Asian Journal of Pharmaceutical and Clinical Research

Innovare Academic Sciences
Knowledge to Innovation

Vol 16, Issue 5, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

EFFECT OF PRE-OPERATIVE FASTING PERIOD ON BLOOD GLUCOSE AND URINE KETONE LEVELS: A COMPARATIVE STUDY

POOJA D KAKADE*, MAYURA D PUJARI, APARNA G BENARE

Département of Anesthesiology Prakash Institute of Medical Sciences and Research, Urun Islampur, Maharashtra, India.
Email: drpoojakakade29@gmail.com

Received: 02 March 2023, Revised and Accepted: 15 April 2023

ABSTRACT

Objectives: The aim of the study was to analyze the duration of pre-operative fasting period and its effects on blood glucose and urine ketone levels in patients undergoing various surgeries.

Methods: The study included 100, ASA Grade 1 and 2 patients between age group of 18–80 years of either sex. They were divided into two groups of 50 each: Group A: Fasting period as per conventional preoperative instructions, that is, nil by mouth after 12.00 midnight and; Group B: Fasting period followed as per fasting guidelines, that is, 6 h prior for solids, up to 2 h for liquids. The blood sugar levels and urine ketones and sugar were tested during pre-anesthetic check-up and just prior to shifting the patient to operation room. SSPS 21.0 software was used for statistical analysis and p<0.05 was taken as statistically significant.

Results: The distribution of mean fasting blood glucose noted in pre-anesthetic checkup in Group A was 101.72±9.34 mg/dl and in Group B is 99.22±8.64 mg/dL (p=0.167) while mean fasting blood glucose before shifting to OT was significantly higher in Group B (95.18±7.34 mg/dL) compared to Group A (90.08±7.12 mg/dL) (p=0.0006). Mean percentage difference in fasting blood glucose levels was higher in Group A (11.12%) compared to Group B (5.97%) which was statistically significant (p<0.01). Of 50 cases studied in Group A, 42 (84.0%) had negative ketones while in Group B, 49 (98.0%) had negative ketones.

Conclusion: From our study, we infer that fasting guidelines need to be implemented and reassessed periodically. This will help to enhance the quality and efficiency of anesthesia care, stimulate evaluation of clinical practices, and reduce the severity of complications.

Keywords: Pre-operative fasting, Aspiration, Blood glucose levels, Urine ketones.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i5.48286. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Pre-operative fasting is defined as the restriction of food and fluid intake before anesthesia or sedation and is essential for patient's safety [1]. Failure to pay attention to the time period between food intake and induction of anesthesia for various surgical procedures can have catastrophic consequences such aspiration leading to hypoxia and if immediate interventions are not done then it can rapidly prove fatal in patients undergoing surgery [2]. Aspiration in patients undergoing surgeries under general anesthesia usually occur during induction of anesthesia. One of the most important causes of aspiration is that the airway protective reflexes are abolished which makes individual susceptible for aspiration. In patients who have a short period of fasting before induction, there can be regurgitation and aspiration of gastric content into the airway thereby causing serious consequences such as hypoxia and pneumonitis [3]. The gastric content causes damage to the lung parenchyma. Moreover, if particulate matter is present in gastric content, then it can mechanically block the airway. It also predisposes for secondary infections mostly by organisms such as staphylococcus, pseudomonas, *Enterobacter,* and anaerobes [4].

To prevent aspiration and its consequences, it is a standard practice to keep patients nil by mouth (NBM) for a considerable period of time before elective surgeries. Prolonged pre-operative fasting can be an unpleasant experience resulting in serious medical complications like distress, fatigue, irritability, dehydration, electrolyte imbalance, hypotension, and hypoglycemia in few patients. It also precipitates gluconeogenesis and increases endocrine response to surgery and anesthesia [5].

Pre-operative fasting is a routine that aims to secure an empty stomach by the time of induction of anesthesia to reduce the risk of regurgitation of acidic gastric content that may flow into the lungs and cause dangerous chemical pneumonia [6]. Based on studies of gastric emptying of various foods and drinks, recent guidelines for elective surgery recommend that solid food should not be taken within 6 h before induction of anesthesia; intake of clear liquids is recommended until 2 h before anesthesia [7]. Moreover, with availability of safer drugs and optimal perioperative anesthesia care has reduced the incidence of aspiration during surgeries. However, this guideline is probably one of the most underused guidelines worldwide today. It may relate to the reluctance of the medical community to change habits from traditional ways to evidence-based practice [8].

