Original Article

DOI: 10.7860/JCDR/2024/74438.20141

Anaesthesia Section

Effect of Unexpected Prolonged Fasting on Patients undergoing Elective Surgery under Spinal Anaesthesia: An Observational Study

CHHAYA M SURYAWANSHI[1], FATEH PAL SINGH GILL[2], SARGAM DHALIWAL[3]

BY-NC-ND

ABSTRACT

Introduction: Preoperative fasting is a standard practice aimed at minimising the risk of pulmonary aspiration during surgery. However, patients often experience prolonged fasting periods beyond the recommended duration due to unanticipated delays in the operating theatre, communication failures between teams, inadequate preoperative planning and other factors.

Aim: To investigate the effects of unexpectedly prolonged fasting on intraoperative and postoperative parameters in patients undergoing elective surgery under spinal anaesthesia.

Materials and Methods: This prospective observational study was conducted from October 2023 to June 2024 at the Department of Anaesthesiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India. The study included 70 patients undergoing elective surgery under spinal anaesthesia. Patients were divided into two groups: Group A (AM group, n=35), scheduled for surgery between 8:00 AM and 12:00 PM and Group B (PM group, n=35), scheduled for surgery after 12:00 PM or with delayed surgeries. Intraoperative parameters, including Mean Arterial Pressure (MAP), Heart Rate (HR), oxygen saturation (SpO_2) and random blood glucose levels, were recorded at specific time points. Postoperative outcomes, such as nausea, vomiting and random blood glucose levels, were also assessed. Continuous and discrete variables were summarised as mean±SD and median, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were tested using Pearson's Chi-square or Fisher's-exact test, with p-values <0.05 considered statistically significant.

Results: The PM group exhibited higher preoperative random blood glucose levels (102.3±18.7 mg/dL) compared to the AM group (89.2±12.5 mg/dL). Postoperative nausea and vomiting were observed in 5 (14.3%) patients in the AM group and 11 (31.4%) patients in the PM group. Both groups showed a gradual decrease in MAP and HR from the preoperative period to 30 minutes after spinal anaesthesia administration, with slightly higher values noted in the PM group. No significant differences in SpO_2 were observed between the groups.

Conclusion: Unexpected prolonged fasting before elective surgery under spinal anaesthesia may contribute to higher preoperative blood glucose levels and an increased risk of postoperative nausea and vomiting. These findings underscore the importance of adhering to preoperative fasting guidelines and exploring potential strategies to minimise prolonged fasting periods, such as carbohydrate loading or allowing clear fluids closer to surgery.

Keywords: Elective surgical procedures, Intraoperative complications, Preoperative care, Respiratory aspiration

INTRODUCTION

Fasting is a routine practice before elective surgical procedures to reduce the risk of pulmonary aspiration and associated complications [1]. The standard fasting guidelines recommend abstaining from solid food for atleast 6-8 hours and from clear fluids for 2-3 hours before the scheduled surgery time [2]. However, in clinical practice, patients often experience prolonged fasting periods beyond the recommended duration due to various reasons, such as delays in the operating room schedule or unforeseen circumstances [3].

Prolonged fasting has been associated with various physiological and metabolic changes, including alterations in blood glucose levels, electrolyte imbalances and dehydration [4,5]. These changes may have implications for patient safety and postoperative outcomes, particularly in patients undergoing regional anaesthesia techniques like spinal anaesthesia.

Spinal anaesthesia is a commonly used technique for lower abdominal, pelvic and lower limb surgeries. It involves the injection of a local anaesthetic into the subarachnoid space, resulting in a temporary loss of sensory and motor function below the level of the injection [6]. While spinal anaesthesia is generally considered safe and effective, it can be influenced by various factors, including the patient's hydration status, blood glucose levels and haemodynamic parameters [7].

The effects of unexpected prolonged fasting on patients undergoing elective surgery under spinal anaesthesia have not been extensively studied. Understanding the potential impact of prolonged fasting on intraoperative and postoperative parameters, such as blood pressure, HR, MAP, peripheral SpO_2, body temperature, blood sugar levels and postoperative nausea and vomiting, could aid in optimising patient care and minimising adverse events [8,9].

