

Nutritional Advancement in the Hospitalized Child After NPO: A Retrospective Cohort Study

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OBJECTIVES: A clear-liquid diet is commonly used after a nil per os (NPO) order in children recovering from acute gastrointestinal (GI) illnesses. Our purpose for this study was to compare outcomes in patients receiving a clear-liquid diet after an NPO order with outcomes in those receiving a regular diet.

METHODS: In this retrospective cohort study, patients aged 1 to 18 years admitted to a tertiary care children's hospital between 2016 and 2017 were screened to identify those who had an NPO order placed for acute GI illnesses. Patients with complex medical needs, a feeding disorder, or chronic GI disorders were excluded.

RESULTS: Of 39 total patients, 17 (44%) received a clear-liquid diet after an NPO order. There was no difference in diet tolerance between patients receiving a clear-liquid diet and those receiving a regular diet on the basis of emesis in the first 12 hours ($P = .40$), pain scores after the first oral intake ($P = .86$), return to clear-liquid diet ($P = .57$), or return to NPO status ($P > .99$). Patients started on a clear-liquid diet had a longer length of stay (LOS) after diet initiation compared with those receiving a regular diet (median: 43.7 hours [interquartile range: 29.8–53.4] vs median: 20.8 hours [interquartile range 6.7–47.3]), both in the univariate analysis ($P = .01$) and after controlling for age, diagnosis category, and pain score before and after the first oral intake ($P = .03$).

CONCLUSIONS: Patients transitioned to a clear-liquid diet after NPO status have a longer LOS after the first oral intake independent of patient age, diagnosis, and pretransition abdominal pain. Both groups had similar diet tolerance, suggesting that transition to a regular diet after NPO status may decrease LOS without significant adverse effects.

ABSTRACT

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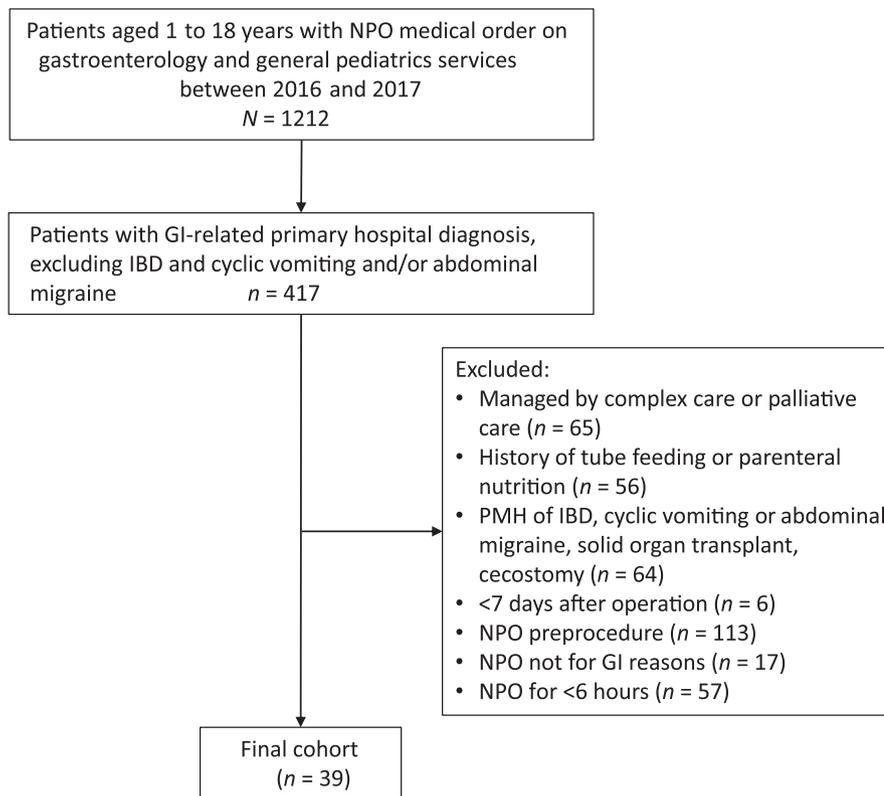


FIGURE 1 Patient cohort identification flow diagram. IBD, inflammatory bowel disease; PMH, past medical history.

Nutrition is an important element of care for hospitalized children with gastrointestinal (GI) illnesses, who make up a substantial proportion of pediatric admissions. After respiratory illnesses, disorders of the digestive system constitute the second most common major diagnostic category in children who are hospitalized.¹ Although guidelines exist for early regular feeding in children with diarrheal illness,^{2–5} little is known about nutritional advancement for children hospitalized with other acute GI illnesses (eg, acute abdominal pain, postinfectious ileus). A clear-liquid diet is commonly ordered as the initial diet after a period of nil per os (NPO) in children who are recovering from acute illnesses that may alter GI motility. A clear-liquid diet has long been perceived to be more easily tolerated than a regular diet in terms of gastric emptying and small-bowel absorption.^{6,7} However, clear-liquid diets have minimal nutritional value and may delay hospital discharge, increasing hospital costs.

