



Preoperative fasting time and reasons for prolongation in pediatric patients  
undergoing elective surgery in Tikur Anbessa Specialized Hospital, Addis Ababa  
Ethiopia 2023/24

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May 2024

DECLARATION OF THE PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as per terms and Conditions of the Department and College, in effect at the time of grant is forwarded as the Result of this application.

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## Abstract

**Background:** Preoperatively all patients, including pediatric patients are ordered to fast for a specified duration in fear of perioperative aspiration. However, the risk of aspiration is recently being reported to be minimal and the actual duration of fasting in these patients is longer than the recommendations resulting in discomfort and possible metabolic derangements intraoperatively.

**Methods:** An institution-based prospective cross-sectional questionnaire-based study was performed on 252 pediatric patients between the ages of 1 day to 12 years who are scheduled to undergo elective surgery at Tikur Anbessa Specialized Hospital. The parents or caregivers were asked the time and type of the last feeding of the child when the child came to the OR and further information was gathered from the patient chart. Parent's level of information about NPO times and reasons behind any deviation from recommendation were also recorded. Data was collected using interviews and descriptive analysis with mean and standard deviation used followed by binary logistic regression used to identify associated factors in prolongation.

**Results:** Two hundred fifty-two participants were included. The mean and SD of actual fasting times were  $10.23 \pm 3.7$  hours for clear fluids,  $6.1 \pm 2.06$  hours for breast milk and  $12.39 \pm 2.8$  hours for light food. 92.3% of children had prolonged actual fasting times to clear fluids above 2 hours from recommendation while its 40% and 81% when it comes to breastmilk and light food, respectively. 30.2% of the parents blame inappropriate information and order delivered preoperatively by the treating team as the cause for their child fasting longer. Age of the child, and appropriateness of information delivered to the caregivers was found to significantly affect actual fasting times of children.

**Conclusion:** Pediatric patients scheduled to undergo elective surgery are subjected to unnecessarily prolonged fasting times above the recommendation put forth by ASA which is found to be influenced by age of the child and appropriateness of information delivered to the caregivers.

## Acknowledgment

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## List of abbreviations

AAU – Addis Ababa University

ACCPM – Anesthesiology, Critical care and Pain Medicine

ASA – American Society of Anesthesiologists

BP – Blood Pressure

CI – Confidence Interval

ERAS – Enhanced Recovery After Surgery

ESAIC – European Society of Anesthesiology and Intensive Care

HR – Heart Rate

MAP – Mean Arterial Pressure

NPO – Nil Per Os

OR – Operation Room

PO – Per Os

SD – Standard Deviation

TASH – Tikur Anbessa Specialized Hospital

## Introduction

### Background

Prevention of perioperative pulmonary aspiration is part of the process of preoperative evaluation and preparation of the patient. [9, 21] Perioperative pulmonary aspiration is defined as aspiration of gastric contents occurring after induction of anesthesia, during a procedure, or in the immediate postoperative period. [9, 21] The well-known report by Mendelson regarding gastric aspiration in 1946 is a basis for this concern. [25] The main and easiest approach to this goal is preoperative fasting which is avoiding oral intakes before a procedure.

The current practice guidelines indicate that the gastric emptying time of different types of feeds is different regardless of age, sex or BMI and a single time cut-point may not be appropriate for each of them [11, 21]. For instance, breast milk was associated with less gastric emptying time when compared to formula milk. [10] For this reason it is recommended to have different minimum fasting times for different forms of feeding depending on their studied gastric emptying times. ASA practice guidelines of 2017 and the 2023 update recommend a minimum fasting time of 8 hours for fried food, 6 hours for light meal or non-human milk such as formula or animal milk, 4 hours for human breast milk and 2 hours for clear fluids. [9, 21] Even more liberal fasting times is recommended by the European society of anesthesiology and intensive care (ESAIC) which suggests a minimum fasting hour of 1 hour for clear fluids, 3 hours for breast milk, 4 hours for formula milk and light solid food while also indicating comorbidities like gastric reflux disease, obesity, isolated type 1 diabetes mellitus, congenital cardiac disease and gum chewing did not increase gastric emptying times. [18]

However, multiple recent studies have shown that perioperative pulmonary aspiration is not as common as thought to be even in a more liberal fasting practice. [5, 8, 26]

On the other aspect prolonged fasting may also have negative outcomes regarding intraoperative hemodynamics, glycemia and preoperative patient anxiety, discomfort and postoperative satisfaction. In spite of recent studies showing rare events of pulmonary aspiration with less and less amount of time, the guidelines have been slow to effect change in themselves or practice of others.

## Statement of problem

Perioperative pulmonary aspiration is a complication feared by most if not all anesthetists across the world. Despite the fear of its occurrence, it is a relatively rare incident occurring in approximately 3 out of 10,000 patients that received anesthesia. [5] Even in a liberal perioperative feeding plan its incidence is not that common.

Preoperative fasting is recommended in both adults and pediatrics to decrease complications like gastric aspiration. Prolonged fasting, however, can result in discomfort, irritability and hypoglycemia and hypovolemia [3, 12]. Despite this fact both adults and pediatric patients report longer nil per Os times than the standard guideline [15, 16, 17]. This means that they are likely to experience hunger and thirst, hypoglycemia, hypovolemia and have less satisfaction than those who fasted according to the protocol postoperatively. [12, 13, 14] There are a number of reasons for the prolongation of fasting times but the main ones found to be significant are inappropriate orders by ward nurses and changes in surgical schedule. [15, 17]

## Significance of study

Strict adherence to the fasting protocol forwarded by ASA practice guidelines 2023 can be difficult. [21] The ambiguity of starting time of cases scheduled after the first case and surgical schedule change, inappropriate NPO orders by physicians or ward nurses and inadequate education of parents regarding the appropriate fasting times with the advantage of a clear fluid 2 hours prior to scheduled procedure among other reasons contribute to the irregularity in adherence. [15, 16, 17]

This study aims to evaluate the duration of fasting of pediatric patients that are elective surgical patients. We will also try to evaluate factors that may be contributing to any deviation from the protocol.