Although guidelines are in place, conventionally "Nil by Mouth" (NBM) from midnight are standard fasting instructions for elective surgeries posted on next day. It is important from the point of view of an anesthetist to bear in mind the consequence of aspiration on perioperative outcomes and also the factors that contribute increased risk of aspiration in patients undergoing various surgeries [9]. It is also important to have strategies for preventing the occurrence of or minimizing the chances of aspiration in patients undergoing emergency life-saving surgeries. The treating surgeon as well as anesthetist needs to balance the consequences of unnecessary fasting on one hand and risk of serious complications such as aspiration pneumonia [10]. Considering the medical problems and consequences related to starvation, we decided to audit the duration of fasting period and its effects on blood glucose and urine ketone levels.

METHODS

After approval by the college ethical committee, the study was conducted in, Département of Anesthesiology Prakash Institute of

Medical Sciences, a tertiary care hospital between duration of January 2021–December 2022. One hundred ASA Grade 1 and 2 patients between age group of 18–80 years of either sex were included in this study on the basis of a predefined inclusion and exclusion criteria. They were divided into two groups with 50 patients in each group. Written informed consent was taken from each patient in a language which they understood. Randomization to two groups was made by table of random numbers. Patients were evaluated in detail during pre-anesthetic evaluation. Blood glucose level was noted. Two groups were made using table of random numbers and patients were divided into two groups:

- Group A: Fasting period as per conventional pre-operative instructions, that is, NBM after 12.00 midnight
- Group B: Fasting period followed as per fasting guidelines, that is, 6 h prior for solids, up to 2 h for liquids.

Clear fasting instructions to patients in both the groups were given verbally as well as in written form. Patient, patient's relative, nursing staff, and concerned healthcare worker were instructed accordingly and precaution were taken regarding strict compliance to the instructions. Patients did not receive any intravenous fluids during fasting period. In Group B (fasting guidelines followed), specific instructions regarding content of meal at previous night were given (non-fatty meal), 6 h before surgery, patient was instructed to take tea and biscuits and clear liquids (water) were given up to 2 h before the surgery. Time of surgery was noted as per the operation theater, booking time and fasting instructions were given related to the same. The blood sugar levels were checked by glucose oxidase peroxide method in laboratory and urine ketones and sugar using test strips in the pre-operative room just before shifting the patient to the operation room (for Group A). Just for uniformity purpose, we have kept actual booking time in Group B, but clear liquid feeds were adjusted noting any possible delays in actual shifting time.

The sample size was calculated according to the previous reference studies in which fasting period in patients undergoing surgeries under general anesthesia was studied. With assumptions 95% confidence interval, 5% marginal error, and 80% power, the calculated sample size was 80. We therefor included 100 patients in our study.

Categorical variables were represented as frequency and percentages while quantitative variables were presented as mean and standard deviation. The intergroup comparison of categorical variables was done using Chi-square test while quantitative variables were compared using un-paired t test. The entire data were statistically analyzed using Statistical Package for the Social Sciences (ver. 21.0, IBM Corporation, USA) for MS Windows. $p<0.05$ was considered to be statistically significant.

Inclusion criteria

The following criteria were included in the study:

- Patients of age group 18–80 years of either of the sex undergoing elective surgeries under general and regional anesthesia
- Patients gave informed written consent
- ASA Grade I and II.

Exclusion criteria

The following criteria were excluded from the study:

- Those who refused consent
- Patients with uncontrolled diabetes and hypertension of chronic obstructive airway disease
- Patients on any morning medications
- Patients with gastrointestinal surgery and patients with gastroesophageal reflux disease.

RESULTS

The analysis of cases on the basis of gender distribution showed that out of 100 patients, 29 of the subjects were females and 71 of the subjects were males in total studied population. Group A contained 16 (32%) females and 34 (68%) males. Group B had 13 (26%) females and 37 (74%) males. The gender distribution among both the groups was found to be comparable with no statistically significant difference ($p=0.65$) (Table 1).

