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Impacts of Pre-Operative Fasting on Patient's Anxiety, Intraoperative Hemodynamic Changes, Emergence Factors, and Post-Operative Complications in Elective Surgical Patients

Abdus Salam[1], Abid Ullah[1], Abid Ali[1], Naeem ud Din[1], Nasir Mehmood[2], Ahsan Saidal[3]
[1]Institute of Health Sciences (Swat Campus), Khyber Medical University, Pakistan.
[2]Northwest General Hospital and Research Centre, Peshawar, Pakistan.
[3]Khyber Medical University, Peshawar, Pakistan.

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Corresponding Author*
Ahsan Saidal
Lecturer, Khyber Medical University, Peshawar, Pakistan.
Email: : ahsan.ipms@kmu.edu.pk

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ABSTRACT

Background: Preoperative fasting is crucial to avoid the risk of pulmonary aspiration during surgeries. The traditional practice of prolonged preoperative fasting remains constant and is associated with various adverse outcomes in surgical patients. The purpose of the study is to evaluate the impacts of preoperative fasting durations on preoperative anxiety, intraoperative hemodynamic changes, emergence factors, and postoperative complications in elective surgical patients.

Method: This six-month Descriptive Cross-sectional study was conducted at Saidu Group of Teaching Hospital (SGTH), Swat. 150 participants,aged 15 to 45 years, fulfilling the ASA-I and II physical status criteria and scheduled for elective surgical procedure were recruited in the study. Data was collected in patients' interviews in the preoperative period, through intraoperative monitoring, and in the postoperative period using a pre designed data collection sheet. Data was analyzed using SPSS software.

Result: Most of the patients were found to have fasted from midnight with a mean fasting duration of 10.11±2.4 hours, with 61 (40.7%) patients fasting for 6-8 h and 89 (59.3%) patients fasting for >8 h. Our study found that patients with extended fasting (>8 h) experienced more anxiety ($p < 0.001$), had elevated intraoperative Heart Rate (HR) ($p = 0.005$), and were more prone to Postoperative Nausea and Vomiting (PONV) ($p = 0.04$) compared to those with standard fasting (6-8 h).

Conclusion: This study found that extended preoperative fasting significantly increases the risk of preoperative anxiety and PONV, and leads to fluctuations in intraoperative HR.

Keywords: Preoperative fasting, Anxiety, Hemodynamics, Aspiration, PONV, Hospital stay, Elective surgery.

INTRODUCTION

Anesthesia is a procedure employed in every surgical treatment in order to avoid the unpleasant sensation of pain and make the patient comfortable throughout the procedure. Generally, for major surgical procedures, general anesthesia is indicated, which involves the use of several irreversible drugs to relieve pain and make the patient unconscious.[1] Preoperative fasting is the phase that the patient must undergo prior to surgery and anesthesia, during which the patient is not allowed to eat or drink anything for a specific period, known as fasting time or fasting duration.[1]

The necessity of Nil Per Os(NPO) criteria has long been recognized, which was initially based on the vomiting -induced discomfort in patients under chloroform anesthesia. The fatal consequences associated with aspiration were revealed later in 1862.[2] Fasting prior to surgery has conventionally been recommended based on the necessity to reduce gastric contents regurgitation and thus prevent potentially serious complications like aspiration of gastric contents which can lead to aspiration pneumonia.[3] The current practice of preoperative fasting is primarily based on a study conducted in 1946 by

Research Article
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Mendelson. They involved over 44,000 patients and found that approximately 0.15% of them experienced pulmonary aspiration during the procedure.[4–6] This finding led to the establishment of preoperative fasting as a safety measure in reducing aspiration risk.[4]

Guidelines have undergone tremendous evolution over the years, recommendations previously advocated that a patient should be fasting completely starting from midnight before surgery. However, later studies have shown such a long period of fasting to be both unnecessary and harmful to patient's well-being.[6] Extended fasting times can be uncomfortable, increasing patient discomfort, fatigue, stress and anxiety levels, risk of dehydration, biochemical imbalance, and hypoglycemia.[7] Additionally, the literature reveals that longer preoperative fasting can increase the risk of pulmonary aspiration and postoperative nausea and vomiting (PONV), leading to ICU admission and increased length of hospital stay.[7,8]