Identifying the principal reasons for poor adherence to the guidelines can help in formulating a plan for reform which in turn can achieve better patient perioperative care, satisfaction and less complications related to inadequate or excessive fasting time in children undergoing elective surgery and possibly relief anxiety among care givers of the children. It can also be a base for future research for improvement towards better adherence.

## Literature review

Prevention of perioperative pulmonary aspiration is part of the process of preoperative evaluation and preparation of the patient. [9] The Risks of which are higher caused by regurgitation of gastric contents added with the fact that the patient has depressed upper airway protective reflexes. Avoiding feeding before surgery and anesthesia has its origins from several reports of pulmonary aspiration especially from obstetric patients by Mendelson in 1946. [25] This resulted in a widespread use of NPO after midnight orders in the aim to decrease such perioperative pulmonary aspiration. This has got recent attention and updated recommendations are being published by American society of Anesthesiology (ASA) and European society of Anesthesiology and intensive care (ESAIC) in light of recent evidence of the risk of aspiration versus the harm of prolonged fasting, especially in pediatric patients. [21]

According to ESAIC guideline of 2022 which was formulated after a meta-analysis of different studies recommend a 1 hour fasting period for clear fluids and 3 hour fasting period for breast milk. They also suggest 4 hours fasting duration for light solid food and non-human milk. While these recommendations were formulated after assessing risk of aspiration of gastric content during induction of anesthesia in normal population, they also tried to look for any condition that might prolong gastric emptying. However, factors such as gastric reflux disease, obesity, isolated type 1 diabetes mellitus, congenital cardiac disease and gum chewing did not increase gastric emptying times. [18]

However, Aspiration of gastric contents perioperatively were found to be 3 in 10,000 and suspected but not confirmed in 14 in a study conducted by Andersson H in 2015. The study retrospectively examined 10,015 pediatric patients between January 2008 and December 2013 to determine incidence of perioperative pulmonary aspiration in pediatric patients allowed unlimited perioperative intake of clear fluids. [5]

Moreover, a 2009 Cochrane systemic review of 25 trials involving 2543 children by Brady M found clear fluids preoperatively up to 120 minutes before procedure did not result in increase in gastric volume or a change in pH compared to those children who fasted for longer durations. [8]

The objective of keeping preoperative patients fasting is to decrease the risks of perioperative pulmonary aspiration while also preventing an unnecessarily long fasting interval. Unfortunately, fasting far beyond recommendation is a common problem among many setups across the globe. The old ways of “nil per Os after midnight” have taken deep roots.

As an instance, a multicenter observational study performed by Beck C et al on 3324 children to evaluate real fasting times found significantly prolonged fasting is common with deviation from guideline of >2 hours in 34.2% for clear fluids and 54.7% for light meals. [2]

The duration of preoperative fasting and its effect on hunger and thirst was also investigated by Aroonpruksakul N, in 2022. 309 patients were included and the actual duration of preoperative fasting was found to be longer than the recommendation for both food and liquid while high hunger score was reported by 76.4% of the participants. However, no direct correlation could be made between fasting time for solids and clear fluids to hunger and thirst, respectively. [4]

In another two studies similar result was found with majority of the pediatric patients involved having a prolonged fasting time before procedures while one of the studies reporting higher hunger and thirst in the ones that fasted for longer durations than recommended, the other found that majority of the NPO orders were non-compliant with the guidelines. [19, 23]

The issues with prolonged fasting are apparent with these studies with increased discomfort of children while shorter fasting times have a proven advantage. While in adults, 179 laparoscopic surgery patients were included in a study that found better comfort levels and GI function recovery with less thirst, hunger and discomfort. When fasting times were decreased from 12 to 6 hours for solids and 6 to 2 hours for clear fluids. [6]

Single perioperative limited carbohydrate drink was also found to improve patient comfort and satisfaction without increasing the risks of aspiration in a study in 2011 by Bopp C in 123 patients when compared to a control group who were kept nil per Os after midnight. The experimental group received 200ml of carbohydrate rich drink up to 2 hours before anesthesia and they had less thirst and hunger and better satisfaction. [7]

Although shorter NPO times are not associated with increased risk of aspiration while having the benefits of increased patient comfort and satisfaction, prolonged fasting is usually encountered.

This prolonged fasting, in addition to having a negative impact on satisfaction and behavioral effects, it is also associated with untoward effects on glycemia and hemodynamics.

Rattanapittayaporn et al studied 402 pediatric patients undergoing cardiothoracic surgery in a retrospective cohort in 2023 and found that prolonged fasting of more than 14.4 hours had increased mortality, bacteremia and hypoglycemia. [1]

Friesen, R in 2002, sought to determine whether the duration of preoperative fasting affects the decrease in blood pressure during halothane anesthesia among 250 pediatric patients. After induction and halothane administration a greater change in systolic and mean arterial pressure were seen in the 1-6 months age group who fasted 8-12 hours than in those fasting 0-4hours. [12]

In another study effect of preoperative fasting duration on blood sugar and hemodynamics was studied across 50 children and it showed there was significant impact on systolic blood pressure but not on blood glucose. [13]

Enhanced Recovery After Surgery strategy (ERAS) strategy of fasting was compared with conventional preoperative fasting in a study among 303 children with ages >3months by Ying Y in 2022. It concluded that the ERAS group had a shorter preoperative fasting time for food, liquids, higher blood glucose level, lower thirst and shorter time to postoperative feeding. Overall. it showed there was increased satisfaction without increasing risk of perioperative aspiration. [20]

The reasons behind this inadequate adherence were not completely understood but there are some studies that provide insight and add the advantage of showing what addressing these factors will do in the fasting duration and, by continuation, patient satisfaction.

