

# Effect of multidisciplinary interventions in perioperative management center on duration of preoperative fasting: A single-center before-and-after study

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## Abstract

**Objectives:** Our aims were to clarify the actual situation regarding preoperative fasting and determine whether multidisciplinary interventions in a perioperative management center shorten the duration of preoperative fasting.

**Methods:** The cohort of this before-and-after study comprised patients undergoing elective surgery aged 18 years or older who underwent general anesthesia at one of three stages: after starting a short preoperative fasting protocol (Group A), after the anesthesiologist started explaining the protocol (Group B), and after the start of the perioperative management center (Group C). Instructions on drinking clear fluids were given up to 2 h and 4 h before the start of elective surgery to the first patient on the list (on-time) and to the second and subsequent patients (on-call), respectively. Data were collected retrospectively in Groups A and B and prospectively in Group C.

**Results:** The study cohort comprised 89 patients in Group A (50 on-time, 39 on-call), 108 in Group B (65 on-time, 43 on-call), and 284 in Group C (182 on-time, 102 on-call). The difference between the instructed and last drinking time was significantly shorter in Group C than Group A (30 [10, 140] vs. 30 [10, 60] vs. 20 [0, 50] min,  $p=0.003$ ). The duration of fasting was significantly shorter in Group C than Group B (243 [150, 395] vs. 213 [151, 323] vs. 180 [146, 280] min,  $p=0.01$ ).

**Conclusions:** Multidisciplinary interventions at the perioperative management center tended to reduce the duration of fasting, suggesting that this approach may contribute to improved compliance.

**Keywords:** Enhanced Recovery After Surgery, Large hospital, Perioperative management center, Perioperative complication, Duration of preoperative fasting

## Introduction

The concept of enhanced recovery after surgery (ERAS) has recently strongly influenced approaches to perioperative management.<sup>1</sup> ERAS, a European protocol designed to enhance recovery after surgery while maintaining safety, aims to achieve rapid recovery, even after highly invasive surgery. This protocol is designed to reduce reactions requiring invasive interventions, prevent complications, and accelerate postoperative recovery.<sup>1-3</sup> The concept of ERAS started in the field of gastroenterology, where it was widely practiced, and gradually spread to other fields.<sup>4-6</sup> Some of the 17 items in this protocol are to do with preoperative drinking and carbohydrate intake.<sup>7</sup> It has been reported that shortening the duration of preoperative fasting can increase patient satisfaction and reduce anxiety on recommencing eating.<sup>8</sup> It has also been reported that prolonged restriction of drinking contributes to circulatory variations during induction of anesthesia.<sup>9</sup> Additionally, the Japanese Society of Anesthesiologists' guidelines for preoperative fasting state that

drinking clear fluids up to 2 h before induction of anesthesia is safe.<sup>10</sup> Despite these guidelines and protocols, prolonged fasting is still customary in many institutions. For example, 50% of anesthesiologists in Europe, Canada, and Australia require abstinence from drinking clear fluids after midnight,<sup>11</sup> and only 45% of anesthesiologists in Lebanon allow drinking of clear fluids up to 2 h before surgery.<sup>12</sup> It has also been reported that the fasting time instructed by nurses can be as much as 3 h longer than that instructed by anesthesiologists, and that the actual duration of fasting is even longer than instructed,<sup>13</sup> making it difficult to promote shortening the duration of preoperative fasting.<sup>14,15</sup> In our hospital, we started using a protocol incorporating shortening the duration of preoperative restriction of clear fluids in July 2013. The anesthesiologist in charge of anesthesia began to distribute a copy of this protocol and explain it during the preoperative consultation (Figure 1). Additionally, we opened a perioperative management center in September 2015 and initiated multidisciplinary interventions. In this before-and-after study, we aimed to clarify the actual situation regarding restriction of clear fluids in our hospital and to determine whether the duration of preoperative restriction clear fluids was shortened by multidisciplinary interventions.