Hence, the present study aimed to evaluate preoperative fasting durations and the effects of preoperative fasting on vital signs, including HR, MAP, peripheral SpO_2, body temperature, blood sugar levels and postoperative nausea and vomiting, in patients undergoing surgery under spinal anaesthesia.

MATERIALS AND METHODS

The study was a prospective observational research project conducted from October 2023 to June 2024 at the Department of Anaesthesiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India. Approval from the Institutional Ethics Committee was obtained prior to the

commencement of the study (Reference Number: I.E.S.C./103/202; Research Protocol Number: IESC/FP/66/2023).

Inclusion and Exclusion criteria: The study included American Society of Anaesthesiologists (ASA) grade I or II patients aged 18 years or older who were undergoing surgeries under spinal anaesthesia, provided they were haemodynamically stable with normal routine investigations and had given written informed consent. Patients were excluded if they were unwilling to participate, had contraindications for spinal anaesthesia, had ASA grade III or above physical status, were under 18 years of age, required emergency procedures, or had psychiatric, neurological, neuromuscular, or cardiovascular conditions, or impaired hepatic or renal function.

Sample size calculation: Open Epi was used to calculate the sample size. Considering the mean fasting durations as 9.5±2.1 hours in the AM group and 12.7±4.4 hours in the PM group for liquids according to Yeniay O et al., the study required a sample size of 19 in each group with 95% confidence and 80% power [10]. For statistical convenience, 35 patients were included in each group.

Study Procedure

Total of 70 patients undergoing elective surgeries under spinal anaesthesia were selected based on the previously outlined inclusion and exclusion criteria. Each patient underwent a preanaesthetic evaluation, relevant laboratory investigations and provided informed written consent. The patients were divided into two groups of 35 each:

- Group A (AM group), consisting of patients scheduled for surgery between 08:00 and 12:00 and
- Group B (PM group), comprising patients scheduled for surgery between 12:00 and 16:00, or those whose surgery was delayed and performed after 12:00

The study recorded the time elapsed since the last intake of oral fluids and food until the operation. Each patient received preoperative hydration with 10 mL/kg of intravenous fluids and the volumes were meticulously documented. An intravenous line was established using a 20 G cannula. Standard monitoring equipment, including Electrocardiogram (ECG), non invasive blood pressure, SpO_2 and a temperature probe, was employed to continuously assess the patient. Baseline parameters, including HR, MAP, SpO_2, body temperature and random blood glucose, were recorded. Measurements of MAP, HR and SpO_2 were taken at predetermined intervals: preoperatively and at the zeroth, 2nd, 5th, 15th and 30th minutes following the administration of spinal anaesthesia. Body temperature was specifically recorded immediately prior to spinal anaesthesia. Spinal anaesthesia was administered under strict aseptic conditions, with continuous monitoring of the aforementioned parameters throughout the surgical procedure and postoperative period. Postoperative data on the incidence of nausea and vomiting, as well as Random Blood Sugar (RBS) levels, were systematically recorded.

STATISTICAL ANALYSIS

The tables were generated for both the AM group (Group A) and the PM group (Group B), summarising parameters such as HR, MAP, SpO_2, body temperature, RBS levels and the incidence of postoperative nausea and vomiting. Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 20.0. Continuous and discrete variables were described using mean±Standard Deviation (SD) and medians, while categorical variables were reported as numbers and percentages. Categorical data were analysed using Pearson's Chi-squared test or Fisher's-exact Test, with p-values <0.05 considered statistically significant.

RESULTS

The study compared demographic and clinical parameters between group A and group B, as shown in [Table/Fig-1]. No significant differences were observed in age (p-value=0.2102), gender distribution (p-value=0.632), weight (p-value=0.288), height (p-value=0.343), BMI (p-value=0.631), or ASA physical status (p-value=0.631). However, a significant difference was found in the preoperative fasting duration, with group B fasting longer than group A (14.2±2.1 hours vs. 9.8±1.5 hours, p<0.001).

