

Association of Nausea and Length of Stay with Carbohydrate Loading Prior to Total Joint Arthroplasty

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ABSTRACT

Background: Enhanced Recovery After Surgery (ERAS) is a multimodal, standardized approach to the surgical patient that incorporates evidenced-based interventions designed to achieve rapid recovery after surgery by minimizing the patient's stress response. One aspect of ERAS, carbohydrate loading, has been shown in multiple randomized controlled trials to result in postoperative benefits in patients undergoing colorectal surgery, but there appears to be insufficient data to make definitive recommendations for or against carbohydrate loading in joint replacement patients.

Objective: To evaluate postoperative nausea and length of stay (LOS) after a preoperative carbohydrate loading protocol was initiated for patients undergoing total joint replacement.

Design: Retrospective chart review.

Setting and participants: 100 patients who underwent either total knee or hip arthroplasty at Winthrop University Hospital, Mineola, NY, in the past 4 years and either had ($n = 50$) or had not received preoperative carbohydrate supplements ($n = 50$).

Methods: Using the total joint database, the medical record was reviewed for the patient's demographics, LOS, documentation of postoperative nausea, and number of doses of antiemetic medication given to the patient.

Results: The mean LOS for the carbohydrate-loading group and non-carbohydrate group was 1.9 days and 2.6 days, respectively, a difference of 0.70 days ($P < 0.0001$). The carbohydrate-loaded group received a total of 13 doses of antiemetic medications and the non-carbohydrate group received 21 doses. The average number of antiemetic doses given to a patient postoperatively was 0.26 for the carbohydrate-loaded group and 0.42 for the non-carbohydrate-loaded group. The difference was 0.16 doses ($P < 0.7815$).

Conclusion: The implementation of carbohydrate loading decreased LOS for joint replacement patients by approximately 1 day. Additionally, there was a trend towards decreased antiemetic use and fewer documented cases of postoperative nausea after carbohydrate loading.

Keywords: carbohydrate loading, ERAS, joint arthroplasty, length of stay, nausea.

Enhanced Recovery After Surgery (ERAS) is a multimodal, standardized approach to the surgical patient that incorporates evidenced-based interventions designed to achieve rapid recovery after surgery by minimizing the patient's stress response.¹⁻⁴ The ERAS protocols have been shown to reduce complications, decrease length of stay (LOS), and improve patient out-

comes.³⁻⁷ The program was originally designed to facilitate recovery after colorectal operative procedures by

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maintaining preoperative organ function and reducing the postoperative stress response. This was done through a coordinated program of preoperative counseling, optimizing nutritional status, standardizing analgesic regimens, and early mobilization.³

The principles of an ERAS program with standardized pre- and postoperative protocols appear ideally suited for the total joint arthroplasty patient.^{1,3-5} Prior studies have demonstrated ERAS to be effective in facilitating decreased LOS, with no apparent increase in readmission rates or complications for both colorectal and joint arthroplasty patients.¹⁻⁷ The protocols have also been shown to be cost-effective, with decreased incidence of postoperative complications, including thromboembolic disease and infections.^{3,4,6} Since 2014, we have adopted many aspects of the ERAS protocol at our institution's joint arthroplasty program. All patients attend a preoperative educational program and undergo medical and dental optimization prior to surgery.⁸ We have adopted guidelines regarding hemoglobin A1c levels (< 8.0), body mass index (< 35), and cessation of smoking (\leq 6 weeks). There are standardized pre- and postoperative pain regimens, including the use of regional anesthesia and postoperative nerve blocks whenever possible.⁹ All patients are mobilized in the post-anesthesia care unit (PACU) once the regional anesthesia has dissipated and vital signs are stable.¹⁰