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## Methods

This study was approved by the Ethics Committee of Fujita Medical School (HM20-030). Because this was a retrospective,

observational study, the requirement for obtaining written consent was waived. The participants were elective surgical patients aged 18 years or older who underwent general anesthesia during the following three periods: 2 months after the protocol for short preoperative fasting became operational (Group A: 11–30 September 2013 [3 weeks]), 6 months after the anesthesiologist began distributing the instruction manual during preoperative assessment (Group B: 24 March–18 April 2014 [3 weeks]), and 5 years after opening the perioperative management center (Group C: 22 June–11 July 2020 [3 weeks]) (Table 1). The following patients were excluded: patients undergoing electroconvulsive therapy, those with gastrointestinal stenosis (pyloric stenosis, ileus), those with gastrointestinal dysfunction, highly obese patients with a body mass index of 35 or higher in whom securing the airway could be difficult, high-risk pregnant women (in labor, with abnormal fetal heart rate), patients undergoing surgery in the prone position, patients with impaired oral intake due to dementia or decreased level of

consciousness, those with missing data, and those who were judged by the anesthesiologist or attending physician to require prolonged fasting. In all groups, the duration of fasting with respect to solid food was until 24:00 on the day before surgery. No specific types of preoperative clear fluid (e.g., water, carbohydrate-containing beverage) were recommended. In general, intake of clear fluids was permitted until 2 h before the scheduled operation time in the first patient on the list (on-time), and until 4 h before the scheduled operation time in the second and subsequent patients (on-call). However, final decisions were left to individual anesthesiologists. The following data were extracted retrospectively from electronic medical records and anesthesia records in Groups A and B, and prospectively in Group C: age, sex, height, weight, department, American Society of Anesthesiologists (ASA) physical status, difference between scheduled and actual time of entering the operation room, difference between instructed and actual last drinking time, duration of fasting, consumption of 200 mL or more of clear fluids, and adverse reactions (vomiting and hypotension). In Group C, the date of the perioperative management center visit, the interval between that visit and the day of surgery, and the presence or absence of a preoperative visit were recorded. The primary endpoint was the duration of fasting, which was defined as the difference between the time of the last drink and that of entering the operation room. The secondary endpoints were the final volume of clear fluids consumed, the difference between the instructed and actual final time of consumption of clear fluids, and decrease in blood pressure during induction. Decreased blood pressure during induction was defined as administration of ephedrine (8 mg or more), phenylephrine (0.2 mg or more), or initiation of continuous catecholamine administration between the start of anesthesia and the start of surgery. Data are presented as median (interquartile range). Statistical analyses were performed using Fisher's exact test for nominal variables and the Bonferroni method for multiple comparisons. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan),<sup>16</sup> which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria).

## Results

During the study period, 261 patients in Group A, 401 in Group B, and 424 in Group C underwent general anesthesia. After exclusion of 172 patients in Group A, 293 in Group B, and 140 in Group C, 89 patients in Group A (50 on-time and 39 on-call), 108 in Group B (65 on-time and 43 on-call), and 284 in Group C (182 on-time and 102 on-call) were finally included in the analysis.

## Overall

Table 2 shows the characteristics of all study patients, including on-time and on-call. There were significant differences in sex, height, and weight between Groups A, B, and C (56% vs.

