



## Otros

# The reality of the surgical fasting time in the era of the ERAS protocol

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### Abstract

Multimodal protocols to optimize perioperative care and to accelerate postoperative recovery include abbreviated pre-and postoperative fasting. The aim of this study was to investigate the pre and postoperative fasting period and the factors that influence it in patients who underwent elective operations. We included patients who underwent surgery of the digestive tract and abdominal wall. Data were collected from the patients and from their personal health records. We included 135 patients between 19 and 89 years old. Most were adults (75.55%), female (60.74%) and the most common procedures were hernioplasty (42.96%) and cholecystectomy (34.81%). The preoperative fasting periods for solids and liquids were similar, median 16.50 (5.50-56.92) and 15.75 (2.50-56.92) hours, respectively. The preoperative fasting period was influenced by the instruction received and surgery time. Postoperative fasting period was 15.67 (1.67-90.42) hours and was influenced by type of surgery and lack of synchrony between the clinical meeting and the nutrition and dietetics service schedules.

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### Abbreviations

ERAS: Enhanced Recovery After Surgery.

LOS: Length of stay.

NPO: Nulla per os (Latin) = nothing by mouth (English).

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### LA REALIDAD DEL TIEMPO DE AYUNO QUIRÚRGICO EN LA ERA DEL PROTOCOLO ERAS

#### Resumen

Los protocolos multimodales para optimizar la atención perioperatoria y acelerar la recuperación postoperatoria incluyen abreviatura del ayuno pre y postoperatorio. El objetivo de este estudio fue investigar el período de ayuno antes y después de la operación y los factores que lo influyen en los pacientes sometidos a cirugía electiva. Se incluyeron pacientes sometidos a cirugía del tracto digestivo y de la pared abdominal. Los datos fueron obtenidos con el paciente y su prontuario médico. Se incluyeron 135 pacientes entre 19 y 89 años. La mayoría eran adultos (75,55%), mujeres (60,74%) y fueron sometidos a hernioplastia (42,96%) o colecistectomía (34,81%). El ayuno preoperatorio de sólidos y líquidos fue similar: 16,50 (5,50 a 56,92) y 15,75 (2,50 a 56,92) horas, respectivamente. El ayuno preoperatorio fue influenciado por la orientación recibida y la hora de la cirugía. El ayuno postoperatorio fue 15,67 (1,67 a 90,42) horas y fue influenciado por el tipo de cirugía y la falta de sincronía entre el tiempo de la reunión clínica y del servicio de alimentación y nutrición.

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Palabras clave: *Ayuno. Procedimientos quirúrgicos electivos. Atención perioperatoria.*

### Introduction

In the last two decades a number of studies have demonstrated that several perioperative care behaviors influence surgical postoperative recovery<sup>1,2</sup>. This concept was named fast track surgery or multimodal approach to perioperative care<sup>3</sup>. In 2005, a group of European investigators published an interesting perioperative care multimodal protocol (on colonic surgery) which was named Enhanced Recovery After Surgery (ERAS)<sup>4</sup>. It was updated in 2009 and 2013 and resulted in three different protocols for perioperative care in colonic surgery, rectal/pelvic surgery and pancreatoduodenectomy<sup>5-7</sup>. These protocols used an evidence-

based medicine approach to find elements from perioperative care that influence postoperative recovery. ERAS pathway aims to reduce the surgical stress and to promote early return to physiological function and to facilitate postoperative recovery<sup>8</sup>.

Even partial compliance to 20 elements of the ERAS protocol was able to reduce the length of stay (LOS) and complication rates<sup>9</sup>. A brief preoperative fasting and the early postoperative feeding are both among ERAS recommendations<sup>8</sup>.

The fasting recommendations changed over time. In 1883, Lister introduced different preoperative periods for solids and liquids. While solids should be avoided close to surgery, liquids were allowed until 2 h before surgery<sup>10</sup>. However, around 1960 the prescription of NPO after midnight became popular. NPO (Nulla per os) is a Latin term which means nothing by mouth. The main reason for this behavior changes was Mendelson's report published in 1946<sup>11</sup>. He observed high pulmonary aspiration rates in pregnant women who underwent general anesthesia for labor. Five of them aspirated solid gastric contents and two died immediately. Those who aspirated liquid gastric contents developed pulmonary damage. Thereafter, aspiration during induction of anesthesia became known as Mendelson's Syndrome.