An important tenet of ERAS protocols is optimizing the nutritional status of the patient prior to surgery.⁶ This includes avoidance of preoperative fasting in conjunction with carbohydrate loading. ERAS protocols instruct the patient to ingest a carbohydrate-rich beverage 2 hours prior to surgery. The concept of allowing a patient to eat prior to surgery is based on the preference for the patient to present for surgery in an anabolic rather than a catabolic state.^{2,3,11} Patients in an anabolic state undergo less postoperative protein and nitrogen losses, which appears to facilitate wound healing.^{2,6,11}

There have been multiple randomized controlled trials demonstrating the postoperative benefits of carbohydrate loading prior to colorectal surgery.^{2,6} However, the data regarding the benefits of carbohydrate loading in joint replacement patients have been inconclusive.^{3,12} One recent study of carbohydrate loading in joint arthroplasty patients has shown promising results, with decreased

LOS and decreased C-reactive protein levels in patients who had ingested a carbohydrate drink prior to surgery.¹³ Although there appears to be insufficient data to make definitive recommendations for or against carbohydrate loading in joint replacement patients,³ the data from the colorectal literature provides a strong basis of support to avoid fasting and preoperatively feed patients in order to enhance recovery after total joint arthroplasty.

Another potential benefit of preoperative carbohydrate loading is a decrease in postoperative nausea.^{1,5,12-14} A decrease in nausea in theory would allow for earlier mobilization with physical therapy and potentially a shorter LOS. Hence, the goal of this study was to examine the impact of preoperative carbohydrate loading on postoperative nausea directly, as well as on LOS, at a single institution in the setting of an ERAS protocol.

Methods

Patients and Setting

We retrospectively reviewed the records of 100 patients who underwent total hip or total knee replacement between 2014 and 2018 at NYU Winthrop University Hospital, Mineola, NY. Fifty patients had received preoperative carbohydrate supplements and 50 patients had not. The remainder of the total joint protocol was identical for the 2 groups.

Protocol

All patients attended preoperative educational classes. For patients receiving carbohydrate loading, written and oral instructions were given for the patient to drink Ensure Clear followed by 8 ounces of water before going to bed the night before surgery. They were also instructed to drink the Ensure Pre-Surgery Drink 2 hours prior to their operative procedure. Patients with diabetes were instructed to drink the Ensure Glucerna Clear drink the night before surgery. No carbohydrate drink was given on the day of surgery until a finger-stick glucose level was performed upon arrival at the hospital. Spinal anesthesia was utilized in all patients, with adductor canal block supplementation for patients undergoing total knee replacement. Orders were written to have physical therapy evaluate the patients in the PACU to facilitate ambulation. Pre- and postoperative pain protocols were identical for the 2 groups.

Table. Patient Demographics and Outcomes

	Carbohydrate-Loading Group (n = 50)	Non-Carbohydrate-Loading Group (n = 50)	P Value
Mean ± SD age, yr	68.6 ± 9.0 (median, 69.0)	68.0 ± 11.1 (median, 69.0)	0.7675
Gender, no. (%)			
Female	26 (52.0)	25 (50.0)	0.8414
Male	24 (48.0)	25 (50.0)	
Mean ± SD LOS, days	1.9 ± 0.9 (median, 2.0)	2.6 ± 0.9 (median, 2.0)	< 0.0001
Episodes of vomiting, no. (%)			
0	49 (98.0)	47 (94.0)	0.6173
1	1 (2.0)	2 (4.0)	
2	0 (0.0)	1 (2.0)	
Mean ± SD no. of antiemetic doses given	0.26 ± 0.49 (median, 0.0)	0.42 ± 0.93 (median, 0.0)	0.7815
Postop nausea documented, no. (%)	2 (4.0)	6 (12.0)	0.2687
Diabetes, no. (%)	7 (14.0)	7 (14.0)	1.0000
Nerve block, no. (%)			
Femoral	8 (16.0)	4 (8.0)	0.3522
None	26 (52.0)	32 (64.0)	
Saphenous	16 (32.0)	14 (28.0)	
Arthroplasty, no. (%)			
Total hip arthroplasty	23 (46.0)	30 (60.0)	0.1608
Total knee arthroplasty	27 (54.0)	20 (40.0)	

LOS, length of stay; SD, standard deviation.