『麻酔を受ける患者様へ』

手術前の絶飲時間の見直しに関して

藤田保健衛生大学病院 麻酔科

これまで手術前には、手術当日0時以降絶食・絶飲するのが通例でした。しかし近年では、手術前2時間まで水分を取ることが安全であるばかりでなく、胃腸を休ませる時間が短いほうが手術後の回復が速いことが分かってきました。これに伴い、日本麻酔科学会でも術前絶飲食ガイドラインを作成し、絶飲時間の見直しの動きが広まってきております。

そこで、当院でも、上記ガイドラインに従い、特別に医学的理由がなければ、入室予定時間の2時間前まで水分を取っていただくように昨年より変更いたしました。なお、2件日以降の手術では、入室時間の変更の可能性も考え、4時間前まで水分摂取していただいております。量に制限はありません。欲しいだけの量を十分に飲水していただいて結構です。この時間まで取っていただいてもよい水分は、お茶、お水、ポカリスエット、果肉を含まない果物ジュース、ブラックコーヒー（ミルク入りはダメ）です。牛乳などの他の飲み物は、胃での滞在時間が長いのでお控えください。

ただし患者様の状態によってはこのような指示と異なることがあります。以下に従ってください。

  

	月		日手術予定の		様の
絶食時間は		日			時
絶飲時間は		日			時です。

※ 指示されたお時間までは、量の制限はありません。

※ 欲しいだけ十分に水分摂取してください。

※※ 飲水可能な水分は、お茶、お水、ポカリスエット、果肉を含まない果物ジュース、ブラックコーヒーです。

Figure 1 Instructions to the patient. The actual duration of fasting can be entered (in Japanese). We used this document to explain that safety and rapid recovery are best achieved by not limiting the amount or specifying the type of clear fluids drunk preoperatively.

Table 1 Observation period and intervention method for each group

	Group A	Group B	Group C
observation period	11–30 September 2013	24 March–18 April 2014	22 June–11 July 2020
Educator to patients	none	Anesthesiologist	multidisciplinary intervention
Date of education	none	Mostly the day before surgery	Mostly 2 weeks before surgery
Date of fasting instruction	the day before surgery	the day before surgery	perioperative management center
Description	oral	Document and oral	Document and oral

60% vs. 47%,  $p=0.03$ ; 161 [153, 166] vs. 158 [152, 165] vs. 160 [155, 168] cm,  $p=0.008$ ; 54 [50, 63] vs. 56 [48, 64] vs. 59 [51, 68] kg,  $p=0.02$ , respectively). There were no significant differences in age, ASA status, percentage of general surgery, or percentage of on-call patients. The difference between the instructed and actual last drinking time was significant and was significantly shorter in Group C than in Group A (30 [10, 140] vs. 30 [10, 60] vs. 20 [0, 50] min,  $p=0.003$ ). The duration of fasting was significantly shorter in Group C than in Groups A and B (243 [150, 395] vs. 213 [151, 323] vs. 180 [146, 280] min,  $p=0.01$ ). A significantly greater percentage of patients consumed 200 mL or more of clear fluids in Group B than in Group C (9% vs. 19% vs. 2%,  $p<0.001$ ). There was no vomiting in any of the three groups. The incidence of hypotension was significantly higher in Group C than in Group B (3% vs. 1% vs. 11%,  $p<0.001$ ).

### Subgroup analysis

#### On-time

There were no significant differences in sex, height, weight, ASA status, or percentage of general surgery between Groups A, B, and C. The findings for the on-time patients are presented in Table 3. The difference between the instructed and last drinking time was significantly shorter in Group C than in Groups A and B (30 [10, 420] vs. 30 [15, 60] vs. 25 [5, 40] min,  $p=0.003$ ). The differences between the groups in duration of fasting and consumption of  $\geq 200$  mL of clear fluid were not significant. The incidence of hypotension was significantly higher in Group C than

in Group B (6% vs. 2% vs. 12%,  $p=0.03$ ).

