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Nil per os after midnight: history of preoperative fasting

Nada vía oral después de medianoche: historia del ayuno preoperatorio

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Abstract

Preoperative fasting is a measure designed to reduce the risk of pulmonary aspiration of gastric contents during anesthesia. The indications for fasting have changed over history from encouraging the intake of clear fluids to a popular indication of “nothing by mouth” which seems to be independent of the time of surgical procedure. There are ritualistic behaviors among healthcare staff which challenge the indications of the guidelines and may be detrimental to patient wellbeing. Hence, several groups have currently developed guidelines and protocols intended to reduce the time of preoperative fasting, improving the experience and accelerating total postoperative recovery.

Key words

ERAS; Fasting; Preoperative; Anesthesia; Anesthesiology.

Resumen

El ayuno preoperatorio es una medida diseñada para reducir el riesgo de aspiración pulmonar de contenido gástrico durante el proceder anestésico. Las indicaciones de ayuno han variado a lo largo de la historia entre estimular la ingesta de líquidos claros y una popular indicación de “nada vía oral” que parece ser independiente de la hora del procedimiento quirúrgico. Existen conductas ritualistas entre el personal de la salud que retan las indicaciones de las guías y podrían perjudicar el bienestar del paciente. Por esto, en la actualidad muchos grupos han desarrollado guías y protocolos que buscan reducir el tiempo de ayuno preoperatorio, mejorando la experiencia y acelerando la recuperación total posoperatoria.

Palabras clave

ERAS; Ayuno; Preoperatorio; Anestesia; Anestesiología.

INTRODUCTION

The development of preoperative fasting guidelines at the end of the Twentieth Century lowered the incidence of pulmonary aspiration to just 0.006%, a rate 25 times lower than the rate reported in previous years. (1) This manuscript explores the evolution of medical recommendations and the dogmas associated with preoperative fasting in the history of medicine. The actual fasting times will be addressed, and the behaviors that have influenced the management of surgical patients will be assessed.

History of the recommendations about preoperative fasting

The history of contemporary anesthesiology dates back to 1840, following the first public displays of the use of ether (2), nitrous oxide (3) and chloroform (3) as anesthetic gases. These agents became popular for minor procedures such as onychectomies, cataract surgery, eye enucleation, exodontia and tumor removal. (2-4) Although these advances marked a milestone in medicine, it did not take long for the first complications to arise.

In January 1848, Hannah Greener underwent an onychectomy procedure under anesthesia with chloroform. Only three minutes after the onset of narcosis, the 15-year-old girl had died. The evidence suggested pulmonary aspiration; a full stomach, lung congestion and the administration of drinks during a state of chloroform-induced narcosis. However, the cause of death was presumed as a chloroform overdose and became an unexplained event in the annals of anesthesia. (5)

Since this tragedy, the lack of fasting before a procedure under anesthesia would be considered a risk of pulmonary aspiration. This inspired different authors to write in various papers (4) and anesthesia books (6), recommendations for preoperative fasting, with variations

Table 1. Major preoperative fasting recommendations and guidelines (1847-2023).

Institution/author	Origin/Year	Recommended fasting times	Type of recommendation
Snow J. (2,4,7)	UK 1847 and 1858	Fluids: Not mentioned Solids: 2-4 hours (light meal) 5 hours (full meal)	Treatise; first anesthesia treatise
Gwathmey JT. (6,7)	USA 1914	Fluids: 2 hours Solids: 2-3 hours, barley or rice soup	First anesthesia book in the United States
Hunt AM. (7,9)	USA 1949	Fluids: 2-3 hours Solids: NPO after midnight	Book
Canadian Anesthesiologists' Society (7,10,11)	Canada 1977, 1987	Fluids: Not mentioned Solids: 5 hours	Guideline
Raeder JC., et al. (12,13)	Norway 1994	Fluids: 2 hours (oral premeditation up to 1 h) Solids: 6 hours (light meal) Breast milk: 4 hours	National consensus
American Society of Anesthesiologists (14-17)	USA 1999, 2011, 2017, 2023	Fluids: 2 hours Solids: 6 hours Fats/protein: 8 hours Breast milk: 4 hours	Guideline
Canadian Anesthesiologists' Society, updates (18-20)	Multiple 2000-2019	Fluids: 2 hours Solids: 6 hours Fats/protein: 8 hours	Guideline
	2020-2023	Adds fluids: 1 hour (children)	Guideline
European Society of Anaesthesiology and Intensive Care (21)	Europe 2011	Fluids: 2 hours Solids: 6 hours Breast milk: 4 hours	Guideline
ACERTO (22)	Brazil 2005-present	Fluids: 2 hours (carbohydrates)	Protocol
ERAS (23)	International Multiple 2005-present	Fluids: Maltodextrin 2-4 hours (administered to the patient) Solids: 6-8 hours	Protocol

NPO: Nothing by mouth; **UK:** United Kingdom; **USA:** United States of America.