One study that investigated the duration of preoperative fasting and its causes was performed in 2013 at a tertiary care hospital in India. Cross-sectional study of 50 children below 15 years were involved and found that fasting times were much longer than recommended. A reaudit was done 6 months later after training the ward nurses and it resulted in a significant reduction in fasting time from a mean of 9 hours to 4 hours. Incorrect NPO orders by ward nurses and change in surgical schedules significantly resulted in prolongation of fasting times. [15]

A similar audit with similar results was one which assessed fasting times and effect of intervention to result in better adherence was done in 2022 by Rawlani, S. The initial audit on 85 children saw that fasting times were significantly prolonged. Following interventions which increased awareness among ward nurses and surgeons a reaudit was done 4 months later which brought about better adherence to fasting times. [17]

Reducing the duration of time children are kept fasting before a procedure to the minimum recommended by the protocol to decrease the complications of aspiration while avoiding the risks of hypoglycemia and hypovolemia is important. One method to achieve this is by improving patient understanding of preoperative fasting which in turn can increase compliance with fasting recommendations as found in a study by Khoyratty, S in 2011. [14]

The knowledge of nursing staff regarding pediatric preoperative fasting in a tertiary pediatric center and a general hospital was studied by Wong A in 2022. In this study that involved 319 participants, 50-80% of the participants were correct for the fasting time for children. Although the majority of staff claim to be able to access the hospital guidelines, knowledge of these guidelines can be improved to better patient care and outcome. [24]

There is a paucity of studies and data regarding this topic but it wouldn't be wrong assuming the usual finding of prolonged fasting in preoperative pediatric patients. On 2021 a study in Tikur Anbessa specialized hospital to elucidate the relationship between preoperative fasting duration and hypoglycemia during anesthesia was done. In this cross-sectional study of 258 pediatric patients, hypoglycemia has significant association with prolonged fasting and order of nil per Os. These children were exposed to unnecessarily prolonged fasting that can result in unnecessary morbidity. [3]

The duration of preoperative fasting for elective surgery at the University of Gondar Hospital was studied in 2013 by Gebremedhin, E using a cross-sectional study of 43 patients. Most patients had a prolonged fasting time than recommended for food (92%) and fluids (95%). [16]

In a comparable study in 2020 by Yimer A to assess adherence to preoperative fasting guidelines and associated factors among pediatric patients undergoing elective surgery in Addis Ababa public hospitals in Ethiopia included 279 pediatric patients and found the majority of the

participants (n = 251, 89.96%) did not follow the guidelines for preoperative fasting. Although this study did not clearly state the suspected reasons for the result. [27]

This study will be conducted to identify possible reasons for the prolongation of fasting in children and the magnitudes of this prolongation to try to be step stone for future studies that might aim to evaluate effectiveness of interventions to mitigate this issue. It could also help identify the gaps in care which can be used to formulate a point of improvement.

## Objectives

### General objectives

The study seeks to uncover the duration of time pediatric patients are kept fasting prior to scheduled procedure and any factors that might contribute to prolonging the intended NPO time in pediatric patients undergoing elective surgery at Tikur Anbessa Specialized Hospital.

### Specific Objectives

- To measure the time between last solid meal and last fluid meal before the procedure in pediatric elective surgery patients.
- To know the level of parent's knowledge on the reason behind keeping the child fasting prior to procedure.
- To identify any associated factors that might alter the intended fasting time in these patients.

## Methodology

### Study area and period

The study was conducted at Tikur Anbessa specialized hospital (TASH) which is a specialist and sub-specialist tertiary care teaching located in Addis Ababa, Ethiopia. Established in 1972 it is the largest referral hospital in a country of over 110 million people. TASH is the main teaching hospital for undergraduate and also postgraduate teaching as well as where specialized clinical services that may not be available in other public or private institutions is provided. It about 700 beds and about 15 operation theatres and more than 900 health professionals in different specialties dedicated to providing health care services and the various departments residents under specialty training in the school of medicine also provide patient care in the hospital.

The study was performed from November 2023 to March 2024 at the study area.

### Study design

An institutional based prospective cross-sectional study was performed on elective pediatric surgical patients that meet the inclusion criteria.

### Population

#### Source population

All pediatric surgical patients that underwent surgical procedure during the study period.

#### Study Population

All elective pediatric patients from newborn to the age of 12 years that underwent elective surgical procedure at Tikur Anbessa Specialized Hospital.

### Inclusion criteria

Pediatric patients scheduled to undergo elective surgery between the ages 0-12 years

## Exclusion criteria

- Patients that require GI surgery requiring GI preparation
- Patients undergoing emergency surgery
- Patients that should be kept NPO prior to the scheduled surgery for other reasons

## Sample size

The sample size of the study ( $n$ ) was estimated using the single population proportion by assuming the prevalence of non-adherence to recommended fasting times to be 0.5 (50%) ( $p$ ) among pediatric elective surgical patients computed with 95% confidence interval ( $z$ ) and 5% margin of error ( $d$ ). Using this the estimated sample size will be calculated using the following formula which results 384 participants.

$$n = \frac{(z_{1-\alpha/2})^2 \times p(1-p)}{d^2}$$
$$n = \frac{(1.96)^2 \times 0.5(1-0.5)}{0.05^2}$$
$$n = 384$$

Where  $n$  = sample size

$P$  = proportion of 50%

$d$  = margin of error

$z_{1-\alpha/2}$  = standard normal variate

Since the number of operated elective pediatric surgical patients at the study area are less than 10,000 correction formula is employed. The total number of pediatric patients undergoing elective surgical procedure in a year at TASH in a 2021 audit was 590.

$$n_{adj} = \frac{n}{1 + \frac{n}{N}}$$

$$n_{adj} = \frac{384}{1 + \frac{384}{590}}$$

$$n_{adj} = 232$$

Accounting for a 10% non-response rate the final sample size would be 255.

### Sampling method

All pediatric patients that meet the inclusion criteria during the study period were included with total enumeration sampling until the sample size was met. Since surgical schedule sequence varies and is suspected to affect the outcome and there are unpredictable number of patients scheduled in a day. So, such sampling method is chosen for better homogeneity of selected participants in the expense of randomization.

