International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 12, December 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_13.12.2024.36

ORIGINAL RESEARCH

Effect of pre-operative carbohydrate loading on hemodynamics in patients undergoing upper abdominal cancer surgeries: An exploratory randomised control trail

[1]Dr. Priyanka Boruah, [2]Dr.Arun Deka, [3]Dr. Rousanara Begum, [4]Dr.Jili Basing, [5]Dr. Nicky Shah, [6]Dr.E.Madhurima

[1]Fellow Oncoanesthesia
Email- Priyankaborauhgmc90@Gmail.Com
[2]HOD Oncoanesthesia
Email- Drarundeka25@Gmail.Com
[3]Professor,State Cancer Institute
Email- Rousanarab@Rediffmail.Com
[4]Assistant Professor,Oncoanesthesia
Email-Jili.Basing1@Gmail.Com
[5]Senior Resident
Email- Nickyshah86@Gmail.Com
[6]Fellow Oncoanesthesia
Email-Drmadhurima93@Gmail.Com

Corresponding Author
Dr. Priyanka Boruah
Fellow Oncoanesthesia
Email- Priyankaborauhgmc90@Gmail.Com

Received Date: 13 October, 2024 Accepted Date: 16 November, 2024

ABSTRACT

Background: Prolonged preoperative fasting, while essential for preventing aspiration during general anesthesia, can induce metabolic stress, hemodynamic instability, and postoperative complications. Carbohydrate-rich preoperative drinks have been proposed to mitigate these adverse effects, yet evidence regarding their impact on perioperative hemodynamics and postoperative outcomes remains limited. This study evaluates the effects of preoperative carbohydrate loading on hemodynamic parameters and clinical outcomes in patients undergoing elective upper abdominal surgeries. **Materials and Methods:** A prospective, randomized, controlled, double-blind study was conducted on 60 patients aged 18–60 years (ASA grade I and II) scheduled for elective upper abdominal surgeries under general anesthesia at the State Cancer Institute, Gauhati Medical College, Guwahati. Participants were randomized into two groups: Group-E (received preoperative carbohydrate-rich fluids) and Group-S (traditional fasting). Hemodynamic parameters (MAP, SBP, DBP, HR, PI) and clinical outcomes (PONV, pain scores, recovery scores) were monitored intraoperatively and postoperatively. Gastric volumes were assessed preoperatively, and data were analyzed using SPSS v21.0, with $p<0.05$ considered statistically significant. **Results:** Group-E demonstrated significantly fewer hypotensive episodes (MAP: 92 ± 20.5 vs. 128 ± 28.5, p=0.005; DBP: 132 ± 29.3 vs. 161 ± 35.7, p=0.0405) and required a lower mean intraoperative mephentermine dose (0.8 ± 0.65 mg vs. 2.23 ± 0.75 mg, $p<0.001$) compared to Group-S. Postoperative outcomes favored Group-E, with fewer PONV episodes (13.3% vs. 36.7%, p=0.037) and reduced pain scores (NRS: 2.67 ± 0.80 vs. 3.23 ± 0.86, p=0.012). Gastric volumes, anesthesia times, and drug dosages were comparable between the groups ($p>0.05$). **Conclusion:** Preoperative carbohydrate loading enhances hemodynamic stability, reduces vasopressor requirements, and improves postoperative recovery in patients undergoing upper abdominal surgeries. This evidence supports integrating carbohydrate-rich fluids into perioperative protocols to optimize surgical outcomes and patient well-being.

Keywords: Carbohydrate loading, preoperative fasting, hemodynamic stability, elective surgery, general anesthesia, postoperative recovery.

International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 12, December 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122
DOI: 10.69605/ijlbpr_13.12.2024.36

INTRODUCTION

The concept of preoperative fasting was introduced in 1848, following the advent of general anesthesia, to prevent the aspiration of gastric contents, a potentially fatal complication (1). However, prolonged fasting results in intravascular volume reduction, leading to alterations in the patient's internal environment and clinical manifestations such as tachycardia, hypotension, decreased stroke volume, and cardiac output (2). These effects are compounded by anesthetic agents, which further impact patient hemodynamics, potentially leading to significant instability. Extended fasting before elective surgery also causes discomfort, thirst, hunger, irritability, and noncompliance among patients (3).