Note: all reference to "fluids" means clear liquids, non-dairy, non-particulate, and fatless.

For a more comprehensive list, see [Complementary material 1](#).

Source: Authors.

between the times and types of food (Table 1). (7) In 1946, one century after the death of Hannah Greener, Doctor Curtis Mendelson published his famous case series on aspiration pneumonitis in obstetric patients, reporting an incidence of pulmonary aspiration of 0.15%. (8) This paper consolidated a medical practice which still prevails: fasting from the night before surgery.

Although prolonged fasting may have been popular in previous years (6,7), the anesthesiology book written by John J. Hunt in 1949, would be the first to suggest prolonged fasting, particularly from midnight, before a procedure under anesthesia. This indication became a tradition passed from generation to generation, despite the new guidelines and findings. (7,24)

During the 70's and 80's some concerns were expressed regarding gastric emptying and the deleterious effects of excessive fasting. (7,25) The Canadian Society of Anesthetists was the first scientific authority to publish some guidelines in 1977 (10) and then again in 1987 (11), recommending five hours of preoperative fasting, with no distinction between fluids and solids.

Years later, in 1993, following the growing evidence supporting the safe intake of clear fluids up to 2 hours before anesthesia, the Norwegian Association of Anesthesiology reached a national consensus suggesting for the first time the indications currently used for preoperative management (12,13): two hours of fasting for clear fluids, four hours for breast milk, and six hours for solids; additionally, allowing for the intake of medications with little water up to one hour before anesthesia in children and adults. Numerous scientific societies around the world published their own similar guidelines and statements over the next decade (Table 1, Figure 1). (14,18,21,26-28)

The Fast-Track Era

The preoperative fasting times did not seem to shorten, despite the guidelines on that regard. (24,29) Consequently, in the late 90's and during the 2000 decade, several surgeons from various European institutions organized the ERAS group (Enhanced recovery after surgery) and published their first protocol based on "fast-track" models in 2005 (focusing on procedures with an accelerated recovery and early discharge). (23,30) Likewise, the ACERTO project (Acceleration of total postoperative recovery) in Brazil, adopted measures to improve the postoperative management of patients undergoing abdominal surgery since 2005. (22,31) Among the interventions suggested by both groups, included limiting preoperative fasting to the minimum suggested by the guidelines, and even administering patients a carbohydrate-based drink two

to three hours prior to the procedure; such intervention has been maintained in their protocols to this date.

Providing patients carbohydrate-rich drinks before surgery has proven to be beneficial, not just to reduce dehydration, but also discomfort, hunger, thirst, and metabolic effects such as insulin resistance. These measures as a whole, together with the rest of the ERAS protocol recommendations, have proven to reduce the hospital length of stay and complications in multiple occasions, improving metabolic and immunologic markers, wellbeing and short and long term outcomes. (32)

Additionally, potential benefits have been studied regarding presurgical conditioning based on introducing changes to the diet of patients in a controlled manner for days or weeks, with a view to optimizing or preparing the body prior to a stressor event such as major surgery. (33)

The current practice in preoperative fasting management

Notwithstanding the publication of these guidelines, prolonged preoperative fasting is still a frequent practice. Table 2 lists some studies evidencing the fasting times used

Table 2. Studies reporting preoperative fasting times (without intervention).

Principal author. Country/year	Sample size	Average length of fasting (hours)		Minimum-Maximum time—Fluids (hours)
		Solids	Fluids	
Crenshaw (29) USA/2002	155	14 ± 4	12 ± 3	3-20
Aguilar-Nascimento (31) Brasil/2006	77	NR	16	8-27
Engelhardt T. (34) UK/2011	1,350 (bimodal distribution)	14.3*	13.6*	8.1- 20.8
		6.3*	5.2*	0-14.9
Cestonaro T. (35) Brasil/2014	135	16.5*	15.7*	2.5-56 (9-21 [¤])
Bilehjani E. (36) Irán/2015	250	12.5 ± 2.6	11.5 ± 2.7	3-18
Abebe W. (37) Botsuana/2016	260	15.9 ± 2.5	15.3 ± 2.3	12-22
Rangel FL. (38) Colombia/2018	292	16.2 ± 4.2	11.8 ± 4.9	2-22
Gómez A. (39) Colombia/2018	102	15.8 ± 5.8	15.8 ± 5.8	6.5-43
Isserman R. (40) USA/2019	37,081	NR	9 ± 5.2	NR
Ramos M. (41) Colombia/2019	132	14* [12; 16]	14* [12; 16]	7-29
Sharkawy A. (42) UK/2020	343	16.1* [13; 19.4]	5.8* [3.5; 10.7]	NR

±: Standard Deviation; *: Median [Q1; Q3]; ¤: Removing extreme values; NR: Not reported; UK: United Kingdom; USA: United States of America.