### Data collection method and procedure

Data was collected by a self-administered structured questionnaire adapted from similar previous studies. Data collection was performed from the caregivers of the pediatric patients preoperatively and from the chart intraoperatively. The participants were asked to provide the data at the preoperative waiting area of the operating theatre (OT). Additional data such as the fasting order, planned procedure, diagnosis and such information the caregivers may not know was obtained from chart review of the child. Data collectors which will be anesthesia providers performing the anesthetic of the patient will be trained in the pilot study. They will collect data consisting of socio demographic characteristics and preoperative assessment, preoperative fasting orders were asked and reviewed patients' medical record in reception area before the anesthesia. Information's on types of food entails, NPO hours, reason why their child has fasting protocols, and possible reason for the prolongation of the fasting time.

## Study variables

### Independent variables

Age, sex, weight, diagnosis, procedure to be done, ward of admission, scheduled number, preoperative fasting instructions given, Personnel giving the fasting instructions, parents' understanding of preoperative fasting and concern of cancellation if non-adherent

### Dependent Variables

Duration of time fasting for solids and liquids prior to procedure, Nature of clear fluid taken prior to procedure if any and possible reasons by the caretakers for prolongation of the child's fasting time.

### Operational definitions

Elective procedure – surgical or other procedure performed after the patient is scheduled, informed, optimized and prepared for the procedure in the days prior with a procedure that is not emergent.

Preoperative fasting – avoiding oral intake prior to scheduled or planned procedure to prevent complications.

Pediatric patient – any child that has an age from newborn to 18 years. But for the purpose of the study, we will be using ages from newborn to 12 years as a pediatric patient.

Carbohydrate-rich clear fluids – fluids that have high content of simple sugars. Examples can be soft drink, tea with sugar and the likes.

Prolonged fasting – prolonged fasting will be considered in patients who have fasted for more than 2 hours from the ASA recommendation. This makes

Actual fasting time – duration from last feeding of that food item (either clear fluids, breast milk, formula milk or light food) to induction of anesthesia.

## Data Analysis procedure

Data was manually checked for errors and missing data and cleaned. After that it was entered into SPSS. Then it was summarized by descriptive statistics into tables and charts. Bivariate logistic regression analysis was performed to identify associated factors for prolonged fasting based on P value of  $<0.25$  and after that multivariate logistic regression was used with P value of  $<0.05$  for avoiding any confounding factors.

## Data quality management

To assure quality of the data, properly designed data collection tool was prepared and informal training given to data collectors about objectives of the study as well as to collect the complete and necessary data from the child's care giver and patient's chart. Additionally, on each data collection day, the collected data was reviewed and checked for its completeness by data collector and then by the principal investigator.

## Ethical consideration

Ethical clearance was obtained from department of anesthesiology, critical care and pain medicine. Objective of the study was explained and permission obtained from the clinical service coordinator of the hospital. Formal verbal consent was obtained from the caregivers of the participants prior to data collection. Confidentiality of the patients was assured by avoiding publication of their identities or any information disclosing personal data.

## Results

### Sociodemographic characteristics

There was a total of 252 data collected with a 98.9% respondent rate. Data was collected from November 2023 to march 2024. The demographic data of the respondents are detailed in the [table below] with children aged 1day-6months of 40(15.9), 7 months to 2 years old 80 (31.7%), 3 to 5 years of age 62 (24.6%) and 6 to 12 years age 70 (27.8%). 158 (62.7%) were male. The caregiver who was the primary source of information was the mother in 210 (83.3%), the father in 38 (15.1%) and other relative in 4 (1.6%). Children who are ASA 1 physical status were 162 (64.3%) while those who were ASA 3 were 22 (8.7%)

Table 1- Sociodemographic and baseline characteristics of pediatric elective surgical patients in Tikur Anbessa Specialized Hospital 2023/24 (N=252)

Variable	Category	N (%)
Age	1 day to 6 months	40 (15.9)
	7 months to 2 years	80 (31.7)
	3 years to 5 years	62 (24.6)
	6 years to 12 years	70 (27.8)
Sex	Male	158 (62.7)
	Female	94 (37.3)
Caregiver	Mother	210 (83.3)
	Father	38 (15.1)
	Other	4 (1.6)
ASA Physical Status	ASA 1	162 (64.3)
	ASA 2	68 (27.0)
	ASA 3	22 (8.7)

## Preoperative fasting time information source

Before the planned elective surgery, the caregivers were informed of the necessary fasting durations prior to the procedure. This was accomplished by different staff of the hospital the majority being done by anesthesia provider 128 (50.8%) followed by member of the surgical team 90 (35.7), ward interns or other ward physician 12 (4.8%) and nurses 18 (7.1%). However, in 4 (1.6%) the caregivers of the children reported to receiving no formal information.

