very prolonged fasts, therefore to mitigate this the requirements of clear liquid fasting could be reduced. Several arguments were presented such as the already mentioned excessively prolonged fasting or the rapid gastric emptying that for light meals can reach 4 hours and for liquids can be much shorter, and it is even assured that the incidence of bronchoaspiration due to stomach content is surprisingly low(17).

Fawcett and Thomas in the year 2018 suggested the change of clear liquid fasting from 2 hours to 1 hour in children, since many times this pair of hours ends up stretching to 6–13 hours for various reasons. In this context it must be understood that the drinks that fall within the so-called clear liquids are; water, juice without pulp, diluted drinks, non- carbonated sports drinks and non-thickened liquids with a maximum of 3 ml/kg(30).

Zhang together with other researchers in a review of fasting guidelines in pediatrics mentioned that short fasting periods are safe and in case of causing bronchoaspiration no serious sequelae have been seen in children, but the reality of the guidelines is one, while that of practice is very different, leading children to fast for long periods causing distress in patients and an increase in undesired outcomes, which is why it must be sought that the recommendations of the guidelines adjust to what is really done(31).

Yurashevich and others in an observational study where two groups of women undergoing elective cesarean section were compared, before and after the educational intervention with a leaflet with ASA and ERAS recommendations regarding preoperative fasting, it was observed that the medians of fasting for liquids decreased from 10 hours to 3.5 hours, however there were no changes with respect to solids(32).

Long fasting

The most recent medical guidelines advise avoiding prolonged or excessively long fasting due to the discomfort reported by patients and the possible associated complications. Despite these recommendations that support a shorter fasting period, it is common for both doctors and patients to opt for prolonged fasting, highlighting the variety of practices. In a survey conducted among anesthesiologist doctors who are members of the Lebanese Society of Anesthesia, of the 118 who responded, 75% ask patients to stop eating after midnight and 45% allow them liquids up to 2 hours before surgery(4). Meanwhile, in a prospective observational study, from the patients' side, the

average fasting time for solids was 14 hours and 6 minutes and for liquids was 9 hours and 48 minutes, which makes evident the variety of approaches(33).

Degeeter and collaborators in a study where 100 ambulatory surgery patients participated, the average fasting times were 13 hours and 29 minutes for solid foods and 9 hours and 51 minutes for liquids. None suffered pulmonary aspiration. Gastric ultrasound only found insignificant amounts of gastric content and there were no significant differences between the antral grade and the fasting time of solids and the antral grade and the fasting time of liquids(5).

Alsharkh and other researchers in 2023 did not find statistically significant differences between performing fasting for solids (>2 hours; >6 hours; >12 hours) and liquids (6–8 hours; >8 hours; >12 hours) at different times and its impact on the overall quality of postoperative recovery, although significant differences were found in the comfort of the group with shorter fasting time for liquids(34). Nabi together with others, in a descriptive cross-sectional study carried out in five academic hospitals with the participation of 390 subjects, observed that the mean duration of fasting for solids was 11 hours and 26 minutes, while for liquids it was 9 hours and 42 minutes(6).

In an analysis involving 164 participants, it was observed that the average preoperative fasting times were 13.34 hours for solids and 12.44 hours for liquids. A positive correlation was found between the total duration of solid fasting and the sensations of thirst, hunger, dry mouth, and weakness experienced just before the surgical intervention. Additionally, it was identified that prolonged fasting was related to greater discomfort in patients(35).

Discussion

Although the recommendations and the evidence on fasting are clear, their application is not always feasible in certain situations. For example, in lung transplants, rapid notification prevents following the fasting recommendations due to the urgency of the procedure, which is not elective and is unpostponable due to the ischemic progression of the organ, limiting the time to achieve adequate gastric emptying(36). External factors must also be taken into account, such as medications that may have relevant effects, for example in a study by Silveira and others where the relationship between using semaglutide and the increase in residual gastric volume is evidenced(37), or even the type of surgery as evidenced in a study by Soffin and collaborators where it is emphasized that surgeries such as hip fracture cannot always be elective and therefore the administration of adjuvants is limited(38).

The main topic pertaining to this study is to discuss the duration of fasting and its effects. If the reviewed guidelines are considered, it can be clearly evidenced how most of them recommend fasting for solids of around 6 hours(2,3,20,21,30) for both children and adults; however, regarding the recommendations for clear liquid fasting, differences are found between the two age groups, a 2-hour fast for adults(2,3,20,26) and only 1 hour for children(21,27,28). As for the recommendations for breast milk in children, a clear hour cannot be given because the findings differ greatly, but the recommendations range from 3 hours to 6 hours. For formula milk and non-human milk, it was found that the ranges are somewhat narrower, going from 4 hours to 6 hours(2,27,28,33).