#### On-call

The findings for the on-call patients are listed in Table 4. Patients in Group B were significantly younger than those in Groups A and C (66 [52, 72] vs. 53 [39, 63] vs. 63 [52, 74] years,  $p=0.002$ ). There were no significant differences between the groups in sex, height, weight, ASA status, or percentage of general surgery. The difference between the scheduled and actual time of entering the operation room was significantly shorter in Group C than in Groups A and B (6 [-30, 36] vs. 15 [2, 54] vs. -2 [-51, 16] min,  $p<0.001$ ). Differences between the instructed and last drinking time and duration of fasting were not significant. A significantly higher percentage of patients in Group B than in Groups A and C had drunk  $\geq 200$  mL of clear fluids (13% vs. 37% vs. 3%,  $p<0.001$ ). The incidence of hypotension was significantly higher in Group B than in Group C (0% vs. 0% vs. 9%,  $p=0.02$ ).

Table 5 shows the findings for consumption of clear fluids in Group C. The interval in days between the perioperative management center visit and surgery or preoperative examination did not differ significantly between the  $\leq 50$  mL, 50–200 mL, and  $\geq 200$  mL groups.

## Discussion

We conducted a before-and-after study to clarify the actual situation regarding preoperative restriction of clear fluids in our hospital and to test the hypothesis that the duration of

Table 2 The results for all cases

	Group A (N=89)	Group B (N=108)	Group C (N=284)	P value
Age years	65 [54, 72]	63 [47, 71]	66 [51, 73]	0.28
Sex Female, N (%)	50 (56)	65 (60)	133 (47)	<b>0.03</b>
Height cm	161 [153, 166]	158 [152, 165]*	160 [155, 168]*	0.008
Weight kg	54 [50, 63]	56 [48, 64]	59 [51, 68]	<b>0.02</b>
Body Mass Index kg/m <sup>2</sup>	21.9 [20.1, 23.9]	22.0 [20.2, 24.3]	22.4 [20.2, 25.7]	0.61
ASA	2 [1, 2]	2 [1, 2]	2 [1, 2]	0.50
General surgery, N (%)	34 (38)	39 (36)	96 (34)	0.74
On-call, N (%)	39 (44)	43 (40)	101 (36)	0.37
The difference between the instructed and last drinking time, min	30 [10, 140]*	30 [10, 60]	20 [0, 50]*	<b>0.003</b>
The duration of fasting, min	243 [150, 395]	213 [151, 323]*	180 [146, 280]*	<b>0.01</b>
Clear fluid consumption of 200 mL or more, N (%)	8 (9)	20 (19)*	8 (2)*	<b>&lt;0.001</b>
Vomit, N (%)	0 (0)	0 (0)	0 (0)	—
Hypotension, N (%)	3 (3)	1 (1)*	30 (11)*	<b>&lt;0.001</b>

Bold font:  $p<0.05$ , with a significant difference between \*.

Table 3 The results for on-time

	Group A (N=50)	Group B (N=65)	Group C (N=182)	P value
Age years	65 [58, 72]	67 [53, 73]	66 [51, 73]	0.84
Sex Female, N (%)	27 (54)	37 (58)	84 (46)	0.27
Height cm	162 [153, 167]	158 [152, 165]*	161 [155, 169]*	0.122
Weight kg	55 [50, 64]	57 [48, 65]	60 [51, 68]	0.12
Body Mass Index kg/m <sup>2</sup>	22.0 [19.5, 23.9]	22.6 [19.8, 24.3]	22.2 [20.2, 25.6]	0.40
ASA	2 [2, 2]	2 [2, 2]	2 [2, 2]	0.99
General surgery, N (%)	23 (46)	27 (42)	67 (37)	0.5
The difference between the instructed and last drinking time, min	30 [10, 420]*	30 [15, 60]#	25 [5, 40]**	<b>0.003</b>
The duration of fasting, min	150 [130, 540]	162 [142, 209]	153 [133, 185]	0.16
Clear fluid consumption of 200 mL or more, N (%)	3 (6)	4 (6)	5 (3)	0.31
Vomit, N (%)	0 (0)	0 (0)	0 (0)	—
Hypotension, N (%)	3 (6)	1 (2)*	21 (12)*	<b>0.03</b>

Bold font:  $p<0.05$ , with a significant difference between \* and #.