Therefore, it was recommended that prolonged preoperative fasting would be safer. The goal was to ensure the empty stomach at anesthesia induction to avoid pulmonary aspiration<sup>12</sup>. Nevertheless, in 1980's the long preoperative fasting period was questioned because liquids and solids empty by different mechanisms at different times<sup>13</sup>. While liquids emptying occur by pressure difference within 2 h, solids need to be broken into particles smaller than 2 mm and take up to 6 hours<sup>13</sup>. If the liquids have nutrients, the caloric content and osmolarity influence gastric emptying. Clear liquids are designed fluids with fast gastric emptying time, such as, water, coffee, tea, juice without pulp and others.

In 1986, Maltby and coworkers showed that 150ml of water can improve gastric emptying and was safe 2-3 h before surgery<sup>14</sup>. Hutchinson and coworkers showed that 150ml of coffee or orange juice do not increase residual gastric volume and is safe close before surgery<sup>15</sup>. Both studies show improvement in discomfort relative to thirst.

Early postoperative feeding improves recovery<sup>8</sup> and is safe after most operative procedures, even with anastomosis<sup>16</sup>. Early feeding promotes faster return of gastrointestinal function, decreasing the paralytic ileum<sup>16,17</sup>, and reduces postoperative infection risk and LOS<sup>8,18</sup>.

Despite all benefits from perioperative nutrition, prolonged fasting periods before and after surgery is common<sup>18</sup>. Thus, the aim of this study was to investigate the pre and postoperative fasting period and factors that influence it in patients who underwent elective surgical procedures.

## Methods

This study was conducted at a gastrointestinal surgical department of a public university hospital in south Brazil. The research project was approved by the Ethics Committee on Human Research (Registry: 2508.115/2011-05). Patients were invited to participate of the study while waiting for surgery. All participants signed the Statement of Consent. Data were collected between February and July 2012 from participating patients during interview and from personal health records. We included patients over 18 years, male or female, admitted for digestive tract or abdominal wall elective surgery.

Preoperative fasting period was calculated from the last meal time (reported by patient) to anesthesia induction time (recorded in personal health record). We assessed preoperative fasting for solids and liquids, because they have different preoperative fasting recommendation. Only clear fluids (emptying quickly from the stomach) without nutrition value were considered liquids (like water, coffee or tea without sugar). Postoperative fasting period was calculated from anesthesia end time (recorded in personal health record) to first solid or liquid intake time (reported by patient).

We asked to the patients about the preoperative fasting period instruction they had received and who provide the instruction. We also asked about hungry and thirsty during the pre and postoperative fasting period.

From personal health records we collected information about age, gender, diabetes diagnosis, American Society of Anesthesiology (ASA) Physical Status Classification System, type of surgery and anesthesia, and operative complications. We classified as elderly subjects who were over 60 years of age and as diabetic who had diagnosis recorded in personal health records. The same group of surgeons performed all operations.

The minimum sample size calculated was 127 patients. It was calculated based on 190 patients that would be operated at the gastrointestinal surgical department during study. Among the numeric variables investigated, only age showed normal distribution (Kolmogorov-smirnov test,  $p = 0.931$ ). Then, all analyzes were made with non parametric tests. The Mann-Whitney test was used to compare two groups and the Kruskal Wallis test (and respectively post hoc test) to compare more than two groups. The Spearman correlation coefficient was used to verify the association between numeric variables. A significant level of 5% ( $P < 0.05$ ) was established for type I error. Data were presented as median (minimum – maximum) because of the asymmetric distribution.

## Results

A total of 165 patients were interviewed and 30 were excluded because of incomplete data. One hundred

thirty five patients between 19 and 89 years were included in the study. Most patients were less than 60 years (75.55%) and were female (60.74%). The most frequent surgical procedures were hernioplasty (42.96%), cholecystectomy (34.81%) and Nissen fundoplication (9.63%). Most surgical procedures were performed by laparoscopic techniques. Most patients were classified as ASA score II (54.07%) or I (38.52%). General anesthesia was used in 64.44% of the patients.