Parameters	Group-A (n=35)	Group-B (n=35)	p-value
Age (years)	45.2±12.3	48.7±10.8	0.2102
Gender (M/F)	18/17	20/15	0.632
Weight (kg)	72.5±9.6	75.2±11.4	0.288
Height (cm)	168.3±7.2	170.1±8.5	0.343
BMI (kg/m^2)	25.6±3.1	26.0±3.8	0.631
ASA Physical Status	I: 20, II: 15	I: 18, II: 17	0.631
Preoperative fasting duration (hours)	9.8±1.5	14.2±2.1	**<0.001**

[Table/Fig-1]: Baseline characteristics of patients in Group-A (AM group) and Group-B (PM group).

Both groups showed a gradual decrease in Mean Arterial Pressure (MAP) and Heart Rate (HR) from the preoperative period to 30 minutes after the administration of spinal anaesthesia. This was an expected physiological response to spinal anaesthesia, which caused sympathetic blockade and a decrease in blood pressure and HR. SpO_2 remained stable and within normal ranges throughout the procedure for both groups, indicating adequate oxygenation. The haemodynamic parameters, including MAP, HR, SpO_2, body temperature and RBS levels, at various time points during the surgical procedure are presented in [Table/Fig-2]. At 15 and 30 minutes, there were statistically significant differences in heart rate when comparing group A with group B, with p-values of 0.0135 and 0.008, respectively.

	Group-A (n=35)			Group-B (n=35)		
Time point	MAP	HR	SpO_2	MAP	HR	SpO_2
Preoperative	92.5±6.8	78.2±9.5	98.1±1.2	95.1±7.2	80.5±10.2	97.8±1.5
0 min	85.7±5.2	70.1±8.3	99.2±0.8	88.4±6.5	72.8±9.1	98.9±1.1
2 min	82.3±4.8	68.5±7.7	99.5±0.6	84.1±5.3	71.2±8.4	99.2±0.9
5 min	79.8±5.1	65.7±6.9	99.7±0.4	81.5±6.2	69.1±7.5	99.4±0.7
15 min	77.2±4.7	**62.4±5.8***	99.8±0.3	79.8±5.8	**66.2±6.7***	99.6±0.5
30 min	75.6±4.2	**60.1±5.2***	99.7±0.4	77.9±5.1	**63.8±6.1***	99.5±0.6

[Table/Fig-2]: Intraoperative parameters at different time points.
*p-value <0.05
At 15 and 30 minutes there was a statistically significant difference in the heart when comparing Group-A with Group-B with p-values 0.0135 and 0.008, respectively

Notably, group B (PM group) had significantly higher preoperative and postoperative RBS levels compared to group A (AM group), with preoperative RBS levels of 102.3±18.7 mg/dL vs. 89.2±12.5 mg/dL (p<0.001) and postoperative RBS levels of 118.5±22.8 mg/dL vs. 92.7±15.2 mg/dL (p<0.001), as shown in [Table/Fig-3]. Although group B also showed a higher incidence of nausea and vomiting (31.4% vs. 14.3%, p-value=0.087), hypoglycaemia (5.7% vs. 2.9%, p-value=0.555) and hypotension (31.4% vs. 17.1%, p-value=0.163),

Parameters	Group-A (n=35)	Group-B (n=35)	p-value
Preoperative RBS (mg/dL)	89.2±12.5	102.3±18.7	**<0.001**
Postoperative RBS (mg/dL)	92.7±15.2	118.5±22.8	**<0.001**
Nausea and vomiting n (%)	5 (14.3%)	11 (31.4%)	0.087
Hypoglycaemia n (%)	1 (2.9%)	2 (5.7%)	0.555
Hypotension n (%)	6 (17.1%)	11 (31.4%)	0.163

[Table/Fig-3]: Postoperative outcomes.

these differences were not statistically significant, as demonstrated in [Table/Fig-3].