There are currently no data supporting the benefit of a clear-liquid diet over a regular diet after a period of NPO. Early nutrition has revealed benefits in some pediatric clinical settings, such as patients with acute pancreatitis^{8–11} and critical illness.^{12,13} The assumption that a clear-liquid diet is superior to a regular diet after NPO has been questioned in acute pancreatitis and immediately after surgery in adults,^{6,11,14–16} but has not been examined in children. Currently, pediatric providers do not have clear guidance in choosing between a regular diet and a clear-liquid diet after a period of NPO for GI reasons.

The purpose of this study was to compare outcomes in patients receiving a clear-liquid diet after NPO for GI reasons with outcomes in those receiving a regular diet. We hypothesized that length of stay (LOS) after diet initiation would be shorter in the regular diet group compared with the clear-liquid diet group. We also hypothesized that there would be no

difference in diet tolerance between the 2 groups.

METHODS

Study Design and Participants

We conducted a retrospective cohort study of hospitalized pediatric patients who were given an NPO order for GI-related reasons (“bowel rest”) in 2016–2017. The study was completed at a large academic pediatric quaternary care center by using electronic health record data. Medical records of patients aged 1 to 18 years admitted to the general pediatrics or gastroenterology services who had an NPO order were screened. Charts of patients with a GI-related primary diagnosis were further reviewed, and those with complex medical needs, feeding disorder, or chronic GI disorders were excluded (Fig 1). The NPO order was assumed to be for bowel rest if the chief complaint and/or admitting diagnosis was related to GI illnesses or symptoms and if the NPO reason was implied or mentioned in the provider documentation. Patients were excluded if the NPO order was placed for other reasons (eg, pre-procedure).

Variables and Outcomes

The primary outcome was LOS after diet initiation, defined as the time the first diet order was placed to the time the discharge order was placed. Secondary outcomes included markers of diet tolerance: emesis within the first 12 hours of diet initiation, pain scores, use of opiates, treatment with scheduled pain medication, emergent abdominal imaging (abdominal imaging performed for change in clinical status) in the first 24 hours after diet initiation, return to NPO, and return to a clear-liquid diet during the admission. Other variables of interest were length of the NPO period and length of time of the clear-liquid diet, both defined by the timing of the respective order placement.

Data Analysis

Patient characteristics were summarized as the median and interquartile range (IQR) or *n* (%). The χ^2 test or Fisher's exact test and the Mann-Whitney-Wilcoxon test were used as appropriate in the univariate analysis.

TABLE 1 Baseline Characteristics and Variables of the Inpatient Study Population by Diet Group

Demographics or Characteristics	Clear-Liquid Diet	Regular Diet	P
Age, median (IQR), y	10 (3–17)	6 (3–13)	.53
Sex			.14
Male	6 (32)	13 (68)	
Female	11 (55)	9 (45)	
Year of study			.86
2016	9 (45)	11 (55)	
2017	8 (42)	11 (58)	
Primary diagnosis grouping ^a			.045
Infectious and postinfectious	3 (20)	12 (80)	
Pancreatitis	5 (71)	2 (29)	
Others	9 (53)	8 (47)	
Service			.092
GI	10 (59)	7 (41)	
General pediatrics ^b	7 (32)	15 (68)	
Duration of NPO, median (IQR), h	13.53 (11.6–20.3)	14.13 (10.7–16.7)	.49
Pain score before diet initiation, median (IQR)	0 (0–4)	0 (0–2)	.39
Use of opiates before diet initiation			.76
Yes	7 (47)	8 (53)	
No	10 (42)	14 (58)	

Data are *n* (%) unless otherwise specified. —, not applicable.

^a Diagnosis grouping is based on the primary diagnosis (*n*): The infectious and postinfectious grouping (15) includes viral gastroenteritis, enteritis, and/or gastritis (10); *Clostridium difficile* infection (2); other infectious enteritis or colitis (1); postinfectious enteropathy (1); and mesenteric adenitis (1). The pancreatitis grouping (7) includes acute pancreatitis (6) and recurrent pancreatitis (1). The others grouping (17) includes constipation (5), abdominal pain (3), Henoch-Schönlein purpura (2), intussusception (2), emesis (3), ileus (1), and diverticulitis (1).

^b Ninety-one percent of the patients were on the hospital medicine service.

was used for multiple testing adjustment. $P < .05$ was considered significant. Statistical analyses were performed by using SAS version 9.4 (SAS Institute, Inc, Cary, NC) and R version 3.5.2.¹⁷

RESULTS

Patient Characteristics

An electronic health record review was used to identify 1212 patients with an NPO order, and after the exclusion criteria were applied, 39 patients remained as the final study cohort (Fig 1). The first diet initiated after the NPO order was a clear-liquid diet in 17 patients (44%) and a regular diet in 22 patients (56%). The median duration of a clear-liquid diet was 14.3 hours (IQR 8.7–23.8).

On the basis of the primary diagnosis, patients were divided into 3 groups: infectious and postinfectious ($n = 15$), pancreatitis ($n = 7$) and others ($n = 17$). In general, the clear-liquid and regular diet cohorts were similar in age, sex, duration of the NPO period, and pain scores before diet initiation (Table 1).