### Preoperative fasting period

The preoperative fasting period for solids and liquids were similar, median of 16.50 h and 15.75 h, respectively (Spearman correlation coefficient = 0.883) (Table I). Minimum preoperative fasting period was 9.5 h for solids and liquids, except for 3 patients that had a shorter fasting period for solids and 1 patient that had a shorter fasting period for liquids. Most patients had a fasting period that varied between 9.5 h and 21.5 h for solids and liquids (Fig. 1).

Fifty-four patients were submitted to more than one fasting period before surgery and 8% of the patients were admitted more than once to the hospital before surgery (Table I). Almost half of the patients had their last meal at the hospital (46.67%), because they were admitted in the day before surgery (Table I).

More than half of the patients related hunger or/and thirst during the preoperative fasting period. However, fasting period for solids and liquids was not different between patients that related or not hunger ( $p = 0.875$  and  $0.703$ , respectively) and thirst ( $p = 0.423$  and  $0.813$ , respectively) (Table II).

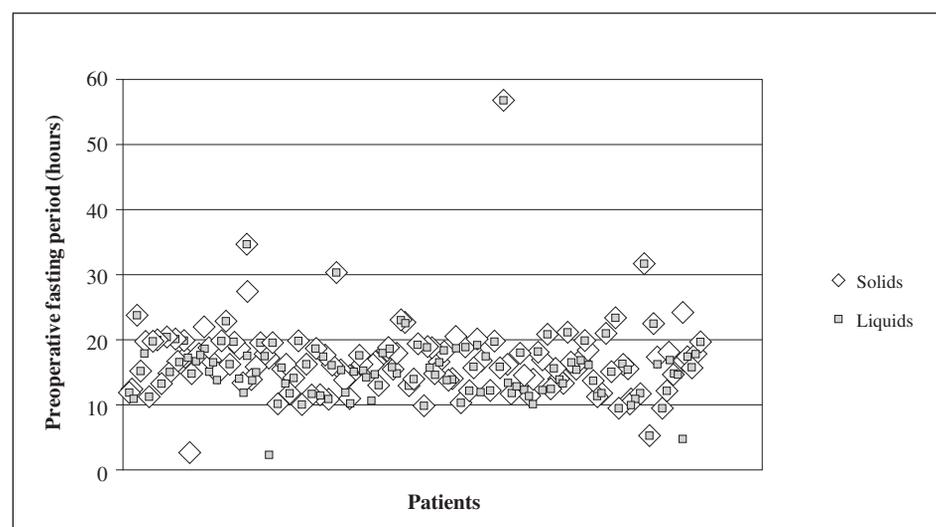
Preoperative fasting period was instructed mainly by a phone call from admission (31.85%), nurse staff (31.85%) and by the physicians (29.63%) (Fig. 2). Other instructions were provide by multidisciplinary team and other patients that were waiting surgery in the same ward. Some patients related that did not receive instruction about fasting. The preoperative fasting period was not related to the instructor (Kruskal Wallis test,  $p = 0,591$  and  $p = 0,605$ , respectively).

Two most frequent fasting instructions were to start fasting after midnight (43.70%) or after 22 h (18.52%) (Fig. 2). Those patients that were instructed to begin fasting after midnight remained less time without eating and drinking than those who was instructed to start fasting after dinner (Kruskal Wallis test,  $p = 0.002$  and  $0.003$ , respectively). Similarly, those who were instructed to start fasting after 22 h remained less time without eating and drinking than those who were instructed to start fasting after dinner (Kruskal Wallis test,  $p = 0.005$  and  $0.008$ , respectively). Those who did not received preoperative fasting instruction for liquids remained less time without drink than those who were

**Table I**  
*Perioperative fasting period*

	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>
Preoperative fasting – Liquids (hours)*	15.75	2.50	56.92
Preoperative fasting – Solids (hours)*	16.50	5.50	56.92
Postoperative fasting (hours)	15.67	1.67	90.42
Number of admissions	1	1	4
Number of preoperative fasting	1	1	7

Note: \*Spearman correlation coefficient = 0.883.