DISCUSSION

The study compared the AM group (surgery scheduled between 8:00 AM and 12:00 PM) with the PM group (surgery scheduled after 12:00 PM or delayed) to evaluate preoperative fasting duration, intraoperative haemodynamic parameters, blood glucose levels and postoperative outcomes. This assessment aimed to understand the effects of fasting duration on outcomes related to spinal anaesthesia. Despite similar baseline demographic characteristics, group B, which experienced longer fasting due to later surgeries, showed higher RBS levels both preoperatively and postoperatively compared to group A. This suggests that extended fasting may impact glucose metabolism. Although group B also had a higher incidence of nausea, vomiting and hypotension, these differences were not statistically significant. Overall, the findings highlight that prolonged fasting could influence glucose levels and potentially increase postoperative complications, although not all effects reached statistical significance.

The "Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: An Updated Report" provides specific fasting recommendations: two hours for clear liquids, four hours for breast milk, six hours for infant formula and non human milk, six hours for a light meal and longer fasting times (e.g., 8 or more hours) for fried foods, fatty foods, or meat [2]. The data in this study indicate that the mean fasting duration was 9.8±1.5 hours for the AM group and 14.2±2.1 hours for the PM group, with the PM group experiencing a significantly longer fasting period. Similarly, Yeniay O et al., reported mean fasting durations of 12±2.8 hours for solids and 9.5±2.1 hours for liquids in the AM group and 15.5±3.4 hours for solids and 12.7±4.4 hours for liquids in the PM group, respectively, which aligns with the findings of this study [10].

Ljungqvist O suggested that undergoing surgery in a carbohydrate-fed state, rather than a fasted state, offers clinical benefits, particularly in reducing postoperative insulin resistance through preoperative carbohydrate loading [4]. The role of preoperative carbohydrate treatments, as discussed by Smith MD et al., is integral to Enhanced Recovery After Surgery (ERAS) or fast track surgery protocols, demonstrating a reduction in the length of hospital stay [8].

One of the notable findings was the higher preoperative RBS levels observed in the PM group (102.3±18.7 mg/dL) compared to the AM group (89.2±12.5 mg/dL). This difference could be attributed to the prolonged fasting state in the PM group, which is consistent with previous studies reporting an increase in blood glucose levels after prolonged fasting periods [4,11]. The elevated blood glucose levels in the PM group may result from increased gluconeogenesis and decreased insulin sensitivity, which are physiological responses to fasting [5].

The observed gradual decrease in MAP and HR from the preoperative period to 30 minutes after the administration of spinal anaesthesia in both groups is an expected physiological response to spinal anaesthesia [6]. However, it is noteworthy that the PM group exhibited slightly higher MAP and HR values at most time points compared to the AM group, with statistically significant differences in HR in groups A and B at 15 and 30 minutes. In comparison to the study by Yeniay O et al., the PM group demonstrated a slightly lower MAP and HR that was statistically significant two minutes after the administration of spinal anaesthesia [10]. Although hypotension was noted in a total of six patients in the AM group and 11 patients in the PM group, this difference was not statistically significant.

Interestingly, the present study also revealed a higher incidence of postoperative nausea and vomiting in the PM group (31.4%) compared to the AM group (14.3%). This finding aligns with a study by Svanfeldt M et al., which reported a higher risk of postoperative nausea and vomiting in patients who experienced prolonged fasting before surgery [12]. The authors suggested that prolonged fasting might contribute to dehydration and electrolyte imbalances, which could predispose patients to nausea and vomiting [12]. Marsman M et al., also suggested that patients who followed a liberal preoperative fluid fasting policy showed a clinically significant reduction in fasting duration, postoperative thirst and a decreased incidence of postoperative nausea and vomiting [13].

The findings of the present study are further supported by a systematic review by Awad S and Lobo DN, which highlighted the potential adverse effects of prolonged fasting on postoperative outcomes, including insulin resistance, hyperglycaemia and an increased risk of nausea and vomiting [3]. They emphasised the importance of implementing strategies to minimise the duration of preoperative fasting, such as carbohydrate loading or allowing clear fluids up to two hours before surgery. The findings listed above highlight the need for careful consideration of preoperative fasting guidelines and the potential benefits of implementing strategies to minimise prolonged fasting periods, such as carbohydrate loading or allowing clear fluids closer to surgery [8,9].