Source: Authors.

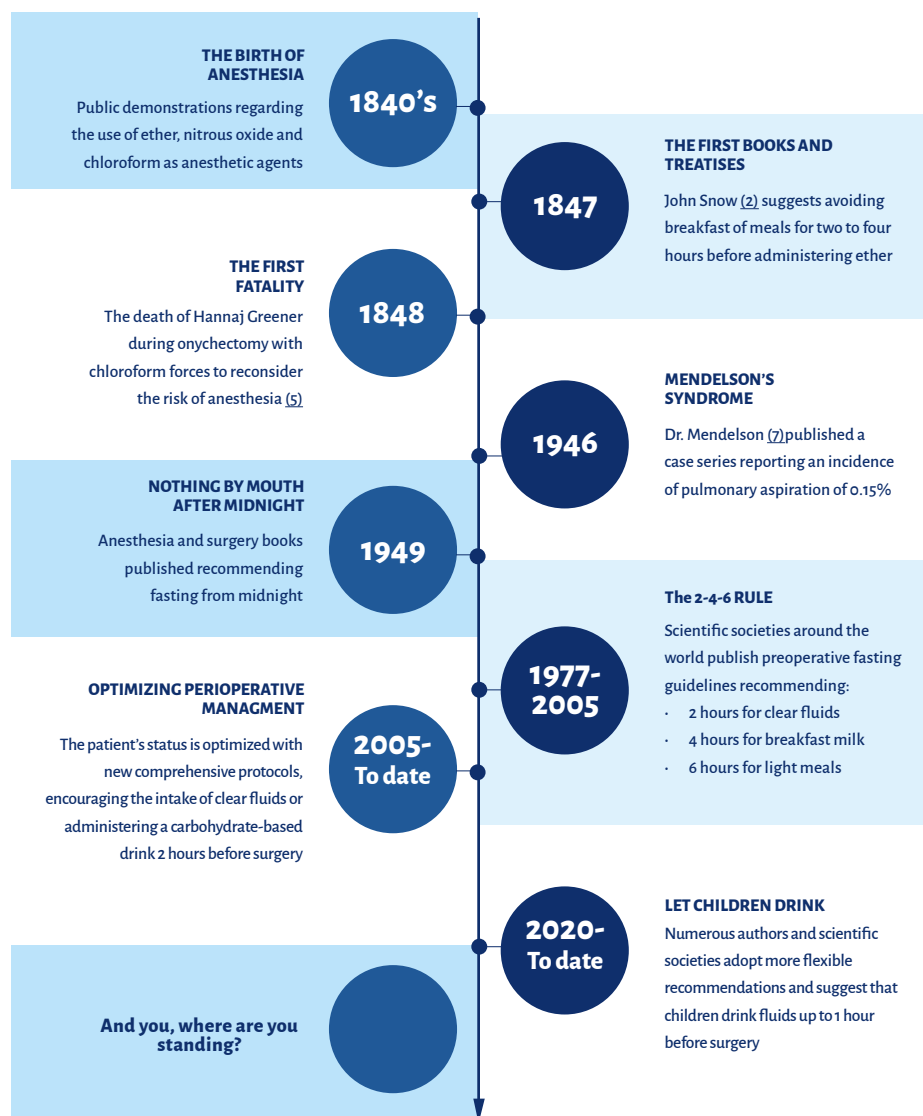
in various institutions around the world. Times seem to be shorter for institutions in developed countries, particularly in hospitals that implement active interventions to control this issue.

A hospital in the United States managed to ensure that more than 60% of children had an intake of clear fluids between two and four hours prior to surgical procedures, through interventions focused on communication with the family and offering drinks to the children at hospital admission. (40) Similarly, in Brazilian institutions they were able to reduce the preoperative fasting time from 16 to five hours, through educational, awareness and audit activities. (22,31) This illustrates how the lack of institutional policies, poor knowledge, or lack of training with regards to the guidelines may significantly impact perioperative management.