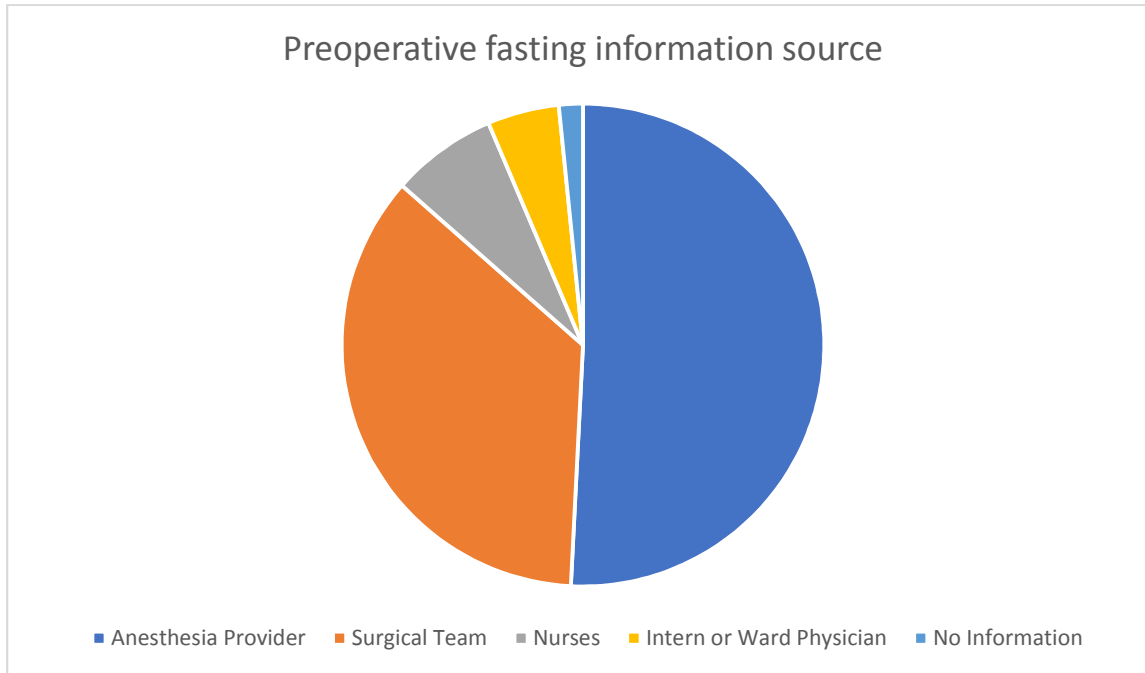


Figure 1 Percentage of caregivers who received preoperative fasting information from different members of the treating team, Tikur Anbessa Specialized Hospital, 2023/24 (N=252)

## Surgical Specialty

Based on surgical specialty for which the participants are scheduled those undergoing abdominal surgery were 92 (36.5%), urologic surgery were 70 (27.8%), orthopedic surgery were 42 (16.7%), ENT surgery were 22 (8.7%), cardiac surgery were 14 (5.6%), thoracic surgery were 10 (4%) and neurosurgery were 2 (0.8%).

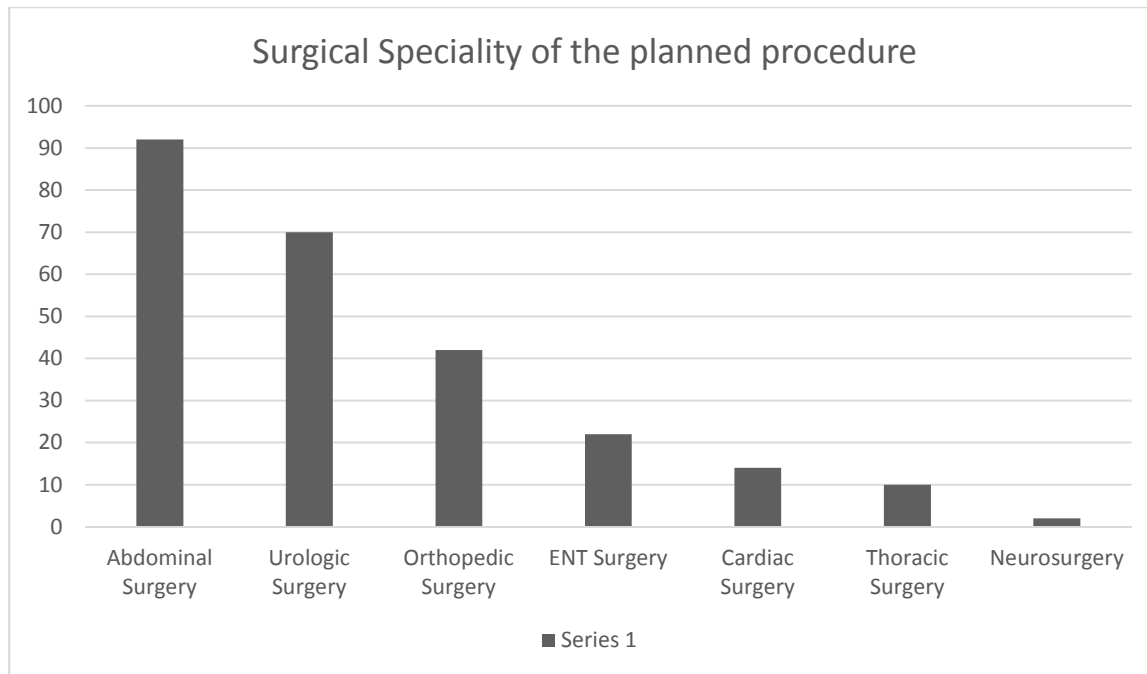


Figure 2- Number of children scheduled and operated by surgical specialty, Tikur Anbessa Specialized Hospital, 2023/24 (N=252)

### NPO times

The mean actual fasting times, which is the time between last feeding to induction, was  $10.23 \pm 3.7$  hours (range 2.2 to 18.8 hours) for clear fluids,  $6.1 \pm 2.06$  hours (Range 2.8 to 12 hours) for breast milk among 60 children and  $12.39 \pm 2.8$  hours (range 6.6 to 18.8 hours) for light food or non-breast milk. With the presumed induction time of 8am for all cases regardless of scheduling means all parents are advised with the presumed induction time of 8am. Therefore, while using the time from last feeding to 8am, the mean fasting times are  $8.14 \pm 3.07$  hours (range 2 to 14 hours) for clear fluids,  $4.5 \pm 1.2$  hours (range 2 to 8 hours) for breast milk and  $10.1 \pm 2$  hours (Range 6 to 16 hours) for light food.

### Prolonged fasting times

Adherence to fasting recommendations were also assessed and prolongation above 2 hours deemed prolonged fasting. 192 (92.3%) of the children had prolonged actual fasting time to clear fluids while when considering actual fasting for any food item the result was 206 (81.7%). 162 (64.3%) children had fasted more than 4 hours above the recommendation.

When considering the incidence of prolonged fasting more than 2 hours above recommendation to the presumed induction time of 8am for clear fluids and any food item it shows that 168 (80.8%) and 166 (65.9%), respectively.