Data Collection

A chart review was performed using the patients' medical record numbers from the joint replacement database at our institution. Exemption was obtained for the project from our institution's Institutional Review Board (IRB). The medical record was reviewed for the patient's age, sex, procedure, surgeon, LOS (in days), documentation of postoperative nausea, and number of doses of antiemetic medication given to the patient on postoperative day (POD) 0 and 1. Antiemetic medication was either trimethobenzamide, metoclopramide, or ondansetron. Data was organized in an Excel spreadsheet.

Analysis

Descriptive statistics (mean, standard deviation, and median for continuous variables; frequencies and percentag-

es for categorical variables) were calculated separately by group. The 2 groups were compared using the chi-square test or Fisher's exact test, as deemed appropriate, for categorical variables, the 2-sample t-test for age, and the Mann-Whitney test for LOS and number of antiemetic doses given. A result was considered statistically significant at the $P < 0.05$ level of significance. All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC).

Results

The carbohydrate-loading group (n = 50) and the non-carbohydrate-loading group (n = 50) were comparable for age, gender, type of arthroplasty, episodes of vomiting, diabetes, and nerve block (Table). Six different joint replacement surgeons participated in the study. The mean LOS for the carbohydrate-loading group was 1.9 days, while the

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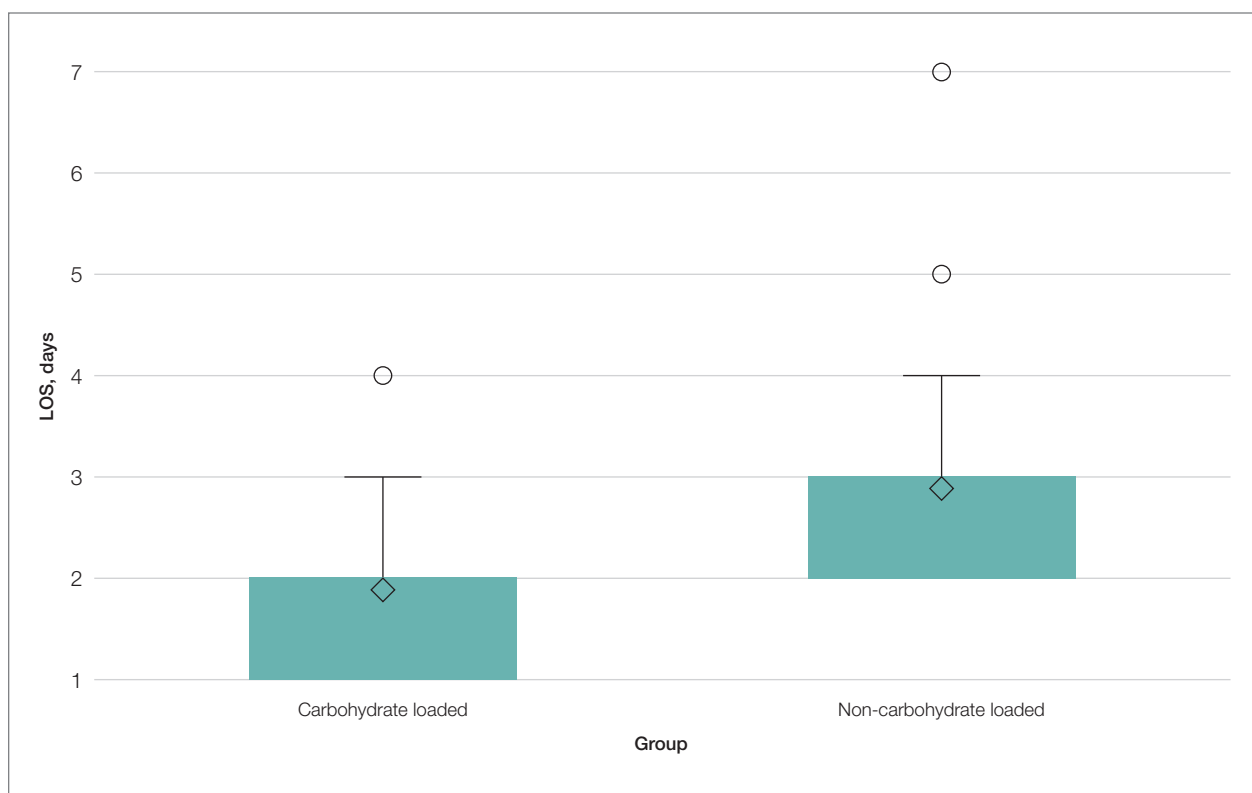