The mean age of the patients in Group A was found to be 39.58±09.64 whereas the mean age of patients in Group B was found to be 41.34±10.12. The mean age of patients in both the groups was found to be comparable ($p=0.375$). The mean weight of patients in Group A and B was found to be 61.74±12.96 and 57.46±10.86. The mean weight of patients in both the groups was also found to be comparable with no statistically significant difference between males and females. Similarly, the mean height of patients in both the groups was also found to be comparable with no statistically significant difference ($p=0.253$) (Table 2).

The analysis of patients on the basis of ASA grades showed that in Group A 39 and 11 patients belonged to ASA I and ASA II, respectively. Whereas in Group B, 36 and 14 patients belonged to ASA I and ASA II, respectively. The groups were found to be comparable in terms of ASA grades ($p=0.644$) (Fig. 1).

In Group A, the mean duration of fasting for solids and liquids was found to be 13.94±1.12 and 13.10±1.10 h, respectively, whereas in Group B, the mean duration of fasting for solids and liquids was found to be 6.74±0.64 and 2.36±0.48 h, respectively. There was a statistically highly significant difference in duration of fasting for solids as well as liquids between the two groups ($p<0.0001$) (Table 3).

The distribution of mean fasting blood glucose noted in pre-anesthetic checkup (PAC) in Group A was 101.72±9.34 mg/dL and in Group B is 99.22±8.64 mg/dL. The mean blood sugar values in both the groups in PAC were found to be comparable with no statistically significant difference ($p=0.1679$). The distribution of mean fasting blood glucose before shifting to OT was significantly higher in Group B (95.18±7.34 mg/dL) compared to Group A (90.08±7.12 mg/dL) ($p=0.0006$) (Table 4).

Mean percentage difference in fasting blood glucose levels was higher in Group A (11.12%) compared to Group B (5.97%) which was statistically significant ($p<0.01$). The difference was more in Group A as the blood glucose levels were less before shifting to operation theater as compared to Group B (Fig. 2).

Of 50 cases studied in Group A, 1 each (2.0%) had moderate and trace, 5 (10.0%) had 1+ urine ketones, 1 case (2.0%) had 2+ urine ketones, and 42 (84.0%) had negative ketones. Of 50 cases studied in Group B, 1 case (2.0%) had 1+ urine ketones, 49 (98.0%) had negative ketone. The distribution of urine ketones was found to be comparable in both the groups with no statistically significant difference ($p=0.184$) (Fig. 3).

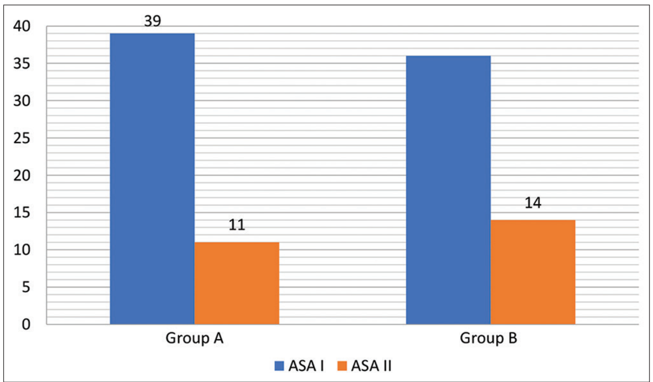

Fig. 1: ASA grades of male and female patients

Table 1: Gender distribution of the studied cases

Gender distribution	Group A		Group B		p-value
	No of cases	Percentage	No of cases	Percentage	
Group A	34	34	16	16	**p=0.65 not significant**
Group B	37	37	13	13	
Total	71	71	29	29	

Table 2: Comparison of age, weight, and height in studied groups

Demographic details	Group A	Group B	p-value
Age (in years)	39.58±09.64	41.34±10.12	0.375 (not significant)
Weight (in kg)	61.74±12.96	57.46±10.86	0.07 (not significant)
Height (in centimeters)	151.82±11.12	149.46±9.36	0.253 (significant)