Table 2 - Incidence of prolonged fasting times from last meal to induction or to presumed induction time of 8am by different type of meal in Tikur Anbessa Specialized Hospital 2023/24 (N=252)

Last meal by the child before surgery		N (%)
Clear fluids	< 2 hours above recommendation from 8am	40 (15.9)
	< 2 hours above recommendation from induction	16 (7.7)
	> 2 hours above recommendation from 8am	168 (80.8)
	> 2 hours above recommendation from induction	192 (92.3)
Breast milk	< 2 hours above recommendation from 8am	54 (90)
	< 2 hours above recommendation from induction	36 (60)
	> 2 hours above recommendation from 8am	6 (10)
	> 2 hours above recommendation from induction	24 (40)
Any feeding	< 2 hours above recommendation from 8am	86 (34.1)
	< 2 hours above recommendation from induction	46 (18.3)
	> 2 hours above recommendation from 8am	166 (65.9)
	> 2 hours above recommendation from induction	206 (81.7)
	> 4 hours above recommendation from 8am	118 (46.8)
	> 4 hours above recommendation from induction	162 (64.3)

The total number of children that had breast feeding were 60 and the adherence to ASA fasting recommendation was 90% when considering 8am assumed induction time but that declines to 60% when taking actual induction time.

#### Surgical scheduling, fasting information delivery and reasons to prolonged fasting according to the caregivers

From 252 participants 110 (43.7%) were scheduled to be operated first, 84 (33.3%) were scheduled second, 54 (21.4%) were third in the schedule and 4 (1.6%) were fourth on the schedule. There were 74 (29.4%) schedule changes.

Information on required preoperative NPO times were provided to the caregivers by different members of the treating team. Majority of them 50.8% (N=128) received their information from their anesthesia provider while 35.7% (N=90) received it from their surgeon or a member of the surgical team. 4 (1.6%) caregivers reported that they received no information. When the information delivered was compared to ASA recommendation 61.1% was appropriate and in accordance with the guidelines while 38.9% showed deviation in one or more aspects. While observing for the order on the patient's chart regarding fasting time 42.9% (N=108) was written by both the surgical and anesthesia team members while 27% (N=68) were by anesthesia provider only and 20.6% (N=52) by surgical team only. 8.7% (N=22) of the patient's charts did not have any order regarding fasting times. From these only 46% (N= 116) were in accordance with ASA guidelines while 19% (N=48) partially were accurate. 34.9% (N=88) of the orders were not in accordance with the recommendations with majority being NPO after midnight orders.

Caregivers reported the reason for the prolongation of fasting time of the child was due to inappropriate information from their treating team in 76 (30.2%) and inconvenience to feed the child or child not wanting to feed in 80 (31.7%).

The mean time the children took from the time they were called to the OR to the actual induction time was  $51.46 \pm 25$  minutes.

### Prolonged fasting above recommendations and their associated factors

The available sociodemographic variables and baseline characteristics of the participants were assessed for association with overall prolonged fasting times. Among the variables age, surgical procedure specialty, ASA physical status, appropriateness of information given to caregivers and caregivers understanding of the information provided were found to be possible factors for prolongation of actual fasting times above 2 hours.

The child's age was found to significantly affect actual fasting times where increasing age also increased the finding of prolonged actual fasting above 2 hours from the ASA recommendation. This was also found to have significant association with multinomial logistic regression analysis where, compared to children aged under 6 months, those aged at 7 months to 2 years [AOR 4.66, 95% CI (1.62-13.36), p=0.04] and those between 3 years to 5 years [AOR 16.9, 95% CI (4.55-

62.94),  $p < 0.01$ ] had a 4.6-fold and a 16.9-fold higher likelihood of having prolonged actual fasting times, respectively.

There was also statistically significant relationship between appropriateness of fasting times information delivered to the caregivers. Parents or caregivers who did not receive appropriate information preoperatively regarding fasting times in accordance with ASA recommendations had significantly higher incidence of prolonged actual fasting times in the children [AOR 3.65 (1.02-13.00)  $p = 0.045$ ].

ASA physical status was also found to affect fasting times significantly with higher ASA classes having less prolonged fasting times above recommendation [COR 2.23 95% CI (1.26-3.95)]. However, this relationship was lost when evaluating for confounders in multinomial logistic regression.

Table 3- Factors associated with prolonged actual fasting time of pediatric elective surgical cases in Tikur Anbessa Specialized Hospital in 2023/24 (n=252)

Variables		Prolonged actual fasting times above 2 hours from recommendation		Odds ratios (95% CI)		P-value
		Yes N (%)	No N (%)	COR (95% CI)	AOR (95% CI)	
Age	1day – 6 months	14 (35)	26 (65)	1.00		<0.001
	7months – 2 years	70 (87.5)	10 (12.5)	<b>13 (5.14-32.88)</b>	<b>4.66 (1.62-13.26)</b>	<b>0.04</b>
	3 years – 5 years	58 (93.5)	4 (6.5)	<b>26.92 (8.08-89.7)</b>	<b>16.9 (4.55-62.94)</b>	<b>&lt;0.01</b>
	6 years – 12 years	64 (91.4)	6 (8.6)	<b>19.8 (6.8-57.14)</b>	<b>3.76 (0.81-17.45)</b>	<b>0.09</b>
Surgical Procedure by specialty	Abdominal Surgery	60 (65.2)	32 (34.8)	1.00		0.55
	Urologic Surgery	66 (94.3)	4 (5.7)	8.8 (2.93-26.34)	6.36 (1.70-23.72)	0.06
	Orthopedic surgery	42 (100)	0 (0)			0.997
	Others (ENT, Cardiac, Thoracic, Neurosurgery)	38 (79.2)	10 (20.8)	2.02 (0.89-4.59)	1.85 (0.53-6.43)	0.328
Change in schedule	Yes	54 (73)	20 (27)	1.00		
	No	152 (85.4)	26 (14.6)	2.16 (1.11-4.19)	1.54 (0.65-3.63)	0.322
ASA class	ASA 1	142 (87.7)	20 (12.3)	1.00		0.216
	ASA 2	48 (70.6)	20 (29.4)	0.33 (0.16-0.68)	0.43 (0.16-1.12)	0.085
	ASA 3	16 (72.7)	6 (27.3)	0.67 (0.37 – 0.13)	0.55 (0.13-2.32)	0.424
Appropriate information delivered to the caregivers	Yes	112 (72.7 – 27.3)	42 (27.3)	1.00		
	No	94 (95.9)	4 (4.1)	<b>8.8 (3.04-25.47)</b>	<b>3.65 (1.02-13.00)</b>	<b>0.045</b>
Caregiver understood and comfortable with information delivered	Yes	160 (78.4)	44 (21.6)	1.00		
	No	46 (95.8)	2 (4.2)	6.32 (1.47-27.08)	2.55 (0.46-14.15)	0.28