Increasing preoperative fasting time can cause major metabolic changes in the body, including insulin resistance, especially in individuals undergoing major surgeries, leading to elevated blood glucose levels and increased gluconeogenesis. It is also associated with metabolic stress which can enhance the acute phase response leading to elevated inflammatory markers and higher risk of complications postoperatively.[9]

Reducing fasting time in the preoperative period is considered safe in the context of improving patient comfort and overall well-being.[7,10] For instance, studies indicate that short preoperative fasting time has been found to decrease patient's anxiety levels, reduce fatigue and discomfort,[12,13] decrease insulin resistance[5] and metabolic stress,[9]reduce the incidence of postoperative nausea and vomiting (PONV),[1,12] and can lead to shorter hospital stays postoperatively.[10] Modern guidelines and American Society of Anesthesiologists (ASA) recommend a minimum fasting of two hours for clear liquids, six hours for solid food, and eight hours for heavy food before the induction of anesthesia for non-emergency surgeries.[2,9,13]

As medical care changes, making patients comfortable and healthy is very important. Traditional preoperative protocols, such as preoperative fasting, are often accepted without question despite their potential to cause significant discomfort and adverse outcomes. Previous studies have focused on specific aspects of preoperative fasting, but a comprehensive examination of its impacts is lacking. Additionally, there is no previous reliable data available in our demographic area, i.e. Swat, Khyber Pakhtunkhwa, Pakistan, that can reflect how preoperative fasting affects patient's anxiety, intraoperative hemodynamic stability, and post-operative complications. Our study aims to fill this gap and provide a foundation for future research

MATERIAL and METHODS

This six-month Descriptive Cross-sectional study was conducted between July and December 2024 at the Department of Anesthesia in Saidu Group of Teaching Hospital, Swat, Pakistan with ethical approval (vide letter No. 17380/0-3; Dated 02/10/2024). The study population consisted of patients of both genders, including males and females, scheduled for elective surgery under general anesthesia, with age range between 15 to 45 years and ASA physical status classes I and II. Patients intubated preoperatively, those with mental retardation or any psychiatric or cognitive disorders, those experiencing nausea or vomiting before anesthesia, patients undergoing emergency surgery, and patients with ASA class III and above were excluded from the study.

To determine the adequate sample size for this study, we referred to the previous report by Scmitz *et al.,* (2024),[20] which reported a prevalence of ~1% (0.11% for aspiration and 0.15% for regurgitation). Due to variability in clinical practice, we added an additional 10% to the prevalence rate to ensure a more significant sample size. By using Cochran's formula, a total of 150 participants were recruited through random sampling based on an adjusted prevalence rate of 11% with a 95% confidence interval and 5% margin of error.

The participants' data was collected only after obtaining written informed consent, using a pre-designed data collection sheet comprising of 6 different sections. Preoperative data was collected in patient interviews in the preoperative period, including patient demographics, hemodynamic measurements, and preoperative anxiety assessment. The anxiety level was assessed using the Amsterdam Preoperative Anxiety and Information Scale (APAIS). The APAIS comprises

Research Article
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six statements, and the answers were evaluated in two scales: the anxiety score and the desire for information score. For assessing patients' level of anxiety, the anxiety scores were obtained from the questions "I'm worried about anesthesia", "the anesthesia is on my mind continuously", "I'm worried about the procedure", and "the procedure is on my mind continuously". Answers to the above questions were evaluated using a Likert Scale, ranging from (Not at all) to 5 (extremely).

Intraoperatively, the hemodynamic measurements, including HR, BP, and MAP were obtained from patient monitoring at intermittent intervals. Three recordings of each hemodynamic parameter (HR, BP, and MAP) were obtained. All patients were continuously observed for the presence of regurgitation or aspiration intraoperatively and during the emergence period.