Table 4 The results for on-call

	Group A (N=39)	Group B (N=43)	Group C (N=102)	P value
Age years	66 [52, 72]*	53 [39, 63]*#	63 [52, 74]#	<b>0.002</b>
Sex Female, N (%)	23 (59)	28 (65)	47 (46)	0.09
Height cm	160 [151, 165]	158 [153, 165]	160 [154, 168]	0.13
Weight kg	54 [48, 63]	56 [50, 60]	57 [51, 69]	0.16
Body Mass Index kg/m <sup>2</sup>	21.8 [20.1, 23.5]	21.6 [20.5, 23.8]	22.7 [20.3, 25.8]	0.78
ASA	2 [1, 2]	1 [1, 2]	2 [1, 2]	0.22
General surgery, N (%)	11 (28)	12 (28)	29 (28)	1
The difference between the scheduled and actual time of entering operation room, min	6 [-30, 36]	15 [2, 54]*	-2 [-51, 16]*	<b>&lt;0.001</b>
The difference between the instructed and last drinking time, min	40 [10, 120]	20 [0, 60]	20 [0, 60]	0.09
The duration of fasting, min	296 [242, 359]	291 [252, 363]	274 [219, 360]	0.58
Clear fluid consumption of 200 mL or more, N (%)	5 (13)*	16 (37)*#	3 (3)#	<b>&lt;0.001</b>
Vomit, N (%)	0 (0)	0 (0)	0 (0)	—
Hypotension, N (%)	0 (0)	0 (0)	9 (9)	<b>0.02</b>

Bold font:  $p < 0.05$ , with a significant difference between \* and #.

Table 5 The results of the relationship between the number of days since perioperative management center and the amount of clear fluid consumed

	≤50 mL (N=112)	50–200 mL (N=164)	≥200 mL (N=8)	P value
Number of days since perioperative management center, day	17 [8, 25]	16 [10, 27]	23 [6, 29]	0.81
Preoperative examination Yes, N (%)	44 (39)	76 (46)	5 (63)	0.3

preoperative clear fluid restriction can safely be shortened by multidisciplinary interventions. To achieve this, anesthesiologists provided instructions that incorporated a recommended 2 h of fasting period before on-time surgery and 4 h before on-call surgery. We found that patients' compliance with the duration of fasting tended to improve with multidisciplinary interventions at the perioperative management center. Previous studies have not identified this.<sup>11–15</sup>

Preoperative fasting at the time of anesthesia induction is considered necessary because of the risk of aspiration. However, in the 1980s it was reported that emptying of liquid from the stomach takes approximately 1 h.<sup>17,18</sup> A meta-analysis concluded that short periods of fasting did not increase the risk of complications over that associated with prolonged fasting.<sup>7</sup> Prolonged fasting reportedly results in difficulty and discomfort with re-introduction of food.<sup>8</sup> Currently, guidelines in many countries permit preoperative drinking for up to 2 h before surgery.<sup>19</sup>

There have been studies on the duration of restriction of clear fluids in many countries worldwide. In Lebanon, approximately 90% of anesthesiologists are aware of the ASA recommendations on fasting and are state that they are willing to comply with them. However, only 45% allow fluid consumption up to 2 h before the procedure.<sup>12</sup> In a study in the Netherlands, 67.8% of patients were asked to fast for a long time, 20.8% being asked to fast for more than 12 h.<sup>20</sup> In a multinational survey of anesthesiologists in Canada, Australia, New Zealand, and Europe, 85% of anesthesiologists claimed to follow the guidelines; however, approximately 50% did not.<sup>11</sup> Thus, although some anesthesiologists reportedly instruct fasting for longer than recommended, despite their countries' guidelines, in this study, fasting instructions were given as per protocol. The difference between the instructed and last drinking time was small (within 40 min) for both on-time and on-call surgery. It was significantly shorter in Group C for on-time surgery and tended to be shorter for on-call surgery.