Figure. Distribution of length of stay (LOS) for carbohydrate-loaded (n = 50) versus non-carbohydrate-loaded patients (n = 50).

LOS for the non-carbohydrate group was 2.6 days (difference of 0.7 days; $P < 0.0001$; **Figure**). The number of antiemetic medication doses on POD 0 and 1 was evaluated. A total of 13 doses of antiemetic medications were given to the carbohydrate-loaded group and 21 doses were given to the non-carbohydrate group. The average number of antiemetic doses given to a patient postoperatively was 0.26 for the carbohydrate group and 0.42 for the non-carbohydrate group (difference of 0.16 doses; $P < 0.7815$). There was not a significant difference in the rate of postoperative nausea documented in the carbohydrate-loaded patients as compared to the non-carbohydrate-loaded patients (4% vs 12%, respectively, $P < 0.2687$).

Discussion

In this study we explored whether carbohydrate loading prior to total joint replacement influenced postoperative nausea and LOS in a single institution. The 2 groups appeared similar in terms of demographics as well as the types of surgical procedures performed.

After initiation of the carbohydrate-loading protocol, LOS decreased by approximately 1 day. There was also a trend toward decreased usage of antiemetics in the carbohydrate-loaded group, although the final values were not statistically significant. There were also fewer documented cases of postoperative nausea in the carbohydrate-loaded group.

The failure to find a statistical difference in postoperative antiemetic usage between carbohydrate-loaded and non-carbohydrate-loaded patients may be due to incomplete documentation (ie, not all patients who were nauseous having their symptoms documented in the chart). Due to the small number of antiemetic doses given to each patient, we may have lacked the necessary numbers to visualize the difference between the groups. We were unable to perform a post-hoc power calculation with our current data. Additionally, the decrease seen in LOS may not have been due solely to carbohydrate loading, since the data were collected over multiple years during implementation of the ERAS protocol. There is a possibility that the ERAS

protocol, which is multimodal, was better implemented as time progressed, adding a confounding variable to our data. Despite these limitations, however, we were able to demonstrate a decreased LOS for patients who underwent total joint replacement with the initiation of a preoperative carbohydrate-loading ERAS protocol. Furthermore, there was a trend toward decreased documented postoperative nausea and decreased antiemetic use in the group that avoided fasting and received carbohydrate supplements.

This decrease in LOS by almost 1 day is consistent with multiple prior studies that demonstrated a similar decrease when implementing an ERAS protocol.^{3-5,7} The trend towards lower antiemetic use and less postoperative nausea in the carbohydrate-loading ERAS protocol gives merit to further research on this topic, with the goal of finding an optimal preoperative practice that allows patients to experience rapid mobilization, minimal postoperative nausea, and faster recovery overall.

Conclusion

The carbohydrate-loading ERAS protocol implemented at our institution was found to decrease LOS for joint arthroplasty patients by approximately 1 day. Additionally, there was a trend toward decreased antiemetic use and fewer documented cases of postoperative nausea when patients underwent preoperative carbohydrate loading. Further research on carbohydrate loading prior to joint replacement appears warranted, as this may be another avenue to optimize postoperative outcomes in this patient population.

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