All the participants enrolled in the study were followed postoperatively in the ward and assessed for the presence or absence of PONV. The patients were considered to have nausea if they experienced "a subjective sensation of an urge to vomit" and vomiting if "forcible expulsion of the gastric contents through the mouth". At the same time, the Visual Analogue Scale (VAS) was employed for assessing postoperative pain levels. VAS was scored as 0-10, and scores were interpreted as '0' for 'no pain' and '10' for 'worst pain possible'. Lastly, the patient's discharge details provided information to determine the length of hospital stay postoperatively.

Data was analyzed using SPSS version-22. Basic descriptive analysis was performed to summarize the data. For continuous variables, means and standard deviations were calculated, while frequencies and percentages were obtained for categorical variables. To determine the significant difference among variables, a t-test was applied for comparing the means of two groups.A Chi-square test was conducted to assess the association between various variables. Univariate and multivariate analysis were applied to evaluate the relationship among dependent and independent variables.

RESULTS

A total of 150 elective surgical patients who met the inclusion criteria were recruited for the study, of whom57.3% (n = 86) were male and 42.7% (n = 64) were female, with an age range between 15 to 45 years. The mean age was 28.2±10.6 years. Out of all, the majority (78.7%) were ASA-I, with 24.7% (n = 37)of patients having past surgical history. The mean of Body Mass Index (BMI) of the patients was 24.67±4.49. Fasting durations were categorized in two groups, namely standard fasting (6-8 h) and long fasting (>8 h) group. Most of the patients were found fasting from midnight with a mean duration of 10.11±2.4 hours, 59.3% (n = 89) of patients fasting for >8 h, (Table-1).

Chi-square test revealed that patients with prolonged fasting (>8 h) experience more anxiety ($p < 0.001$), compared to patients with standard fasting (6-8 h). Moderate anxiety was more common in patients with fasting duration between 6-8 h (68.9%), while severe anxiety was significantly higher in patients with longer fasting times (>8 h, 57.3%), (Table-3). APAIS questions and scores in both fasting groups have been summarized in Table-2.

There were no observed cases of regurgitation or aspiration in patients from both fasting groups. The incidence of postoperative nausea and vomiting (PONV) was significantly higher ($p = 0.043$) in patients with prolonged fasting duration (29.3%) compared to patients with standard fasting periods (14.8%). The Chi-square test indicated no significant association between postoperative pain levels and fasting duration ($p = 0.605$), as mild and moderate-severe pain was reported in almost similar proportion among patient with extended fasting duration of >8 h (46.1% and 6.7%), and those with standard 6-8 h fast (42.6% and 4.9%). Also, the postoperative hospital stay showed no significant association with fasting durations ($p = 0.861$). Majority of patients in both fasting groups showed a hospital stay between 24-48 hours after surgery (Table-3).

Intraoperative heart rate (HR) was significantly higher ($p = 0.005$) in patients with prolonged fasting times (>8 h). However, no considerable difference was found in other preoperative and intraoperative hemodynamic parameters such as systolic and diastolic blood pressure (SBP and DBP) and mean arterial pressure (MAP) in both standard and prolonged fasting groups (Table-4).

Univariate analysis for the assessment of association between preoperative fasting durations (6-8 h vs >8 h) and various patients' outcomes showed that patients with short fasting duration (6-8 h) had a significant association with moderate anxiety [unadjusted OR 4.3, 95% CI 0.89-20.8, p

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ISSN: 3006-5852 & ISSN: 3006-5844