LOS After Diet Initiation

Patients who were ordered a clear-liquid diet after NPO had longer LOS after diet initiation compared with those ordered a regular diet (median: 43.7 hours [IQR 29.8–53.4] versus median: 20.8 hours [IQR 6.7–47.3]; $P = .01$). This remained significant after including diagnosis grouping ($P = .02$) or after including diagnosis grouping, age, last pain score before diet initiation, and first pain score after diet initiation ($P = .03$).

Emergency department visits or hospital readmissions at 7 and 30 days were no different between the 2 diet groups (Table 2).

Diet Tolerance

There was no significant difference in diet tolerance between the 2 diet groups as measured by emesis in the first 12 hours ($P = .40$), use of opiates in the first 24 hours ($P = .21$), return to a clear-liquid diet ($P = .57$), and return to NPO status ($P > .99$) (Table 2).

There was no difference in the initial pain score or rate of change in pain

Pearson correlation coefficients were used to measure the statistical significance of the relationship between log-transformed LOS after diet initiation and last pain score before first intake and first pain score after first intake. The effects of diet order and diagnosis category on log-transformed LOS after diet initiation were examined by using

analysis of variance. Analysis of covariance was used to control for potential confounding variables. A linear mixed-effects model was used to model pain scores after first oral intake. A negative binomial model was used to test the effects of diet order on the number of emesis episodes in the first 12 hours. Tukey's test

TABLE 2 Indices of Diet Tolerability of the Study Population by Diet Group

Indices of Tolerability	Clear-Liquid Diet	Regular Diet	P
Emesis in the first 12 h, median (IQR)	0 (0–0)	0 (0–0)	.40
Used opiates in the first 24 h	5 (29)	2 (9)	.21
On scheduled pain medication in the first 24 h	5 (29)	3 (14)	.26
Return to NPO	2 (12)	3 (14)	>.99
Return to clear-liquid diet	2 (12)	1 (5)	.57
Emergent abdominal imaging in first 24 h	3 (18)	3 (14)	>.99
Readmission, 7 d	1 (6)	1 (5)	>.99
Readmission, 30 d	3 (18)	3 (14)	>.99

Data are *n* (%) unless otherwise specified.

scores after diet initiation between the 2 diet groups ($P = .86$ and $.052$, respectively). The following covariates, tested separately in the model, were found to have a significant impact on pain and so were subsequently included in a multivariable model: age, last pain score before oral intake, diagnosis grouping, and service. Pain scores were lower in the infectious and postinfectious group and the others group compared with the pancreatitis group (Tukey-adjusted $P = .001$ and $.008$, respectively).

DISCUSSION

With this study, we add to the research regarding the benefits of early nutrition by comparing outcomes between a clear-liquid diet and regular diet across a range of pediatric patients with uncomplicated GI-related diagnoses. We found that a regular diet was well tolerated after a period of NPO for medical reasons, similar to findings of previous studies in acute pancreatitis.^{9–11,14} We did not find any evidence of adverse outcomes with regular diets, including no significant difference between pain scores, emesis, return to NPO status, use of opiates after diet initiation, and readmissions. Patient started on regular diets had the benefit of decreased LOS after diet initiation.

Although our population included a broad group of diagnoses, the difference in LOS remained significant even after accounting for diagnosis type. This suggests that the decreased LOS with regular diets was seen across all diagnoses and that a single diagnosis grouping did not unduly weight our results. The length of time on a clear-liquid diet could explain a significant portion of the observed difference in LOS between the 2 diet groups. Patients initially started on regular diets may meet discharge criteria faster than those who must prove that they can tolerate a clear-liquid diet before advancing to and tolerating a regular diet.

Our study is limited by the difficulty in controlling for disease severity. Patients placed on a clear-liquid diet may have had a more severe disease. We attempted to control for markers of disease severity, such as diagnosis grouping, last pain score,

and first pain score after diet initiation, but this might not have captured the entire severity of the disease that clinicians considered when deciding between clear-liquid and regular diets. In addition, there were a few patients in the clear-liquid group who had a slow advancement in diet from a clear-liquid diet to a full-liquid or soft diet before advancing to a regular diet, which may have contributed to their LOS. These patients ($n = 5$) had a wide variety of diagnoses (abdominal pain, Henoch-Schönlein purpura, intussusception, and pancreatitis) and may have had more severe disease; 2 of them were on opiates via patient-controlled analgesia while under the NPO order, and 1 developed a pancreatic cyst that required drainage by interventional radiology. Finally, the relatively small sample size and single-center design may limit the ability to generalize our findings. Additional directions may include studies to look at nutritional advancement in patients fed via gastrostomy or jejunostomy tubes or in patients who have medical complexity.

CONCLUSIONS

We found that regular diets were tolerated as well as clear-liquid diets after NPO status for GI reasons without increased adverse outcomes and with the added benefit of decreased LOS. Our results call into question the traditional wisdom that clear-liquid diets are better tolerated than regular diets.

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