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Original Research Article

Role of preoperative carbohydrate loading in reducing port site pain following laparoscopic cholecystectomy for gall stone disease

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ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard for gallstone disease, though postoperative port-site pain remains common. Preoperative carbohydrate loading, an enhanced recovery after surgery (ERAS) component, helps reduce fasting discomfort and enhance recovery. This study aimed to assess its role in reducing port-site pain and analgesic use after laparoscopic cholecystectomy. The aim of the study was to evaluate the effect of preoperative carbohydrate loading on postoperative port site pain in patients undergoing laparoscopic cholecystectomy for gallstone disease.
Methods: This prospective observational study was conducted at the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, from February 2023 to January 2024. Sixty cholelithiasis patients were assigned to a control group (fasting) or an intervention group (preoperative carbohydrate drink). Postoperative pain (VAS), analgesic timing, and total doses were recorded. Data were collected via a predesigned questionnaire and analyzed using statistical package for the social sciences (SPSS) 22.0.
Results: In 60 patients, baseline characteristics were comparable ($p>0.05$). Postoperative pain scores were lower in the intervention group at 6 hours (4.53 versus 5.13), 12 hours (4.93 versus 5.40), 18 hours (3.92 versus 4.31), and 24 hours (2.82 versus 3.27) ($p<0.05$). Time to first and repeat analgesic doses was longer (7.20 versus 6.73 hours; 15.40 versus 14.90 hours; $p<0.05$), and total analgesic dose was lower (2.80 versus 3.53; $p=0.001$) compared to controls.
Conclusions: Preoperative carbohydrate loading significantly reduced postoperative pain and the total analgesic requirement, with the intervention group needing fewer doses than the control group.

Keywords: Preoperative carbohydrate loading, Port site pain, Laparoscopic cholecystectomy

INTRODUCTION

Laparoscopic cholecystectomy is recognized as the gold standard for the treatment of symptomatic gallstone disease, offering shorter hospital stays, faster recovery, and reduced postoperative complications, mortality rates, and length of hospitalization compared to open cholecystectomy.[1-3] Despite these advantages, postoperative pain—particularly at port sites—remains a significant concern for patients undergoing this minimally invasive procedure.[4] Pain is often most intense in the initial hours post-surgery and is a leading reason for overnight hospital stays following laparoscopic cholecystectomy.[5]

Effective management of postoperative pain is critical not only for patient comfort but also for optimizing physiological recovery.[6] Traditional pain management relies on opioids and non-steroidal anti-inflammatory drugs (NSAIDs), which, while effective, carry the risk of side effects, and reducing doses to minimize complications may compromise analgesic efficacy.[6] Consequently, alternative strategies to manage pain safely and effectively are warranted.

Preoperative carbohydrate loading has emerged as a promising approach to mitigate postoperative pain and improve recovery outcomes. Administering a carbohydrate-rich drink two hours before surgery has been shown to reduce fasting-induced discomfort, modulate the surgical stress response, lower cortisol levels, and decrease postoperative insulin resistance and hyperglycemia.[7-9] It also improves patient well-being, enhances muscle function, accelerates recovery, reduces hospital stay, and decreases treatment costs.[10-12] Within the enhanced recovery after surgery (ERAS) framework, preoperative carbohydrate intake is a key component, recommended by many anesthesiology societies as safe for consumption up to two hours before surgery.[13,14]

Preoperative carbohydrate loading has been demonstrated to reduce postoperative pain, lower opioid requirements, and improve patient outcomes across various surgical procedures.[15-17] It has additional physiological benefits, such as lowering the expression of HLA-DR on monocytes, reducing intraoperative hypothermia, and minimizing protein and nitrogen loss, which facilitate wound healing and enhance recovery.[10,18] Moreover, evidence suggests that carbohydrate loading does not adversely affect patients with controlled comorbidities and is increasingly adopted worldwide as part of modern perioperative care.[13,19]

Although several studies have highlighted the benefits of preoperative carbohydrate loading, limited research has specifically examined its effect on port site pain following laparoscopic cholecystectomy. Therefore, this study aims to evaluate the role of preoperative carbohydrate loading in reducing port site pain and postoperative analgesic requirements in patients undergoing laparoscopic cholecystectomy for gallstone disease. We hypothesize that patients receiving preoperative carbohydrate loading will experience lower intensity and shorter duration of port site pain compared to those undergoing traditional fasting, thereby contributing to improved perioperative care and patient recovery.