= 0.035; adjusted OR 5.2, 95% CI 0.97-28.04, p = 0.05]. Similarly, severe anxiety was associated with long fasting duration (>8 h) [unadjusted OR 35.1, 95% CI 6.5-188.3, p < 0.01; adjusted OR 54.31, 95% CI 8.7-336.4, p < 0.01]. For PONV, univariate analysis found a significant association with fasting durations [unadjusted OR 2.4, 95% CI 1.02-5.5, p = 0.043], while in multivariate analysis no significant association was found with fasting at 95% CI [adjusted OR 2.46, 95% CI 0.93-6.53, p < 0.07]. In multivariate analysis, mild pain indicated a shift toward significance in the short fasting group (6-8 h) [adjusted OR 2.2, 95% Confidence Interval (CI) 0.56-8.5, p = 0.1], while moderate-severe and very severe pain showed no significant associations. Similarly, no significant association was found between fasting duration and postoperative hospital stay durations [unadjusted OR 1.17, p = 0.63 for 24-48 h, and OR 1.5, p = 0.74 for >48 h); (adjusted OR 0.65, p = 0.30 for 24-48 h and OR 2.2, p =0.57 for > 48 h), (Table-5).

Table-1. Descriptives of Patients Demographics

Characteristics	Subgroups	% (n)
Patient's Age	15-24 years	48.0 (72)
	25-34 years	19.3 (29)
	35-45 years	32,7 (49)
Gender	Female	42.7 (64)
	Male	57.3 (86)
ASA Class	Class-I	78.7 (118)
	Class-II	21.3 (32)
Smoking Status	Non-Smoker	90.7 (136)
	Current Smoker	7.3 (11)
	Former Smoker	2.0 (03)
Fasting Duration	6-8 hours	40.7 (61)
	>8 hours	59.3 (89)
Type of Surgery	General Surgery	29.3 (44)
	Urology	20.0 (30)
	Orthopedic	19.3 (29)
	ENT	31.3 (47)
Previous Surgical History	No	75.3 (113)
	Yes	24.7 (37)

Table-2. Amsterdam Preoperative Anxiety & Information Scores

APAIS Question	Standard Fast (h)	Prolonged Fast (h)	t-test	
			t-value	p-value
1.Worried about anesthesia	1.74±0.6	1.81±0.6	-0.70	-0.48
2.Thinking about anesthesia	1.52±0.7	1.81±0.7	-2.37	0.01
3.Want information about anesthesia	2.16±0.9	2.66±0.8	-3.3	0.001
4.Worried about surgery	2.89±0.9	3.91±1.0	-6.4	<0.001
5.Thinking about surgery	2.59±0.8	3.40±0.8	-5.7	<0.001
6.Want information about the procedure	2.30±0.9	2.92±0.9	-4.13	<0.001

Research Article
ISSN: 3006-5852 & ISSN: 3006-5844

Table-3. Association between Different Patient Outcomes and Fasting Durations

Characteristics		Fasting Duration		p-value
		6-8 h	>8 h	
Pre-operative Anxiety Level	Mild Anxiety	11 (18.0%)	2 (2.2%)	<0.001
	Moderate Anxiety	42 (68.9%)	33 (37.1%)	
	Severe Anxiety	8 (13.1%)	51 (57.3%)	
	Extremely Severe Anxiety	0 (0.0%)	3 (3.4%)	
Regurgitation	Absent	61 (100%)	89 (100%)	-
Aspiration	Absent	61 (100%)	89 (100%)	
PONV Incidence	No PONV	52 (85.2%)	63 (70.7%)	0.043
	PONV	9 (14.8%)	26 (29.3%)	
Post-operative Pain Level	No pain	6 (9.8%)	4 (4.5%)	0.60
	Mild pain	26 (42.6%)	38 (42.7%)	
	Moderate-severe pain	26 (42.6%)	41 (46.1%)	
	Very severe pain	3 (4.9%)	6 (6.7%)	
Post-operative Hospital Stay	<24 hours	30 (49.2%)	40 (44.9%)	0.86
	24-48 hours	30 (49.2%)	47 (52.8)	
	>48 hours	1 (1.6%)	2 (2.2%)	