Nowadays, a growing number of authors and scientific societies seek to stimulate the intake of clear fluids and hence reduce fasting times to the minimum established under the guidelines. While the ERAS protocols give their patients a carbohydrate-based drink, the recommendation of encouraging clear fluids intake up to two hours prior to anesthesia has only been reflected in a small number of official publications, including the 2011 European guidelines (21), the Canadian guidelines in all of its versions since 2016 (43), and the guidelines of the American Society of Anesthesiology in 2023 (17) (Figure 1).

Furthermore, the Canadian Society of Anesthetists adopted the recommendation of one hour fasting for clear fluids in children since 2020 (20), while the International Committee for the Advancement of Procedural Sedation has suggested to abolish fasting for clear fluids in children and adults undergoing procedures under sedation (based on patient's condition and the procedure to be conducted.) (44) However, the ASA clarifies that there is not enough evidence to recommend a one-hour fluids fasting time among the pediatric population, and hence they do not follow such recommendation. (17)

Figure 1. Fasting history timeline.



Source: Authors.

The preoperative fasting dogma

There are a number of conditions described in the literature that favor these prolonged preoperative fasting schedules such as the difficulty to ensure individualized diet and indications for each patient undergoing surgery. Likewise, there is a misconception that prolonged fasting is simply uncomfortable rather than unsafe. For this reason, the prescription of "nil per os" (Latin, abbreviated NPO, meaning nothing

by mouth) persists among physicians, nurses and administrative staff, from midnight or after 10 p.m. for all patients with a surgical diagnosis, regardless of the time of surgery. (24,29,35,36) Additionally, there is the belief that by ensuring fasting in every surgical patient, it would be easier to move the procedure to an earlier time slot; however, less than 10% of these procedures start before the scheduled time, starting between 30 and 60 minutes. (1)

Similarly, fear of procedure cancellation leads both hospital staff and patients to keep a longer fast than necessary, ignoring the detrimental effects of this practice. (24,29) Despite this, extended fasting may not reduce residual volume or decrease stomach acidity. Subjects who fast for three hours may exhibit the same gastric volume as those who have fasted for 25 hours. (45,46) Even people with pathologies such as obesity, diabetes, chronic renal disease and gastroesophageal reflux can maintain an elevated residual gastric volume (up to 3-4 times that of a healthy person), despite the fact that more than eight hours have passed since the last meal. (47)

CONCLUSION

This manuscript addresses the historical evolution of preoperative fasting, analyzing how the medical recommendations have changed and how the current practices reflect significant progress since the birth of anesthesiology. The current guidelines use minimal fasting times according to the type of intake: six hours for light meals; two hours for drinks – ideally carbohydrate-based; and in case of children, fasting should only be of four hours for breast milk and one hour for clear fluids. Over the past few years, efforts have been made to reduce prolonged fasting, encouraging intake or even administering something to drink to patients before the surgical procedure.

However, ritualistic behaviors among hospital staff and the lack of patient, family and administrative staff education, favor the persistence of inadequate indications leading to prolonged fasting of surgical patients. Consequently, in order to limit fasting times of surgical patients, an active, institutional, and healthcare associations multidisciplinary effort is needed. The implementation of protocols such as ERAS or ACERTO are economically feasible comprehensive measures that may be adopted at every institution with proven results.

Finally, it should be kept in mind that while the risk of pulmonary aspiration of gastric contents is higher under certain conditions such as obesity and pregnancy, maintaining a more prolonged fasting will probably not alleviate this risk, but on the contrary may increase the sensation of thirst, hunger, irritability, head ache, and insulin resistance, as well as impairment of the physiological stress response to surgical trauma. It is reasonable to conclude that in case of increased risk of pulmonary aspiration, a different or additional approach to fasting might be wiser.

Conflicts of interests

None declared by the authors.

Founding and sponsorship

None declared by the authors.

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Complementary material 1. Presurgical fasting recommendations and guidelines (1847-2023).