Objective

Objective of the study was to evaluate the effect of preoperative carbohydrate loading on postoperative port site pain in patients undergoing laparoscopic cholecystectomy for gallstone disease.

METHODS

This prospective observational study was conducted at the Department of General Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from February 2023 to January 2024. A total of 60 patients diagnosed with cholelithiasis and scheduled for elective laparoscopic cholecystectomy were enrolled based on predefined inclusion and exclusion criteria. Patients were divided into two groups: 30 patients in the control group fasted from midnight before surgery, while 30 patients in the intervention group received 400 mL of a carbohydrate-rich drink (12.5% glucose) 2 hours prior to surgery.

Inclusion criteria

Patients diagnosed with cholelithiasis and scheduled for elective laparoscopic cholecystectomy, age 18–65 years, irrespective of gender, and ASA physical status I–II were included.

Exclusion criteria

Patients with history of previous upper abdominal surgery affecting recovery, diabetes mellitus, pregnancy or lactation, patients requiring conversion to open surgery, and patients who received patient-controlled analgesia (PCA) or pre-emptive analgesia were excluded.

All patients underwent laparoscopic cholecystectomy using a standard four-port technique under uniform anesthetic and surgical protocols, maintaining intra-abdominal pressure at 12–15 mmHg. The primary outcomes were duration and severity of port-site pain and the dose and frequency of postoperative analgesics, with preoperative carbohydrate loading as the independent variable. Age, gender, and body mass index (BMI) were considered potential confounders. Postoperative pain was assessed using the visual analog scale (VAS) at 6, 12, 18, and 24 hours. The timing of first and subsequent analgesic doses, along with total analgesic consumption, was also recorded.

Data were collected using a semi-structured questionnaire, with outcome assessors blinded to group allocation. Quantitative data were expressed as mean±standard deviation and analyzed using the unpaired t-test, while qualitative data were expressed as frequencies and percentages and analyzed with the Chi-square test. A p value <0.05 was considered statistically significant, and all analyses were performed using statistical package for the social sciences (SPSS) version 22.0. Ethical approval was obtained from the Institutional Review Board of BSMMU, and written informed consent was secured from all participants. Patient confidentiality was maintained throughout, and the study was conducted in accordance with the Declaration of Helsinki.

RESULTS

According to Table 1, more than one-fourth of patients (29.9%) in the control group and 5 patients (16.6%) in the intervention group were aged >50 years. The mean age was 42.6±12.61 years in the control group and 37.63±11.85 years in the intervention group. Two-thirds of patients (66.7%) in the control group and 17 patients (56.7%) in the intervention group were female. Almost two-thirds of patients (63.3%) in the control group and 20 patients (66.7%) in the intervention group had ASA grade I. The differences between the two groups were not statistically significant (p>0.05). The mean weight was 62.53±8.05 kg in the control group and 65.13±7.83 kg in the intervention group. More than three-fourths of patients (76.0%) in the control group and 18 patients (59.4%) in the intervention group had a BMI of 18.5–24.9 kg/m². The mean BMI was 23.74±1.85 kg/m² in the control group and 24.39±1.86 kg/m² in the intervention group. These differences were also not statistically significant (p>0.05).

The mean pain score at 6 hours was 5.13±0.57 in the control group and 4.53±0.72 in the intervention group. At 12 hours, the mean pain score was 5.40±0.72 in the control group and 4.93±0.74 in the intervention group. At 18 hours, it was 4.31±0.77 in the control group and 3.92±0.68 in the intervention group. At 24 hours, the mean pain score was 3.27±0.63 in the control group and 2.82±0.71 in the intervention group. The differences between the two groups were statistically significant at all-time points (p<0.05) (Table 2).