However, subgroup analysis showed that the duration of fasting was 274 min, even in Group C, particularly for on-call. This was because the instructed drinking time was up to 4 h before the on-call time. The commonest reason for not adhering to the guideline of allowing drinking of water up to 2 h prior to surgery in previous international surveys was concerns regarding variable operation room schedules.<sup>11,12</sup> However, in the former of these surveys, only about 15% of respondents reported that surgery was often performed earlier than scheduled, and only about 5% reported that this was often a problem. Approximately 15% of anesthesiologists reported operations being moved to an earlier time than planned. Only 5% of anesthesiologists stated that these schedule changes frequently caused problems.<sup>11</sup> In the present study, there was very little difference between the scheduled and actual time for entering the operation room for on-call surgery. This finding suggests that anesthesiologists play a role in shortening the duration of abstinence from clear fluids for on-call surgery. However, in the present study, the difference between the instructed and actual last drinking time was significantly shorter in Group C for on-time surgery and tended to be shorter for on-call surgery. These findings suggest that educating patients about drinking clear fluids through multidisciplinary interventions in the perioperative management center setting may be useful in shortening the duration of fasting.

In contrast, there is no clear recommendation regarding the volume of fluid that should be consumed preoperatively. Studies that have been used as the basis for guideline recommendations have varied from citing 100 mL to no limit.<sup>21</sup> Preoperative drinking of 400 mL of carbohydrate-containing beverages can reportedly reduce insulin resistance.<sup>22</sup> In accordance with published reports,<sup>23–25</sup> we recommend that patients drink a full glass (200 mL) of clear fluid. Therefore, in this study, we used 200 mL as the cutoff when examining the volume of clear fluids consumed. Consequently, the percentage of patients who drank ≥200 mL of clear fluid was the highest in Group B (19%) and significantly lower in Group C (2%).



Hypotension during anesthesia is harmful and one-third of hypotensive episodes occur between induction of anesthesia and the initial incision.<sup>26</sup> Prolonged preoperative fasting has been reported to significantly increase circulatory variability during induction compared with drinking clear fluid up to 2 h before surgery, suggesting that preoperative drinking may reduce hypotension during induction.<sup>9</sup> In contrast, some researchers have reported that duration of fasting is not associated with hypotension during induction.<sup>27</sup> Thus, the relationship between preoperative drinking and hypotension during induction is unclear. We hypothesized that drinking large volumes of clear fluids and a short fasting time would minimize hypotension during induction. In the present study, the duration of fasting was 30–60 min shorter in Group C than in Groups A and B, but 7% and 17% fewer patients in Group C than in Groups A and B, respectively, drank more than 200 mL of water. The percentage of patients with hypotension was highest in Group C and lowest in Group B. These results suggest that the volume of water consumed may contribute more strongly than the duration of abstinence from fluids to lowering blood pressure at the time of induction. They also suggest that explaining the policy on consumption of fluids in the ward after admission, as in Group B, might increase the volume of clear fluids consumed. In the future, combining post-hospitalization explanations by ward nurses with multidisciplinary interventions in preoperative management centers may contribute to shortening the duration of fasting and increasing the volume of clear fluids consumed.

This study had some limitations. It was conducted over only 3 weeks, and Groups A and B were studied retrospectively, whereas Group C was studied prospectively. The frequency of hypotension and vomiting and volume of clear fluids consumed may have been influenced by the study design.

## Conclusion

We evaluated the status of preoperative drinking of clear fluids in our hospital. Anesthesiologists provided instructions that incorporated the recommended duration of fasting and patient compliance with that duration tended to improve with multidisciplinary interventions in our perioperative management center. However, this intervention did not affect the percentage of patients who drank more than 200 mL of clear fluids.

## Conflict of Interest

The authors declare no conflicts of interest associated with this manuscript.

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