Table-4. Relation between Hemodynamic Changes & Fasting Durations

Parameters	Fasting Duration	Mean (SD)	t-test	
			t-value	p-value
Preoperative HR	6-8 h	82.2 (10.1)	0.06	0.94
	>8 h	82.1 (8.8)		
Preoperative SBP	6-8 h	123.5 (9.3)	-0.86	0.38
	>8 h	125.3 (13.9)		
Preoperative DBP	6-8 h	81.8 (5.7)	-0.35	0.72
	>8 h	82.2 (7.5)		
Preoperative MAP	6-8 h	94.5 (6.5)	-1.56	0.12
	>8 h	97.2 (12.1)		
Intraoperative HR	6-8 h	91.9 (11.1)	-2.88	0.005
	>8 h	97.8 (13.2)		
Intraoperative SBP	6-8 h	125.2 (13.1)	1.40	0.16
	>8 h	122 (13.9)		
Intraoperative DBP	6-8 h	79.8 (9.1)	0.40	0.68
	>8 h	79.2 (9.8)		
Intraoperative MAP	6-8 h	92.8 (10.3)	-0.08	0.93
	>8 h	92.9 (11.9)		

DISCUSSION

To the authors' knowledge, this study is the first of its kind in Pakistan that explores the broader aspect of the adverse effects of preoperative fasting, which aims to assess the effects of preoperative fasting on multiple patients' outcomes including anxiety, intraoperative hemodynamic stability, regurgitation and aspiration, and postoperative complications, in patients scheduled for elective surgical procedures. The findings reveal how different fasting durations, especially short (6-8 h) and long (>8 h), affect these clinical aspects.

The concept of preoperative fasting emerged in the late 19th century.[2] It's a mandatory procedure for minimizing the risk of vomiting or aspiration by reducing the volume and acidity of gastric contents, and other associated complications.[7,13] Despite the existence of well-established fasting guidelines, the long- standing traditional practice of nil by mouth after midnight remains constant.[14] In the present study, most of the patients scheduled for elective surgery fasted for significantly longer period than recommended.

Research Article
ISSN: 3006-5852 & ISSN: 3006-5844

Table-5: Logistic regression analysis of patient's outcomes associated with preoperative fasting				
Variables	Univariate analysis (Model 1)		Multivariate analysis (Model 2)	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Preoperative Anxiety				
Mild	*Reference*			
Moderate	4.3 (0.89-20.8)	0.035	5.2 (0.97-28.04)	0.05
Severe	35.1 (6.5-188.3)	<0.01	54.31 (8.7-336.4)	<0.01
Extremely severe	2.2 (0.45-9.2)	0.42	4.3 (0.96-22.3)	0.31
PONV				
No PONV	*Reference*			
PONV	2.4 (1.02-5.5)	0.043	2.46 (0.93-6.53)	0.07
Postoperative Pain				
No pian	*Reference*			
Mild	2.2 (0.56-8.5)	0.25	3.9 (0.76-20.8)	0.102
Moderate-severe	2.3 (0.6-9.2)	0.21	3.1 (0.60-16.2)	0.176
Very severe	3.0 (0.46-19.6)	0.25	1.8 (0.2-16.)	0.607
Hospital stay				
<24 h	*Reference*			
24-48 h	1.17 (0.61-2.27)	0.63	0.65 (0.29-1.4)	0.306
>48 h	1.5 (0.13-17.3)	0.74	2.2 (0.13-37.4)	0.577

Anxiety is a familiar psychological concern found in surgical patients, and prolonged preoperative fasting has been known to exacerbate anxiety.[11] This study found a significant association between anxiety and fasting durations. Patients who underwent prolonged fasting experienced higher levels of anxiety compared to those who fasted within standard limits, with the deviation being statistically significant ($p < 0.001$). A descriptive study conducted in a university hospital in Bursa, Turkey, (İster et al. (2024)), revealed that surgical patients with long-term fasting experience more pain and anxiety.[11] Literature indicates that allowing clear liquid intake up to one hour before surgery, and chewing gum during the fasting periods can help reduce anxiety without increasing the risk of aspiration.[15]