It should be mentioned that although fasting times are usually longer than recommended, as found in a study by Witt and others where fasting was 11.3 hours and 14.5 hours for liquids and solids respectively, after an educational intervention these same times can be significantly reduced to 5 and 4 hours for liquids and solids respectively(39).

In a 2019 study, the impact of different fasting times on women and neonates was examined, and it was evidenced that a fast for solids lasting between 6 and 8 hours and a fast for liquids of less than 2 hours can reduce vomiting in women and the risk of hypoglycemia and acidosis in neonates(40).

Similarly, the average preoperative fasting times in another study were 13.34 ± 3.07 h for solids and 12.44 ± 2.82 h for liquids, of which 11% reported mild nocturnal hunger, 15.9% thirst, 32.3% sensation of hunger, and 29.3% thirst before the operation, although both hunger and thirst from the afternoon/evening prior to the intervention were not associated with the duration of fasting(35).

A survey was conducted among 621 anesthesiologists in India, of whom 395 responded; it was found that 69% of them correctly described the ASA practice guidelines for preoperative fasting in adults and pediatric patients undergoing elective procedures, more than 86.56% of respondents reported pre-anesthetic management based on

ASA recommendations, but 51.86% and 40.67% confirmed that their institutions actually followed these protocols. Regarding management, 53% confirmed that their institution follows 6–8 hours for solids, 4–6 hours for breast/formula milk, and 2 hours for clear liquids(41).

Alsharkh and others in 2023, in an observational study in adults, reported that 55.8% of patients fasted more than 6 hours for liquids and 38.5% fasted for more than 12 hours, while 50.6% fasted solids for 8 hours and 43.6% for more than 12 hours(34).

The duration of the preoperative fasting may impact outcomes; for example, in a study comparing fasting duration with glucose levels and other hemodynamic parameters in children, it was observed that the fasting time did not affect glucose levels and other hemodynamic parameters in children, it was observed that the fasting time did not affect glucose levels, but it could be related to alterations in systolic blood pressure(42).

In another study evaluating hemodynamic variables, no statistically significant differences were found in cardiovascular and body fluid variables between patients who underwent surgery as the first case of the day (shorter fasting hours) versus those who were the second case of the day (longer fasting time)(43).

Often during the preoperative period, more attention is given to hospital care for the patient, although other intrinsic factors of the patient must be considered, such as malnutrition, which can determine worse outcomes and higher operation costs; moreover, many patients suffering from this problem are neither diagnosed nor adequately diagnosed(44).

Table 1 summarizes the guidelines for the use of adjuvants during preoperative fasting. The evidence found shows that reducing preoperative fasting with carbohydrate-rich drinks improved the metabolic and inflammatory response of children undergoing surgery for inguinal hernias(45).

For pediatric patients, 88% recommend 6–8 hours of fasting for solids, 83% recommend 4–6 hours of fasting for breast/formula milk, and 79% recommend 2 hours for clear liquids.

Preoperative care aims to improve procedural outcomes for the patient as well as prioritize their well-being. One idea that arises from these premises is chewing gum before the preoperative period as a palliative method for anxiety and stress. For example, in a study reviewing the effect on anxiety scores when adding gum to the oral carbohydrate load, it was shown that adding gum chewing to the carbohydrate load reduced anxiety more than carbohydrates alone(46). However, in another study, it was found that gum did not reduce the anxiety of patients undergoing cesarean section, but it did reduce pain during induction(47).

Limitations

•Some recommendations lack clear consensus, especially in pediatrics.

•Limited clinical application in urgent situations or with patients receiving certain medications.

•Persistent gap between guidelines and actual clinical practice.

•Scarce regional evidence, especially in Latin American contexts.

•Little specific research on adjuvants in preoperative fasting.

Conclusions

Finally, most of the evidence found was in favor of shorter fasting times. In addition, it was also observed that fasting in practice is usually longer than ideal, so it is recommended to reduce the fasting period that patients undergo to adjust to a period of 6 hours for solids in both adults and children, 2 hours for liquids in adults, and 1 hour for children. In infants, breast milk can be administered up to 4 hours and formula milk up to 6 hours. Furthermore, based on the guidelines, the administration of a carbohydrate drink 2 hours before anesthetic induction is recommended, and surgery should not be postponed if it is confirmed that the patient was chewing gum

Recomendations

•Consider the particularities of patients that predispose them to complications more closely.

•Expand the number of studies on the use of various adjuvants during fasting that improve patient stay and outcomes.

•Develop preoperative fasting guidelines that take into account the population characteristics of the region due to the lack of reliable references in Latin America.

•Educate healthcare personnel and surgical patients on this topic, due to the discrepancies between guideline recommendations and clinical practice.

•Keep a record of perioperative complications in patients associated with fasting.

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