## Discussion

This observational study shows that a majority of children scheduled to undergo elective surgery are subjected to unnecessarily prolonged fasting hours prior to their procedure. The prevention of a perioperative aspiration event is the primary reason for preoperative fasting but inappropriate orders and lack of knowledge of the benefits of shorter fasting times seem to play a role.

Unfortunately, inability to predict exact induction times and possible unplanned schedule changes together with inconveniences to feed children to the shortest times possible can cause hinderance.

The finding of the study suggested that 92.3% of children had fasted more than 2 hours above recommendations for clear fluids and 81.7% for any last meal. This result is comparable to the results of the studies performed in Gondar [16] and in a previous study done in Tikur Anbessa [27] which reported 95% and 89.9% incidence of prolonged perioperative fasting.

The mean actual fasting times in our study, when compared with a similar study in the same setup in 2021 [3], was shorter and showed less incidence of prolongation above 2 hours of ASA recommendation. This was significant decrement when compared to the study by Assen [3] who found 89.9%, 57.9%, and 100% of participants had fasted from solid, breast milk, and clear fluids for more than 8, 6, and 4 hours, respectively and they also found, from the participants studied, 26.2% were found to be hypoglycemic.

The mean fasting times observed in this study were longer than a similar study by Beck [2] which showed 9 hours for light meals, 4.8 hours for breast milk and 2.7hours for clear fluids. However, our findings are similar with findings by Aroonpruksakul [4] who found 11hours duration for food and 10 hours for clear fluids.

Table 4 - Literature review and comparison of recent similar studies' characteristics and mean fasting times of pediatric elective surgical patients

Authors, year [reference]	Country	Participants	Age	Fasting time for clear fluid	Fasting time for light food
Assen et al., 2021 [3]	Ethiopia	258	4.9 ±3.8	12.3±3.2	13.3±3.1
Yimer A et al., 2020 [27]	Ethiopia	279		10±4.03	13.5±2.76
Beck et al., 2020 [2]	Germany	12093	5.2 [2.5-9.9]	2.3 [1.4-4.8]	14.0 [12.4-15.7]
Rattanapittayaporn et al. , 2023 [1]	India	402	3.0 [1.2-6.0]	9.6 [7.1-13.25]	
Arun B et al., 2013 [15]	India	50		9.25 h	11.25 h
Rawlani et al., 2022 [17]	Turkey	85		6.64	9.43
Aroonpruksakul et al. 2023 [4]	Thailand	320	3.0 [IQR: 1.2, 6.0]	10.0 h [IQR: 7.2, 12.5],	11.1 h [IQR: 8.0, 14.0]

Even though ASA had updated the recommendations [21] of fasting for different food items, especially shorter times for clear fluids, there is still those caregivers that receive inadequate or wrong information preoperatively which is found to significantly factor the incidence of prolonged fasting as those who received appropriate information had a lesser likelihood of having prolonged fasting.

When comparing with a study from India [15 and Turkey [17] this study also found that inappropriate information to parents on fasting times of their children was a major factor for prolonged actual fasting times. However, the finding of inappropriate information delivered to patients was much lower in this study (38.9%) compared with these audits. However, change in surgical schedule which was a significant contributor for prolonged actual fasting time in these studies was not found to be an independent risk factor in our study.

Our study found that majority of the caregivers' reason for their child having prolonged fasting was some difficulty in feeding the child either with the child being asleep or the child not wanting to feed. However, since all fasting orders are given with the presumed induction time of 8am regardless of the surgical schedule the child would spend much time awake and hungry before the procedure if they are not first in the procedure schedule list. Since change in schedule

cannot be predicted much of the time, which this study found to be 29.4% schedule changes, close communication with treating ward team, nurses, operating surgeon and anesthesiologist is necessary to avoid prolonged fasting in those who are going to be induced in the late morning or early afternoon.

According to ESAIC guideline of 2022 [18], it suggested fasting as short as 1 hour for clear fluids was applicable with no increment in aspiration events. The mean time between the child being called to the OR to induction time found in this study was  $51.46 \pm 25$  minutes. Therefore, with improved and strict communication a practice of 'clear fluids until call to OR' can be implemented although this requires further QI projects.

## Strengths and Limitations

The relatively large sample size, collection of and description of data from different surgical subspecialties and comparison of actual fasting times with presumed fasting times can be taken as a strength. We also tried to evaluate time between call to OR and induction time which can be used as an important tool for further research or recommendation.

This study was conducted in a single center which can limit its reproducibility. We also did not employ systematic sampling for the data collection as the quantity of surgical cases performed in the study period was limited compared to the sample size which forced us to include all patients eligible.

## Conclusion

According to this study children scheduled to undergo elective surgery are subjected to unnecessarily long fasting periods preoperatively which is significantly above the recommendations put forth by ASA in 2021. Older children compared to younger children had higher likelihood of having longer fasting as well as children whose caregivers received inadequate or inaccurate information regarding their required fasting times.

## Recommendations

Adherence to fasting recommendations is key to avoid aspiration events intraoperatively but prolonged fasting has its own risks and complications. Addressing the issue of inappropriate or inadequate information delivery to the caregivers and close communication with ward treating team, nurses, anesthesia provider and surgeon can ensure shorter and more appropriate fasting times in children.