Table 3: Comparison of mean duration of fasting for solids and liquids

Mean fasting duration	Group A	Group B	p-value
Mean fasting duration for solids (In hours)	13.94±1.12	6.74±0.64	p<0.0001 highly significant
Mean fasting duration for liquids (in hours)	13.10±1.10	2.36±0.48	p<0.0001 highly significant

Table 4: Comparison of mean blood sugar levels in studied groups

Mean blood sugar levels	Group A	Group B	p-value
During APC (in mg/dL)	101.72±9.34	99.22±8.64	p=0.1679 not significant
Before shifting to OT (in mg/dL)	90.08±7.12	95.18±7.34	p=0.0006 highly significant

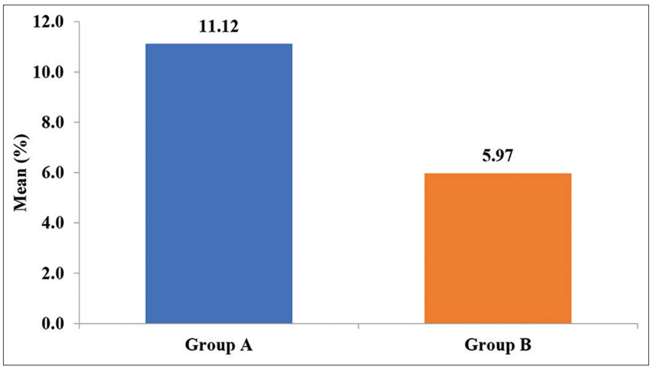

Fig. 2: Mean percentage difference in fasting glucose levels in studied groups

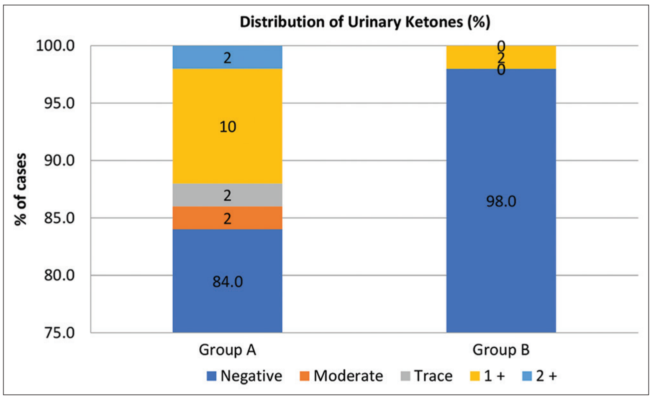

Fig. 3: Distribution of urinary ketones in both the groups

DISCUSSION

Abstinence from food and drink before anesthesia remains a cornerstone of safe practice, as a method of reducing the risk of regurgitation of gastric contents. However, pre-operative fasting also deprives patients of nutrition and hydration [11]. This study was conducted as a randomized study on patients who were fasting as per conventional preoperative instructions (from 12 midnight) and those who were fasting as per fasting guidelines (6 h for solids, 2 h for clear liquids). The main parameters of a fasting regimen, that is, the duration of fasting and its effect on blood glucose levels and urine ketones were studied.

Through our study, we have audited the fasting duration when conventional instructions were given. In Group A, fasting duration varied from 10 to 18 h in one and three patients respectively, mean being 13.94±1.12 h, much longer than recommended in fasting guidelines. Delays from booking time were due to OR availability and other factors. Various studies have also shown similar findings with prolonged duration of fasting period.