*Fig. 1.—Preoperative study period.*

**Table II**  
Hunger and thirst during perioperative fasting period

		Preoperative fasting						Postoperative fasting			
		Median (min - max) (hours)						Median (min - max) (hours)			
		Solids	n	p	Liquids	n	p	n	p		
Hunger	Yes	16.50 (6-57)	91	0.875	15.83 (3-57)	91	0.703	15.50 (2-90)	81	0.527	
	No	16.50 (10-28)	44		15.75 (10-24)	44		16.42 (2-90)	54		
Thirst	Yes	16.75 (6-57)	93	0.423	15.92 (3-57)	93	0.813	15.58 (2-90)	91	0.748	
	No	15.75 (10-24)	42		15.25 (10-24)	42		15.71 (3-90)	44		

Note: Min = minimum. Max = maximum. Mann-Whitney test.

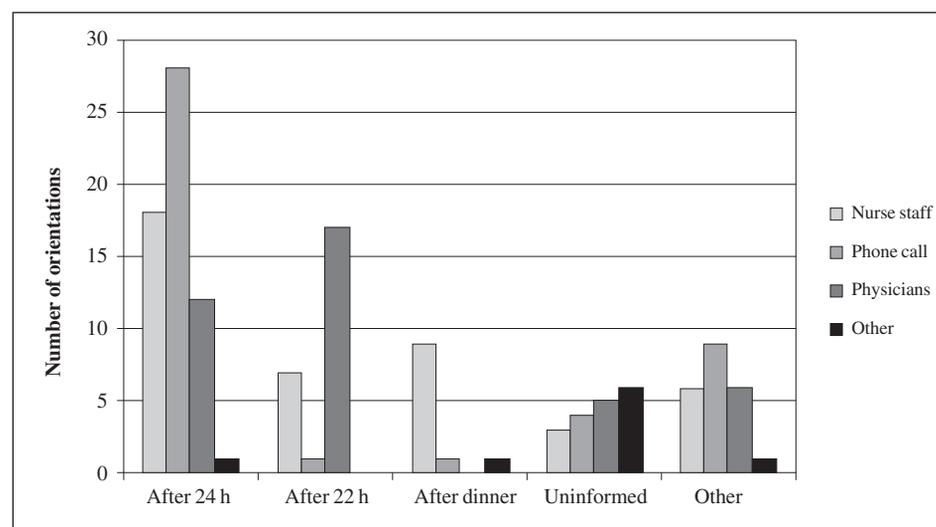


Fig. 2.—Type of preoperative fasting instruction according to the instructor.

instructed to start fasting after dinner (Kruskal Wallis test,  $p = 0.05$ ) (Table III). The preoperative fasting instruction was the same for solids and liquids.

Preoperative fasting periods for solids and liquids were not different according to the ASA score (Kruskal Wallis test,  $p = 0.642$  and  $0.613$ , respectively), type of surgery (Kruskal Wallis test,  $p = 0.614$  and  $0.724$ , respectively), age (Kruskal Wallis test,  $p = 0.892$  and  $0.965$ , respectively) and diagnosis of diabetes (Kruskal Wallis test,  $p = 0.123$  and  $0.353$ , respectively).

### Postoperative fasting

Postoperative fasting period was similar to preoperative fasting period, median 15.67 h (Table I). More than half of the patients reported postoperative hunger (60%) and/or thirst (67.41%). However, these findings were not related to the postoperative fasting period ( $p = 0.527$  and  $0.748$ , respectively) (Table II).

Those who underwent the surgical procedure under general anesthesia had a longer postoperative fasting period than those who underwent surgery under other

anesthetic procedure (Mann-Whitney test,  $p = 0.019$ ). Those patients who underwent Nissen fundoplication were submitted to a longer postoperative fasting period than those who underwent hernioplasty ( $p = 0.004$ ).

Postoperative fasting was similar regardless the ASA score ( $p = 0.524$ ), age ( $p = 0.203$ ) and diagnosis of diabetes ( $p = 0.266$ ).