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## Annex 1: Subject information sheet

Addis Ababa university

School of medicine

Subject information sheet

Hello, my name is -----, I am here in behalf of Dr. Yoseph Aregawi, a final year anesthesiology, critical care and pain medicine student in Addis Ababa University School of medicine. He is conducting research on “Preoperative fasting time and reasons for prolongation in pediatric patients undergoing elective surgery in Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia 2023”. He has received permission from Addis Ababa University School of Medicine and Tikur Anbessa Specialized Hospital officials to conduct the study.

You are selected to participate in this study because you are a caretaker or a parent of a child undergoing elective surgery in Tikur Anbessa specialized hospital. Your participation in this study will only be based on your willingness to participate. You have the right to choose not to take part in this study. If you are willing to take part in the study, you have the right to stop at any time or withdraw without giving any reason and you will not be subjected to any ill-treatment. There will be no direct benefit to participating in this study but in the future information gathered by this study will help policymakers, programmers, and researchers to give appropriate attention on issues of interest and design specific treatment options.

The information that you provide will be kept confidential by using only code numbers and locking the data. Only the members of the study team will have access to the non-coded data and the data will not be used for purposes other than the study. Your willingness and active participation are very important for the success of this study.

If you need any further information or explanation regarding to the study, you can have this address to contact.

Name – Dr. Yoseph Aregawi    Tel - +251922390441    Email - [Aregawiyoseph@gmail.com](mailto:Aregawiyoseph@gmail.com)

## Annex 2: Consent Form

### **CONSENT FORM**

#### **TITLE OF STUDY**

Preoperative fasting time and reasons for prolongation in pediatric patients undergoing elective surgery in Tikur Anbessa Specialized Hospital

#### **PRIMARY RESEARCHER**

Name – Dr. Yoseph Aregawi Final year ACCPM resident

Primary Advisor- Dr. Semira Indris

Department - ACCPM

Address – Addis Ababa

Phone – 0(+251)922390441

Email – aregawiyoseph@gmail.com

#### **PURPOSE OF STUDY**

The study seeks to uncover the duration of time pediatric patients are kept fasting prior to scheduled procedure and any factors that might contribute to prolonging the intended NPO time in pediatric patients undergoing elective surgery at Tikur Anbessa Specialized Hospital

#### **PROCEDURES**

An institutional based prospective cross-sectional study will be performed on elective pediatric surgical patients that meet the inclusion criteria.

#### **RISKS**

There is no anticipated risk to you if you participated in this study

#### **BENEFITS**

You will be contributing to the development of anesthesia in Ethiopia

#### **CONFIDENTIALITY**

Please do not write any identifying information.

Every effort will be made by the researcher to preserve your confidentiality including the following by assigning code names/numbers for participants that will be used on all research notes and documents

### **CONTACT INFORMATION**

If you have questions at any time about this study, you may contact the researcher whose contact information is provided above.

### **VOLUNTARY PARTICIPATION**

Your participation in this study is voluntary. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw.

### **CONSENT**

I have read and I understand the provided information and have had the opportunity to ask questions. I consent to take part in the research study of “Preoperative fasting time and reasons for prolongation in pediatric patients undergoing elective surgery in Tikur Anbessa Specialized Hospital”.

**Participant's Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

**Researcher's Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

### Annex 3: Questionnaire

Number	Question	Responses
1.1	Card number	_____
1.2	Age	_____days/months/years
1.3	Sex	1. Male 2. Female
1.4	Weight	_____Kg
1.5	Caregiver	1. Mother 2. Father 3. Sibling 4. Other_____
1.6	Diagnosis	_____
1.7	Procedure to be done	_____
1.8	Sequence of schedule	1. 1 <sup>st</sup> case 2. 2 <sup>nd</sup> case 3. 3 <sup>rd</sup> case 4. 4 <sup>th</sup> case 5. >4 <sup>th</sup> case

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Number	Question	Response
2.1	ASA physical status	1. ASA 1 2. ASA 2 3. ASA 3 4. >ASA 4
2.2	Any change in surgical scheduling?	1. Yes 2. No
2.3	Time the patient is called to the OR	
2.4	Time anesthesia induced	

Times of fasting of different feeds

Number	Time of last intake of...	Data
3.1	1. Clear fluids	..... am/pm
3.2	2. Breast milk (if breastfeeding)	..... am/pm
3.3	3. Formula/other milk	..... am/pm
3.4	4. Light solid food	..... am/pm

Fasting information of the child

Number	Fasting information	Data
4.1	Order on the chart written by	1. Surgical resident 2. Anesthesia provider 3. Intern 4. Nurse 5. Other
4.2	Order on the chart according to ASA guideline?	1. Yes 2. No 3. Only partially
4.3	If no or only partially to the above, please specify	..... .....
4.4	Preoperative fasting information delivered to patients by...	1. Surgical resident 2. Anesthesia provider 3. Intern 4. Nurse
4.5	Preoperative fasting information given to caregivers appropriate?	1. Yes 2. No, ..... .....

4.6	Caregiver understood and comfortable with information	1. Yes 2. No
4.7	Reason for the child fasting	1. Avoiding vomiting

		<ol style="list-style-type: none"> <li>2. Requirement of surgery</li> <li>3. Prevent anesthesia complications</li> <li>4. Food may obstruct Airways</li> <li>5. Avoid sugar level during surgery</li> </ol>
	<p>Reason for prolonged fasting of child (If prolonged)</p>	<ol style="list-style-type: none"> <li>1. Inconvenience to feed the child</li> <li>2. The child didn't want to feed</li> <li>3. Fear of cancellation of surgery</li> <li>4. Inadequate information on benefits of recommended times</li> <li>5. Inappropriate order by treating team <ol style="list-style-type: none"> <li>a. Nursing team</li> <li>b. Surgical team</li> <li>c. Ward physician</li> <li>d. Anesthesia team</li> </ol> </li> </ol>