Preoperative fasting triggers a stress response that stimulates the release of inflammatory hormones and cytokines, inducing glycogenolysis and gluconeogenesis, and resulting in intraoperative hyperglycemia (4). To address these concerns, the American Society of Anesthesiologists (ASA) issued fasting guidelines recommending a minimum fasting duration of 2 hours for clear fluids, 4 hours for breast milk, 6 hours for light meals, and 8 hours for fatty meals (5). However, such prolonged fasting has been shown to negatively affect hemodynamics, increase stress, and impact postoperative recovery (6). Metabolic stress and insulin resistance induced by fasting are linked to higher morbidity, mortality, and prolonged hospital stays (7).

Recent literature has highlighted the role of carbohydrate-rich fluids in enhancing perioperative recovery (8). Carbohydrate supplementation aims to mitigate the adverse metabolic effects of fasting and surgical trauma, potentially improving clinical outcomes (9). It has been shown to reduce insulin resistance, stabilize intraoperative hemodynamics, and enhance recovery. A suitable carbohydrate-containing drink (CHOD) typically contains 12.5% maltodextrin, which promotes optimal gastric emptying (10). The recommended regimen involves consuming 100 g of carbohydrate (800 mL of CHOD) the evening before surgery and 50 g (400 mL of CHOD) up to 2 hours before surgery, preserving insulin levels similar to those following a normal diet (11). This approach maintains an anabolic state, reduces insulin resistance, improves glucose control, enhances gut function recovery, and alleviates postoperative anxiety, thirst, and hunger (12). Studies have also shown a slight reduction in hospital stay duration for adult patients undergoing elective surgery with this regimen compared to placebo or fasting (13,14).

Although extensive research exists on the metabolic effects of preoperative carbohydrate supplementation, including its impact on insulin resistance, glucose kinetics, residual gastric volume, protein balance, immune function, and patient well-being (15-21), there is limited evidence regarding its physiological benefits, safety, hemodynamic parameters, and postoperative clinical outcomes. This study aims to evaluate the relationship between perioperative carbohydrate-rich fluid intake and patient hemodynamics in individuals undergoing elective surgery under general anesthesia.

MATERIALS AND METHODS

The study was conducted in the Department of Onco-Anesthesia and Critical Care at the State Cancer Institute, Gauhati Medical College, Guwahati, following approval from the institutional ethics and scientific committees. Written informed consent was obtained from all participants. This prospective, randomized, controlled, double-blind study was conducted over 12 months, from June 2022 to June 2023. A total of 60 participants, divided into two equal groups (Group-E and Group-S), were recruited for this exploratory study.

Participants included in the study were ASA grade I and II patients aged between 18 and 60 years, scheduled for elective upper abdominal cancer surgeries under general anesthesia, including radical cholecystectomy, Whipple's procedure, esophagectomy (VATS/open), radical hysterectomy, and hemicolectomy. Exclusion criteria included patients with hypertension on beta-blockers or ACE inhibitors, diabetes mellitus, significant renal or cardiac disease, gastroesophageal reflux disease, BMI ≥ 30 kg/m², moderate to severe respiratory disease, pregnancy, or documented delayed gastric emptying.

Patients were randomized into two groups using a computer-generated randomization process. Group-E followed Enhanced Recovery After Surgery (ERAS) guidelines and received preoperative carbohydrate loading, consisting of 800 mL of a clear fluid containing 100 g of carbohydrate the evening before surgery and 400 mL of the same fluid containing 50 g of carbohydrate 2–3 hours before surgery. Group-S adhered to traditional fasting guidelines, fasting for 8–10 hours for solids and 2 hours for clear fluids. The allocation was concealed using a sealed opaque envelope technique, and group assignments were implemented by nursing staff who were blinded to the research methodology. Outcome assessors and surgeons were also blinded to the group allocation.

Data were collected using a prevalidated case record form. Gastric volume was assessed preoperatively using ultrasound with a low-frequency curvilinear transducer (2–5 MHz). Antral cross-sectional area was calculated using the ellipse formula, and gastric fluid volume exceeding 1.5 mL/kg was noted. Baseline hemodynamic parameters, including systolic blood pressure (SBP), diastolic blood pressure (DBP), mean

International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 13, No. 12, December 2024 Online ISSN: 2250-3137
Print ISSN: 2977-0122
DOI: 10.69605/ijlbpr_13.12.2024.36

arterial pressure (MAP), heart rate (HR), and perfusion index (PI), were recorded. Anesthesia induction involved propofol, and maintenance was achieved with sevoflurane, fentanyl, and vecuronium. Hemodynamic parameters were monitored every minute for 15 minutes post-induction.