Arun and Korula audited fifty children, concluded that the mean pre-operative fasting times were found to be much longer than the recommended times [12]. The pre-operative fasting time for solid food and milk (breast and nonhuman) in the audit ranged between 4 h and 18.75 h. Similarly, Dolgun *et al.* investigated pre-operative fasting times of 332 children undergoing surgery under GA; they concluded that patients' pre-operative fasting times were longer than recommended by current guidelines [13]. Gebremedhn and Nagaratnam *et al.* in 43 patients reported that minimum, maximum, and mean fasting hours for food were 5, 9.6, and 19.60 h respectively [14]. Most patients fasted for both food (92%) and fluid (95%) longer than the fasting times. They concluded that a standard pre-operative fasting guideline should be implemented. Al Maqbali studied pre-operative fasting times, with consequent complications, in total of 169 patients [15]. The minimum and maximum fasting hours with regard to food were 7 h and 19 h, and for fluids were 4 and 19 h, respectively. They concluded that most of the patients fasted more than the time recommended by the American Society of Anesthesiologists. Tosun *et al.* audited the effects of pre-operative fasting and fluid limitation in patients undergoing laparoscopic cholecystectomy [16]. They concluded that mean time of pre-operative fasting and fluid limitation was, respectively, 14.70±3.14 and 11.25±3.74 h. Patients fasting 12 h or longer had higher hunger, thirst, nausea. They also concluded that receiving nothing by mouth after midnight preoperatively is a persisted intervention and results in discomfort of patients.

In our study, we have found that the mean blood glucose level noted in the PAC in Group A was 101.72 mg/dL and in Group B was 99.22 mg/dL which was statistically not significant (p=0.253). The mean blood glucose level noted before shifting to operation theatre in Group A was 90.08 mg/dL and in Group B was 95.18 mg/dL which was statistically significant (p<0.01). This indicates better maintained blood glucose levels in patients who fasted according to fasting guidelines. The mean % difference in fasting glucose from PAC and before shifting the patient to OR in Group A was 11.72 mg/dL and in Group B was 5.92 mg/dL, this difference is statistically significant (p<0.01). This finding indicated that Group B patients showed lesser difference between 2 values (PAC to before shifting to operation theater).

A retrospective study by Redfern *et al*. measured blood glucose in two groups, in children, the mean BSL in afternoon surgery group was significantly lower than that of the morning group [17]. However, no child in either group was hypoglycemic. Therefore, the study concluded that pre-operative fasting is well tolerated in healthy pre-school children regardless of the timing of surgery. On similar lines with above study, the study by Jensen *et al*. suggests that children older than 6 months should be fasted overnight and operated on in the morning to minimize the risks [18]. Kyrtatos *et al*. recognized that pre-operative fasting was an important factor in perioperative patient care [19]. The authors audited perioperative fasting in a general hospital, implemented changes to the pre-operative information leaflet, and improved fasting practices. Improving this domain of clinical practice requires sustained and conscious efforts with repeated reassessment.

In our study, we noted that there was no significant difference between the urine ketones noted before shifting to operation theatre in both groups. Group A, 1 each (2.0%) had moderate and trace ketones, 5 (10.0%) had 1+ urine ketones, and 1 case (2.0%) had 2+ ketones. Remaining 42 patients (84.0%) had negative urine ketones. Of 50 cases studied in Group B, 1 case (2.0%) had 1+ and 49 (98.0%) had negative urine ketones. In Group A, total 8 patients (16%) showed trace to 2+ ketones while in Group B only 1 (2%) patient showed ketonuria. Findings were statistically not significant (p=0.184). This indicates that prolonged starvation can lead to ketonuria. Dennhardt *et al*. evaluated the effect of pre-operative fasting of glucose concentration, urinary ketone after prolonged pre-operative fasting [20]. The authors concluded that children younger than 36 months can present with ketoacidosis and low blood glucose concentration and fasting period should not be longer than 2 h.

CONCLUSION

Although pre-operative fasting is an essential component of anesthetic management of the patients undergoing various surgeries prolonged pre-operative period of fasting may increase the risk of hypoglycemia as well as ketoacidosis. There is a need to optimize the duration of fasting. as per recent protocol.

CONFLICTS OF INTEREST

None.