### Discussion

Preoperative fasting period was similarly prolonged to solids and liquids (median 16.50 and 15.75 h, respectively). Long preoperative fasting period are common worldwide. Aguilar-Nascimento and co-workers showed a preoperative fasting period of 16 h in a public university hospital in western Brazil<sup>18</sup>. Preoperative fasting period was 15.5 h for solids and 12.5 h for liquids in a United Kingdom study<sup>19</sup>, while in the United States they were 14.5 h for solids and 12 h for liquids<sup>20</sup>.

Approximately 47% of patients were hospitalized in the day before surgery, because the surgery was often

**Table III**  
Preoperative fasting instruction and the resulting fasting period for both liquids and solids

Instruction	n	Frequency (%)	Solids Eman (min - Max)	Liquids (hours)
After 24 h <sup>1,3</sup>	59	43.70	16.17 (10-28)	15.17 (3-20)
After 22 h <sup>2</sup>	25	18.52	16.23 (10-32)	14.75 (10-32)
Uninformed <sup>3</sup>	18	13.33	16.59 (11-30)	15.50 (5-30)
After dinner <sup>1,2,3</sup>	11	8.15	20 (13-24)	20 (11-24)
Others	22	16.30	17.75 (6-57)	16.25 (6-57)

Note: Min = minimum. Max = maximum. <sup>1</sup> Wallis test for solids (p = 0.002) and liquids (p = 0.003). <sup>2</sup> Kruskal Wallis test for solids (p = 0.005) and liquids (p = 0.008). <sup>3</sup> Kruskal Wallis test for liquids (p = 0.05).

canceled and scheduled to the next day. Surgical theater reform and public employees strikers occurred during this study and might have contributed to the profile of surgical procedures during this study. But delay surgery or even its cancellation occur frequently even in an ordinary day. Because of this, 40% of patients underwent more than one preoperative fasting period (in the same hospitalization) in order to prepare for surgery and 8% were admitted more than once.

We did not find difference in preoperative fasting period between patients that referred hunger or thirst. This might be due to the long preoperative fasting periods of all patients. Almost all patients stayed fasting for a minimum of 9.5 h, while the recommendation is 2 h and 6 h for liquids and solids, respectively.

Abbreviate fasting with clear fluids without nutritional content improve preoperative thirst, but does not improve hunger or change the metabolic state. However, this can be achieved by the intake of carbohydrate-rich beverages<sup>21</sup>. Moreover, the intake of these beverages 2 h before surgery attenuates the metabolic response to stress<sup>22</sup>, notably insulin resistance<sup>23,24</sup>. Insulin action is the key element of postoperative metabolic changes. Insulin resistance is related to higher postoperative complications rate, longer LOS, and increased mortality<sup>25,26</sup>. Insulin resistance delays the return of the physiology function and, consequently, food intake and patient mobilization<sup>4</sup>. Awad and coworkers demonstrated a 1 day decreased LOS after major abdominal surgery with preoperative intake of carbohydrate-rich beverages<sup>27</sup>. Fasting abbreviation with these drinks can promote recovery while long fasting periods might delay recovery.

There is no preoperative fasting instruction protocol in the hospital where this study was performed. Usually, patients are instructed about fasting by a phone call from admission. If surgery is canceled and scheduled for the next day, the patient remains hospitalized and he or she is again instructed about fasting by the nurse staff or by a physician. In our study the instructor did not influence the preoperative fasting period. This might be due to similarity in the recommendations of different instructors.

The most common instruction in our study was to start fasting after midnight. Other frequent instructions

were start fasting after 22 h and after dinner. Many health professionals believe that instruction based on daily activities schedules is easily understood.

The instruction to start fasting early resulted in longer preoperative fasting period than the instruction to start fasting late. Usually, the instructor intended to keep patient fasting around 8 h. But, in the practice the fasting periods are longer than the instruction periods. A study from the United States showed that practice fasting is 2.5 h longer than instruction fasting for liquids and 4.5 h for solids<sup>20</sup>. This might be due to patients beliefs that longer fasting period would be safer. Instruction to have the last meal close to midnight would be more efficient to reduce fasting periods than instruction to eat or drink until midnight.