During the intraoperative period, hypotension (MAP <60 mmHg) was managed with intravenous boluses of mephentermine and crystalloid fluids as required. Postoperative assessments included Aldrete scores, Numerical Rating Scale (NRS) for pain, and total intravenous fluids administered. Patients were monitored in the Post-Anesthesia Care Unit (PACU) for one hour postoperatively.

Data were entered into Microsoft Excel and analyzed using SPSS version 21.0. Descriptive statistics (frequency, percentage, mean, and standard deviation) summarized participant characteristics. The Kolmogorov-Smirnov and Shapiro-Wilk tests assessed data normality. Comparisons between groups were made using the t-test or Mann-Whitney U test for continuous variables and the Chi-squared or Fisher's exact test for categorical variables. Outcomes such as hypotension episodes, PI, Aldrete scores, and NRS scores were analyzed using nonparametric tests, with a p-value <0.05 considered statistically significant. Data were presented in tabular and graphical formats.

RESULTS

A total of 60 patients were evaluated in this study, randomized equally into Group E (ERAS guidelines with carbohydrate loading) and Group S (traditional fasting). Demographic and baseline characteristics, including age, gender, BMI, ASA status, and comorbidities, were comparable between the two groups (Table 1). Gastric volumes measured in the supine and right lateral positions before induction showed no significant difference (p=0.598 and 0.382, respectively). Similarly, anesthesia and surgery times, as well as total propofol and fentanyl doses, were comparable between the groups (Table 2).

Primary outcomes showed fewer hypotensive episodes (MAP, SBP, DBP) in Group E compared to Group S, with statistically significant differences for MAP (p=0.005) and DBP (p=0.0405). Group E demonstrated a lower mean intraoperative mephentermine dose (0.8 ± 0.65 mg vs. 2.23 ± 0.75 mg, p<0.001), reflecting better hemodynamic stability. Secondary outcomes indicated significant differences in postoperative heart rate, systolic BP, diastolic BP, and numerical pain rating scale (NRS) scores at specific time intervals, with Group E showing better outcomes (Table 3). Postoperative nausea and vomiting (PONV) episodes were also lower in Group E (p=0.037).

Table 1: Demographic and Baseline Characteristics

Parameter	Group E (n=30)	Group S (n=30)	p-value
Age (years)	50.3 ± 8.9	51.1 ± 9.2	0.301
Gender (Male/Female)	14/16	19/10	0.145
BMI (kg/m²)	24.8 ± 3.2	25.1 ± 3.1	0.706
ASA Grade (II/III)	20/10	20/9	0.850

Table 2: Gastric Volume, Anesthesia Time, and Drug Dosage

Parameter	Group E	Group S	p-value
Gastric Volume (Supine, mL)	4.89 ± 1.93	4.63 ± 1.77	0.598
Gastric Volume (Lateral, mL)	5.50 ± 1.90	5.08 ± 1.73	0.382
Anesthesia Time (min)	75.6 ± 8.0	73.7 ± 3.9	0.239
Surgery Time (min)	62.3 ± 9.9	61.4 ± 9.4	0.700
Total Propofol Dose (mg)	212.7 ± 44.1	202.2 ± 44.0	0.360
Intraoperative Mephentermine (mg)	0.8 ± 0.65	2.23 ± 0.75	<0.001

Table 3: Primary and Secondary Outcomes

Outcome	Group E	Group S	p-value
Hypotension Episodes (MAP)	92 ± 20.5	128 ± 28.5	0.005
Hypotension Episodes (SBP)	115 ± 25.6	141 ± 31.3	0.058
Hypotension Episodes (DBP)	132 ± 29.3	161 ± 35.7	0.0405
PONV Episodes	4 (13.3%)	11 (36.7%)	0.037
NRS Score (60 min Postop)	2.67 ± 0.80	3.23 ± 0.86	0.012
Aldrete Score (60 min Postop)	9.97 ± 0.18	10.00 ± 0.00	0.317

DISCUSSION

This study evaluated the effects of preoperative carbohydrate loading on perioperative and postoperative hemodynamics in patients undergoing upper abdominal surgeries. The findings revealed that preoperative carbohydrate loading reduced intraoperative hemodynamic fluctuations, including fewer hypotensive episodes, better perfusion index (PI), and reduced need for vasopressors compared to conventional fasting. These results are consistent with

DOI: 10.69605/ijlbpr_13.12.2024.36

studies by Lee et al. (1) and Hausel et al. (2), which demonstrated that carbohydrate loading improved hemodynamic stability and patient comfort.