Institution/author	Origin/year	Recommended fasting time	Type of recommendation
Robinson J. (1,2)	UK 1847	Not mentioned	Treatise; first anesthesia treatises
Snow J. (1,3,4)	UK 1847 y 1858	Fluids: Not mentioned Solids: 2-4 hours (light meal) 5 hours (full meal)	Treatise; first anesthesia treatises
Lister J. (1,5)	UK 1883	Fluids: 2 hours Solids: "no solids in the stomach"	Book section
Hewitt FW. (1,6)	UK 1905	Fluids: Not mentioned Solids: 4 hours	Book
Gwathmey JT. (1,7)	USA 1914	Fluids: 2 hours Solids: 2-3 hours, barley or rice soup	First anesthesia book in the United States
Hunt AM. (1,8)	USA 1949	Fluids: 2-3 hours Solids: NPO after midnight	Book
Lee J, Atkinson R. (1,9)	UK 1964	NPO after midnight or > 6 hours	Book
Canadian Society of Anesthesiologists (1,10,11)	Canada 1977, 1987	Fluids: Not mentioned Solids: 5 hours	Guidelines
Kallar S, Everett L. (12)	USA 1993	Fluids: 2-3 hours Solids: 5 hours	Review
Stoelting R. (13)	USA 1994	Fluids: 2 hours Solids: NPO on the day of surgery	Conference
Danish Society of Anesthesia (13)	Denmark 1994	Fluids: 4 hours Solids: 6 hours	Bulletin
Raeder JC., et al. (14,15)	Norway 1994	Fluids: 2 hours (oral premedication up to 1 hours) Solids: 6 hours (light meal) Breast milk: 4 hours	National consensus
American Society of Anesthesia (16-19)	USA 1999, 2011, 2017, 2023	Fluids: 2 horas Solids: 6 horas Fats/protein: 8 hours Breast milk: 4 hours	Guidelines
Canadian Society of Anesthetists, updates (20)	Multiple 2000-2019	Fluids: 2 hours Solids: 6 hours Fats/protein: 8 hours	Guidelines
German Society of Anesthesiology and Intensive Medicine (21)	Germany 2004	Fluids: 2 hours Solids: 6 hours Breast milk: 4 hours	Bulletin
Association of Anesthetists of Great Britain (20,22)	UK 2001, 2005, 2010	Fluids: 2 hours Solids: 6 hours Breast milk 4 hours	Guidelines
Scandinavian Society of Anesthesiology and Intensive Care (23)	Scandinavia 2005	Fluids: 2 hours (oral premedication up to 1 hour) Solids: 6 hours Breast milk: 4 hours	Guidelines

Complementary material 1. Presurgical fasting recommendations and guidelines (1847-2023).

Institution/author	Origin/year	Recommended fasting time		Type of recommendation
Royal College of Nursing (24)	UK 2005	Fluids: 2 hours Solids: 6 hours		Guidelines
College of Anesthesiologists, Academy of Medicine of Malaysia (25)	Malaysia 2008	Fluids: 2 hours Solids: 6 hours		Guidelines
European Society of Anesthesiology (26)	Europe 2011	Fluids: 2 hours Solids: 6 hours Breast milk 4 hours		Guidelines
Royal College of Anesthetists (27)	UK 2012	Fluids: 2 hours Solids: 6 hours (children) Breast milk: 4 hours		Compendium of Quality Standards
French society of Anesthesiology (28)	France 2010/ 2012	Fluids: no more than 2-3 hours Solids: no more than 6 hours		Guidelines /Experts panel
Rincón D, Escobar B. (29)	Colombia 2015	Fluids: 2 hours Solids: 6 horas Fats/protein: 8 hours		Clinical Practice Manual
Association of Anesthetists and the British Association of Ambulatory Surgery (30)	UK 2019	Fluids: 2 hours Solids: 6 hours		Guidelines
Sociedad Canadiense de Anestesistas, actualizaciones (31)	Canada Multiple 2019–to date	Fluids: 2 horas/1 hours (children) Solids: 6 hours Fats/protein: 8 hours		Guidelines
International Committee for the Advancement of Procedural Sedation (32)	Internacional 2020	Minimal risk*	Fluids: no restriction Solids: 2 hours approx. Breast milk: no restriction	Consensus
		Mild risk*	Fluids: no restriction Solids: 4 hours approx. Breast milk: 2 hours approx.	
		Moderate risk*	Fluids: 2 hours approx. Solids: 6 hours approx. Breast milk: 4 hours approx.	
Colegiado Real de Anestesisistas (33)	UK 2020	Fluids: 2 hours (adults), 1 hour (children) Solids: 6 hours Breast milk: 4 hours		Compendium of Quality Standards
ACERTO (34)	Brazil 2005-to date	Fluids: 2 hours (carbohydrates)		Protocol
ERAS (35)	International Multiple 2005-to date	Fluids: Maltodextrin 2-4 hours (administered to the patient) Solids: 6-8 hours		Protocol

Approx.: Approximately; NPO: nothing by mouth; UK: United Kingdom; USA: United States of America; *: Risk factors including age, medical conditions and procedure to be conducted; for further information the reader is encouraged to review the reference ([32](#)).

Note: any mention to “Fluids” refers to clear fluids, non-dairy, no particles and fatless; and solids refers to “light meal”, and this definition varies according to the guidelines.

Source: Authors.

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