REFERENCES

1. Falconer R, Skouras C, Carter T, Greenway L, Paisley AM. Preoperative fasting: Current practice and areas for improvement. Updates Surg 2014;66:31-9. doi: 10.1007/s13304-013-0242-z, PMID: 24346767
2. Nason KS. Acute intraoperative pulmonary aspiration. Thorac Surg Clin 2015;25:301-7. doi: 10.1016/j.thorsurg.2015.04.011, PMID: 26210926; PMCID: PMC4517287
3. Studer P, Räber G, Ott D, Candinas D, Schnüriger B. Risk factors for fatal outcome in surgical patients with postoperative aspiration pneumonia. Int J Surg 2016;27:21-5. doi: 10.1016/j.ijsu.2016.01.043, PMID: 26804349
4. Son YG, Shin J, Ryu HG. Pneumonitis and pneumonia after aspiration. J Dent Anesth Pain Med 2017;17:1-12. doi: 10.17245/jdapm.2017.17.1.1, PMID: 28879323; PMCID: PMC5564131
5. Zhou G, Zhu F, An Y, Qin L, Lv J, Zhao X, *et al*. Prolonged preoperative fasting and prognosis in critically ill gastrointestinal surgery patients. Asia Pac J Clin Nutr 2020;29:41-7. doi: 10.6133/apjcn.202003_29(1).0006, PMID: 32229440
6. Briones-Claudett KH, Briones-Claudett MH, Cabrera CA, Zamora KH, Márquez DC, Solís JB, *et al*. Mendelson's syndrome: Chemical pneumonitis after pesticide intake. Am J Case Rep 2020;21:e923776. doi: 10.12659/AJCR.923776, PMID: 32827430; PMCID: PMC7469903
7. Toms AS, Rai E. Operative fasting guidelines and postoperative feeding in paediatric anaesthesia-current concepts. Indian J Anaesth 2019;63:707-12. doi: 10.4103/ija.IJA_484_19, PMID: 31571683; PMCID: PMC6761784
8. De Aguilar-Nascimento JE, Dock-Nascimento DB. Reducing preoperative fasting time: A trend based on evidence. World J Gastrointest Surg 2010;2:57-60. doi: 10.4240/wjgs.v2.i3.57, PMID: 21160851; PMCID: PMC2999216
9. Sparn MB, Widmann B, Pietsch U, Weitzendorfer M, Warschkow R, Steffen T. Risk factors and outcomes of postoperative aspiration pneumonia in abdominal surgery patients: An exact matching and weighting analysis. Surgery 2021;170:1432-41. doi: 10.1016/j.surg.2021.05.025, PMID: 34148710
10. Jones J. Risk and outcome of aspiration pneumonia in a city hospital. J Natl Med Assoc 1993;85:533-6. PMID: 8350375; PMCID: PMC2568143
11. Hamid S. Pre-operative fasting - A patient centered approach. BMJ Qual Improv Rep. 2014;2(2):u605.w1252. doi: 10.1136/bmjquality.u605.w1252.
12. Arun BG, Korula G. Preoperative fasting in children: An audit and its implications in a tertiary care hospital. J Anaesthesiol Clin Pharmacol 2013;29:88.
13. Dolgun E, Yavuz M, Eroğlu B, Islamoğlu A. Investigation of preoperative fasting times in children. J Perianesth Nurs 2017;32:121-4.
14. Gebremedhn EG, Nagaratnam VB. Audit on preoperative fasting of elective surgical patients in an African academic medical center. World J Surg 2014;38:2200-4.
15. Al Maqbali MA. Preoperative fasting for elective surgery in a regional hospital in Oman. Br J Nurs 2016;25:798-802.
16. Tosun B, Yava A, Açıkel C. Evaluating the effects of preoperative fasting and fluid limitation. Int J Nurs Pract 2015;21:156-65.
17. Redfern N, Addison GM, Meakin G. Blood glucose in anaesthetised children. Anaesthesia 1986;41:272-5.
18. Jensen BH, Wernberg M, Andersen M. Preoperative starvation and blood glucose concentrations in children undergoing inpatient and outpatient anaesthesia. Br J Anaesth 1982;54:1071-4.
19. Kyrtatos PG, Constandinou N, Loizides S, Mumtaz T. Facilitates adherence to preoperative fasting guidelines. J Perioper Pract 2014;24:228-31.
20. Dennhardt N, Beck C, Huber D, Nickel K, Sander B, Witt LH, *et al*. Impact of preoperative fasting times on blood glucose concentration, ketone bodies and acid-base balance in children younger than 36 months: A prospective observational study. Eur J Anaesthesiol 2015;32:857-61. doi: 10.1097/EJA.0000000000000330, PMID: 26351828