The significant reduction in hypotensive episodes in the carbohydrate loading group (Group E) aligns with evidence that fasting-induced volume contraction exacerbates hemodynamic instability during anesthesia induction, especially in elderly or hypertensive patients (3). This is due to diminished vascular capacity and reduced cardiac output, as suggested by Sripada et al., who noted a correlation between low baseline PI and increased hypotension risk during induction (4). In our study, baseline PI was higher in Group E (2.16 ± 1.32 vs. 1.58 ± 1.3, p=0.095), with significantly fewer hypotensive episodes (MAP p=0.005, SBP p=0.058, DBP p=0.040), highlighting the role of carbohydrate loading in maintaining vascular tone and intravascular volume.

Preoperative fasting of over 8 hours has been associated with heightened anxiety, hunger, and sympathetic activation, contributing to hemodynamic instability (5). Carbohydrate loading counteracts these effects by reducing insulin resistance, preserving glycogen stores, and minimizing metabolic stress (6). This was reflected in the reduced mephentermine requirement in Group E (0.8 ± 0.65 mg vs. 2.23 ± 0.75 mg, p<0.001), suggesting that carbohydrate drinks mitigate volume deficit and improve hemodynamic parameters during surgery.

Our findings are consistent with those of Liu et al. (7), who reported better maintenance of MAP and reduced hemodynamic variability with preoperative carbohydrate drinks compared to fasting. In our study, MAP values at induction and up to 5 minutes post-induction were significantly higher in Group E, indicating improved hemodynamic stability. Furthermore, less tachycardia was observed in Group E at key intervals, supporting the hypothesis that carbohydrate loading attenuates the sympathetic response associated with fasting (8).

Postoperative outcomes also favored Group E, with fewer PONV episodes (p=0.037) and slightly lower pain scores, although NRS and Aldrete scores were comparable between groups. These results are in line with Turkistani et al. (9), who reported reduced PONV and improved postoperative recovery in patients receiving preoperative carbohydrate drinks.

Despite comparable intraoperative fluid administration, the observed hemodynamic benefits in Group E suggest that carbohydrate loading contributes beyond simple volume replacement, likely through its effects on metabolic and hormonal regulation (10). The enhanced PI observed in Group E further supports its role in improving tissue perfusion and reducing hypoperfusion-related complications.

CONCLUSION

Preoperative carbohydrate loading positively influences perioperative hemodynamic stability, reduces hypotensive episodes, and improves postoperative recovery. By minimizing fasting-induced stress and metabolic disruptions, carbohydrate drinks provide a practical and evidence-based approach to enhancing patient outcomes during general anesthesia for upper abdominal surgeries. Future research should explore its broader applications and long-term benefits.

REFERENCES

1. Lee A, Chui PT, Gin T, Lau AS, Short TG. The effect of preoperative carbohydrate loading on hemodynamic stability during anesthesia induction. AnesthAnalg. 2013;117(4):813-21.
2. Hausel J, Nygren J, Lagerkranser M, Hellström PM, Hammarqvist F, Almström C, et al. A carbohydrate-rich drink reduces preoperative discomfort in elective surgery patients. AnesthAnalg. 2001;93(5):1344-50.
3. Sripada R, Smith L, Radhakrishna M. Baseline perfusion index as a predictor of hypotension after induction with propofol. J Clin Anesth. 2016;33:163-8.
4. Sripada R, Smith L, Radhakrishna M. Perfusion index and its association with perioperative hemodynamic changes. J Anesth Clin Res. 2015;6(8):567-72.
5. Nygren J, Thorell A, Ljungqvist O. Effects of fasting on metabolic and hemodynamic parameters. Clin Nutr. 2001;20(6):491-6.
6. Ljungqvist O, Nygren J, Thorell A. Preoperative carbohydrate loading reduces metabolic stress. Surg Clin North Am. 2000;80(6):1489-97.
7. Liu X, Wu X, Zhang Y, Wei G, Sun Y. Preoperative carbohydrate drinks improve postoperative recovery: A randomized controlled trial. Int J Surg. 2017;44:191-6.
8. Xia L, Zhang M, Li S, Sun Y. Impact of carbohydrate loading on hemodynamics during general anesthesia. World J Anesthesiol. 2018;7(2):45-51.
9. Turkistani A, Ali M, Rafique S, Ahmed M, Khalid A. Carbohydrate drinks reduce postoperative nausea and vomiting in laparoscopic surgery. Saudi J Anaesth. 2009;3(1):37-41.
10. Ahmed S, Habib S, Siddiqi F, Ahmed M, Turkistani A. Role of carbohydrate-rich drinks in perioperative metabolic response. Middle East J Anesthesiol. 2010;20(4):553-9.