The mean time of the first analgesic dose was 6.73±0.68 hours in the control group and 7.20±0.66 hours in the intervention group. The mean time of the repeat dose was 14.90±0.84 hours in the control group and 15.47±0.73 hours in the intervention group. The differences between the two groups were statistically significant (p<0.05) (Table 3).

Table 4 shows the distribution of patients according to the total analgesic dose administered. Almost two-thirds of patients (60.0%) in the control group received 4 doses, compared to 3 patients (10.0%) in the intervention group. The mean total dose was 3.53±0.63 in the control group and 2.80±0.61 in the intervention group. The difference between the two groups was statistically significant (p<0.05).

Table 1: Demographic characteristics of the study patients (n=60).

Demographic variables	Intervention group (n=30)		Control group (n=30)		P value
	N	%	N	%	
Age (years)					
<30	6	19.8	10	33.2	
31-40	8	26.5	8	26.6	
41-50	7	23.2	7	23.3	
>50	9	29.9	5	16.6	
Mean±SD	42.6±12.61		37.63±11.85		[a]0.121[ns]
Range (min, max)	19, 65		19, 58		
Sex					
Male	10	33.3	13	43.3	[b]0.425[ns]
Female	20	66.7	17	56.7	
ASA grade					
I	19	63.3	20	66.7	[b]0.786[ns]
II	11	36.7	10	33.3	
Weight (kg)					
Mean±SD	62.53±8.05		65.13±7.83		[a]0.209[ns]
Range (min, max)	50, 79		51, 76		
BMI (kg/m²)					
18.5-24.9	23	76.0	18	59.4	
25.0-29.9	7	23.1	12	39.7	
Mean±SD	23.74±1.85		24.39±1.86		[a]0.180[ns]
Range (min, max)	20.56, 27.08		20.56, 27.49		

a=Unpaired t-test; b=Chi-square test; ns=Not significant (p>0.05).

Table 2: Postoperative pain scores at different time intervals (n=60).

Pain score (hours)	Intervention group (n=30), mean±SD	Control group (n=30), mean±SD	P value
6	4.53±0.72	5.13±0.57	0.007[s]
12	4.93±0.74	5.40±0.72	0.014[s]

Continued.

Pain score (hours)	Intervention group (n=30), mean±SD	Control group (n=30), mean±SD	P value
18	4.31±0.77	4.31±0.77	0.042s
24	2.82±0.71	3.27±0.63	0.012s

s: significant

Table 3: Timing of analgesic administration (1st and subsequent doses) (n=60).

Time of dose (hours)	Intervention group (n=30), mean±SD	Control group (n=30), mean±SD	P value
Time of 1st dose	7.20±0.66	6.73±0.68	0.009s
Time of repeat dose	15.40±0.73	14.90±0.84	0.017s

s: significant

Table 4: Distribution of patients by total analgesic dose administered (n=60).

Total dose (number)	Intervention group (n=30)		Control group (n=30)		P value
	n	**%**	**n**	**%**	
2	3	10.0	2	6.7	
3	18	60.0	10	33.3	
4	9	30.0	18	60.0	
Mean±SD	2.80±0.61		3.53±0.63		0.001s

s: significant

DISCUSSION

Preoperative carbohydrate loading plays a pivotal role in enhancing recovery following laparoscopic cholecystectomy for gallstone disease by mitigating surgical stress and optimizing metabolic responses. Studies have shown that patients receiving carbohydrate loading before surgery experience reduced postoperative pain, particularly at port sites, and decreased overall analgesic requirements. Tavalaee et al highlighted its benefits in minimizing postoperative discomfort and reducing reliance on pain medication, suggesting that carbohydrate loading is a valuable perioperative strategy to improve recovery and patient satisfaction.[9]

This cross-sectional study aimed to evaluate the effect of preoperative carbohydrate loading on postoperative pain in patients undergoing laparoscopic cholecystectomy. The mean VAS scores for pain were compared between patients receiving carbohydrate loading and a control group, while also examining the impact on patient satisfaction and the pace of postoperative recovery.