We believe that the statistically significant relationship between the anesthetic technique and preoperative fasting period was random, because fasting instruction in our study did not consider individual surgical or anesthetic features. Fasting instruction considered only the hypothesis that the patient would be operated in the first morning or afternoon schedule. Therefore, we believe that only the fasting start time and the surgery schedule influenced preoperative fasting period.

The long preoperative fasting instruction started after the high aspiration rate related by Mendelson. However, Mendelson observed a high risk group for aspiration: pregnant women at labor. Back then, many surgical aspects were very different from the current practices, especially anesthesia. According to the Scottish Audit of Surgical Mortality, current aspiration rates are approximately 12 times less than in the past (0.03% in 2009)<sup>28</sup>. A clinically significant pulmonary aspiration is rare in healthy individuals undergoing elective surgery. Usually this is restricted to emergency surgery<sup>13</sup>.

Nowadays, there are many protocols that recommended brief preoperative fasting period. There are different recommendation for liquids and solids. Recommended fasting solids period is 6 h (8 h in the case of high fat or meat meals) while recommended fasting for clear liquids is only 2 h (4 h for breast milk and 6 h for other types of milks)<sup>29</sup>.

Despite the scientific evidence, long preoperative fasting period instruction was frequent among different instructors in this study. It can be due to the difficulty to

introduce new scientific evidences into the daily clinical routine. Evidence based guidelines intent to collect best evidence about best practice. But, there are many barriers against the implementation of best medical practices into the daily routine. These barriers are related to health care team, patients and institutions at different levels (cultural, emotional, economic, political and organizational)<sup>30</sup>.

Postoperative feeding began only in average 15.67 h after the operation. Patients who underwent Nissen fundoplication had a longer postoperative fasting period than those who underwent hernioplasty. Nissen fundoplication requires consistency food changes, what might have generated excessive caution and postponed the start of feeding.

In our study, anesthetic technique showed statistical relationship with postoperative fasting period. We believe that this relationship was random. Feeding is decided after the afternoon clinical round and the meals must be requested for the nutrition and dietetics service 3 h before served to allow preparation, portioning and transportation. Therefore patients ate only in the next breakfast.

Long postoperative fasting periods are common after major gastrointestinal surgical procedures with anastomosis. However most patients submitted to a colonic surgery might receive clear liquids hours after surgery<sup>31</sup>. When oral feeding is not possible, enteral feeding might be a good alternative, such as after head and neck surgery and major surgery for resection of gastrointestinal tumors<sup>31</sup>. Several studies have showed reduced mortality and LOS with early feeding after gastrointestinal surgery<sup>32,33</sup>.

Despite these barriers, Aguilar-Nascimento and coworkers have successfully introduced a protocol for multimodal perioperative care in a public university hospital in western Brazil. They started with educational activities to increase the awareness of the staff and audit later. Among the positive results were the reduction of the preoperative fasting period from 16 h to 4 h and the postoperative feeding return 1 day before<sup>18</sup>. Bosse, Breuer e Spiesl (2006), believe that unawareness about preoperative fasting recommendation is the main barrier to the implementation of these recommendations<sup>30</sup>.

Evidences to support shorter pre and postoperative fasting periods are convincing and recommendations about this are part of multimodal perioperative care protocols. It is clear that implementation of these protocols improves perioperative care<sup>34</sup>. The present study showed long pre and postoperative fasting periods and we believe that these periods might be abbreviated by the implementation of a multimodal protocol of perioperative care. This protocol might change also other perioperative behavior and contribute to patient's recovery.

## Conclusion

The hospital does not have a protocol on preoperative fasting instruction and adopts the same preoperative

fasting instruction for solid and liquids regardless the age, diagnosis, type of anesthesia and type of surgery, resulting in prolonged preoperative fasting periods for both solids and liquids. We believe that unawareness about actual preoperative fasting recommendations and difficulties to introduce scientific evidence into the daily clinical routine contributed to the long preoperative fasting period.

Postoperative fasting period might have been influenced by the lack of synchrony between clinical meeting and nutrition and dietetics service schedules. Besides, lack of knowledge prevented to order a special meal.

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