Intraoperative hemodynamic stability is crucial in reducing the risk of complications associated with surgery. However, fasting duration has been found to affect the perioperative hemodynamic stability.[16] In this study, a significant difference ($p = 0.005$) was found in intraoperative mean heart rate between the two fasting groups, with the long fasting group exhibiting an elevated heart rate. This suggests that extended fasting may increase sympathetic nervous system activity, most likely as a result of compensatory response to dehydration and electrolyte imbalance. However, no significant difference was found in other hemodynamic parameters, namely BP, and MAP,which may be due to the effect of anesthetic drugs or the body's compensatory mechanisms. Anas *et al.* (2024) and Muller *et al.* (2024), concluded in their studies that preoperative fasting doesn't significantly affect hemodynamic status.[17,18]

Aspiration is a critical medical complication, specifically in the context of general anesthesia. Patients under general anesthesia are always at risk of regurgitation and aspiration. Preoperative fasting is the most essential step in reducing the risk of aspiration and regurgitation.[6] This study, with a sample size of 150, observed no cases of regurgitation or aspiration. The results are noteworthy, as the study had a small sample size ($n = 150$), with elective surgical procedures and ASA class-I and II patients. In a case control study, Kim et al. (2022), states that these complications are more common in at risk population, including those with gastrointestinal disorders, dysphagia, neurological impairments, or in elderly

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population,[19] and a multi-institutional cohort study (2019-2021) in USA, recorded only 25 (0.11%) cases of aspiration and 34 (0.15%) cases of regurgitation in approximately 22,000 anesthetics reports.[20]

In addition to studying the impacts of preoperative fasting on anxiety, intraoperative hemodynamic changes, and emergence factors, this study also focuses on specific postoperative complications, including PONV, pain, and hospital stay. PONV is considered the most frequent and disturbing complication in the postoperative period.[21] The findings of this study indicate a significantly higher incidence of PONV in patients with prolonged fasting times (29.3%) compared to patients with standard fasting (14.8%). A recent study in Tasikmalaya, Indonesia by Karmana et al. (2024), determined a significant correlation ($p = 0.013$) between preoperative fasting time and the incidence of PONV.[1] In a systematic meta-analysis, which included 23 studies performed on approximately 22,000 participants,it revealed that the prevalence rate of PONV was 27.7%. The finding also showed that "the prevalence of PONV was higher during the first 24 h in European countries".[22]

This study's findings indicate no significant association between preoperative fasting and postoperative pain ($p = 0.605$), and postoperative hospital stay ($p = 0.861$). Existing literature indicates that factors such as the anesthetic technique, the type of surgery, and patient health status are more closely related to postoperative pain and hospital length of stay, rather than preoperative fasting times.[23]

LIMITATIONS

The study recruited a small sample size, focused on a specific age range (15-45 years), and ASA status (I and II). Additionally, despite other anesthetic techniques such as regional anesthesia (spinal and epidural), the study was specific to general anesthesia only. Besides the limitations highlighted above, it is hoped that the readers and researchers will gain more knowledge and understanding from the study's findings.

CONCLUSIONS and RECOMMENDATIONS

This study found that extended preoperative fasting significantly increases the risk of preoperative anxiety and postoperative nausea and vomiting, and leads to fluctuations in intraoperative heart rate. However, no significant relation was found between preoperative fasting duration and BP and MAP, postoperative pain intensity and hospital length of stay.

Based on the findings of this study it is recommended that seminars, workshops, and studies should be conducted to highlight the issue and increase the awareness of healthcare professionals regarding preoperative fasting and associated complications.

It is important for the hospital administration to implement customized preoperative fasting protocols according to individual patient needs by considering patient -specific factors such as age, health status, and type of surgery, and follow a patient centered approach in preoperative care by involving patients in the decision making process regarding their fasting protocols.

It is suggested to introduce anxiety management programs to reduce preoperative anxiety. Furthermore, comprehensive care plans should be developed for monitoring patients in the preoperative period to address serious complications associated with preoperative fasting. Additionally, further studies and research are encouraged to assess the long-term effects of preoperative fasting by targeting patient populations at extreme ages, including children and the elderly.

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