A total of 60 patients aged 18–65 years, classified as ASA I–II, were enrolled from the General Surgery Department of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, between February 2023 and January 2024. Patients with prior upper abdominal surgery, diabetes, pregnancy, lactation, or non-compliance with the protocol were excluded. The results were analyzed in the context of existing literature, reinforcing the potential benefits of preoperative carbohydrate loading on postoperative outcomes.

In this study, patient demographics were comparable between the control (42.6±12.61 years) and intervention (37.63±11.85 years) groups, with no significant age- or gender-related differences ($p>0.05$). ASA grades were predominantly I, and mean weights and BMIs were similar, indicating that physical parameters did not significantly influence the efficacy of preoperative carbohydrate loading.[12,20,21]

Significant reductions in postoperative pain scores were observed in the intervention group at multiple time points, particularly at 6 and 24 hours, demonstrating the analgesic benefit of preoperative carbohydrate loading. Tavalaee et al similarly reported decreased pain and inflammatory markers, suggesting a dual physiological effect of modulating inflammation alongside pain reduction.[9] Singh et al noted reductions in pain and postoperative nausea and vomiting, attributing the effect to attenuation of the surgical stress response and prevention of fasting-induced catabolic states.[17] Chaudhary et al also reported VAS reductions, reinforcing the consistency of carbohydrate loading in mitigating postoperative pain.[22] Variations in the magnitude and timing of pain reduction across studies may reflect differences in surgical techniques, patient populations, and carbohydrate loading protocols.

While all studies support the positive impact of preoperative carbohydrate loading, variations in outcomes may reflect differences in assessment tools or postoperative care protocols. The present study suggests that carbohydrate loading is effective in reducing postoperative pain following laparoscopic cholecystectomy by modulating the body's response to surgical stress, though further research is needed to clarify the underlying mechanisms.

Notably, the intervention group received both the first (7.20±0.66 hours) and repeat (15.40±0.73 hours) analgesic doses later than the control group (6.73±0.68 hours and 14.90±0.84 hours, respectively; $p<0.05$), indicating that carbohydrate loading may influence analgesic timing and recovery trajectory. Awad et al highlighted that early carbohydrate loading improves patient comfort and reduces postoperative insulin resistance, indirectly affecting pain and recovery.[23] Similarly, Ismy et al demonstrated significant improvements in postoperative quality of life across multiple domains following preoperative oral glucose administration ($p<0.001$).[20] Collectively, these findings reinforce the potential of preoperative carbohydrate loading to enhance recovery and reduce incision-site pain after laparoscopic cholecystectomy.

Pachella et al implemented carbohydrate loading in thoracic surgery patients within an ERAS protocol, reporting reduced postoperative opioid and antiemetic use in the first 24 hours.[24] Similarly, the present study found that patients receiving preoperative carbohydrate loading required fewer analgesics postoperatively ($p<0.05$), highlighting its efficacy. Kausar et al observed that carbohydrate-loaded patients undergoing laparoscopic cholecystectomy had better hemodynamic stability, lower intraoperative heart rates, and reduced postoperative pain, along with improved glucose control.[25]

Talutis et al demonstrated that patients with type II diabetes tolerated preoperative carbohydrate loading without increased insulin requirements or adverse glycemic effects.[26] Karaca et al further emphasized its safety across cardiac surgery patients, suggesting broad applicability.[27]

Mechanistically, carbohydrate loading may reduce postoperative pain by modulating insulin sensitivity, inflammatory responses, and stress hormone levels. These findings support the use of preoperative carbohydrate loading as an effective strategy to reduce port-site pain and improve recovery in patients undergoing laparoscopic cholecystectomy for gallstone disease.

Limitations

The study had a few limitations. Variation in individual pain thresholds and medication requirements, which may have influenced the observed outcomes. The absence of blinding in the study design poses a risk of bias, potentially affecting the accuracy of pain reporting and outcome assessment. Other potential confounding factors, such as the use of additional pain management techniques or patients' psychological status, were not assessed and may have impacted postoperative pain outcomes.

CONCLUSION

Based on the findings of this study, preoperative carbohydrate loading effectively reduces the severity of postoperative pain and decreases the requirement for initial and subsequent doses of analgesics in patients undergoing laparoscopic cholecystectomy for gallstone disease.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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