Limitation(s)

It is important to note that the present study had certain limitations, including the lack of randomisation in group allocation. Additionally, potential confounding factors, such as the amount of spinal anaesthesia drug administered and co-morbidities that could have influenced the observed outcomes, were not assessed.

CONCLUSION(S)

In conclusion, the present study adds to the growing body of evidence suggesting that unexpected prolonged fasting before elective surgery under spinal anaesthesia may have adverse effects on intraoperative and postoperative parameters, including higher blood glucose levels and an increased risk of postoperative nausea and vomiting. Timely recognition and appropriate management of prolonged fasting periods could contribute to enhancing patient safety and improving postoperative recovery.

REFERENCES

[1] Brady M, Kinn S, Stuart P. Preoperative fasting for adults to prevent perioperative complications. Cochrane Database Syst Rev. 2003;(4):CD004423.
[2] Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures: An updated report by the American Society of Anesthesiologists task force on preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration. Anaesthesiology. 2017;126(3):376-93.
[3] Awad S, Lobo DN. Metabolic conditioning to attenuate the adverse effects of perioperative fasting and improve patient outcomes. Curr Opin Clin Nutr Metab Care. 2012;15(2):194-200.
[4] Ljungqvist O. Modulating postoperative insulin resistance by preoperative carbohydrate loading. Best Pract Res Clin Anaesthesiol. 2009;23(4):401-09.
[5] Nygren J. The metabolic effects of fasting and surgery. Best Pract Res Clin Anaesthesiol. 2006;20(3):429-38.
[6] Covino BG. Rationale for spinal anaesthesia. Int Anaesthesiol Clin. 1989;27(1):08-12.
[7] Pitkänen M, Haapaniemi L, Tuominen M, Rosenberg PH. Influence of age on spinal anaesthesia with isobaric 0.5% bupivacaine. Br J Anaesth. 1984;56(3):279-84.
[8] Smith MD, McCall J, Plank L, Herbison GP, Soop M, Nygren J. Preoperative carbohydrate treatment for enhancing recovery after elective surgery. Cochrane Database Syst Rev. 2014;(8):CD009161.
[9] Ljungqvist O, Scott M, Fearon KC. Enhanced recovery after surgery: A review. JAMA Surg. 2017;152(3):292-98.
[10] Yeniay O, Tekgul ZT, Okur O, Koroglu N. Unexpectedly prolonged fasting and its consequences on elderly patients undergoing spinal anaesthetics. Acta Cir Bras. 2019;34(3):e201900309.
[11] Awad S, Lobo DN. What's new in perioperative nutritional support? Curr Opin Anaesthesiol. 2011;24(3):339-48.

[12] Svanfeldt M, Thorell A, Hausel J, Soop M, Rooyackers O, Nygren J, et al. Randomized clinical trial of the effect of preoperative oral carbohydrate treatment on postoperative whole-body protein and glucose kinetics. Br J Surg. 2007;94(11):1342-50.

[13] Marsman M, Kappen TH, Vernooij LM, van der Hout EC, van Waes JA, van Klei WA. Association of a liberal fasting policy of clear fluids before surgery with fasting duration and patient well-being and safety. JAMA Surg. 2023;158(4):e231000. Available at: https://pubmed.ncbi.nlm.nih.gov/36598762/.

PARTICULARS OF CONTRIBUTORS:
1. Professor and Head, Department of Anaesthesiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India.
2. Resident, Department of Anaesthesiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India.
3. Resident, Department of Pathology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Fateh Pal Singh Gill,
Resident, Department of Anaesthesiology, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune-411018, Maharashtra, India.
E-mail: gillfatehpal08@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 23, 2024
- Manual Googling: Aug 23, 2024
- iThenticate Software: Sep 12, 2024 (15%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jul 23, 2024**
Date of Peer Review: **Aug 21, 2024**
Date of Acceptance: **Sep 13, 2024**
Date of Publishing: **Oct 01, 2024**