

ORIGINAL RESEARCH



CE Causes of readmissions for patients discharged on enteral nutrition

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Funding information

National Institute of Diabetes and Digestive and Kidney Diseases, Grant/Award Numbers: P30-DK050306, T32-DK007740; Penn Center for Nutritional Science and Medicine

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Abstract

Background and Aims: Patients discharged with enteral nutrition (EN) through an enteral access device (DCENs) are noted to have increased hospital readmissions, but data on the readmission causes are limited. We assessed the proportion of these readmissions attributed to EN and determined the contributing factors to readmissions.

Methods: Using electronic health record data, we conducted a retrospective cohort study of all hospital encounters in an academic, urban hospital from July 2017 to December 2019 with discharge with EN to find all unplanned readmissions at the same hospital within 90 days. For each readmission, we evaluated through chart review whether discharge documentation identified the primary cause of readmission to be EN-related and evaluated for EN-related plan adjustments upon discharge.

Results: Over the 30-month period, there were 224 and 442 readmissions within 30 and 90 days for DCENs, respectively. EN-related readmissions accounted for 20.5% of 30-day readmissions and 16.7% of 90-day readmissions. Among these, 44.6% (33 of 74) documented enteral access device issues, 40.5% (30 of 74) cited gastrointestinal symptoms that the team attributed to EN, and 14.9% (11 of 74) cited sodium imbalance. The EN plan was changed in 97.3% (72 of 74) of EN-related readmissions and 32.3% (119 of 368) of EN-unrelated admissions. 52.0% of 90-day readmissions were within 90 days of initiating EN.

Conclusion: 20.5% of readmissions for DCENs are related to EN, with 52.0% occurring within 90 days of initiating EN. Quality improvement interventions targeting postdischarge care may decrease hospital readmissions in this high-risk and medically complex patient population.

KEYWORDS

enteral nutrition, hospital discharge, hospital readmission causes, nutrition support

CLINICAL RELEVANCY STATEMENT

A recent study confirmed that patients discharged with enteral nutrition are noted to have increased hospital readmissions. In this study evaluating for the causes of readmission, we found that >20% of 30-day readmissions were related to enteral nutrition, and the three most common causes, accounting for nearly 95% of those readmissions, were gastrointestinal symptoms of intolerance, issues with the enteral access device, and sodium imbalance attributed to dehydration. Quality improvement interventions targeting post-discharge care to address these causes may decrease hospital readmissions in this high-risk and medically complex population.

INTRODUCTION

Enteral nutrition (EN) delivered via an enteral access device (EAD) is employed to treat severe malnutrition as well as feed patients with a pathologic condition restricting oral intake. A 2017 study estimated that approximately 250,000 adults in the United States are using EN at home,¹ which is a dramatic increase from an estimate of 152,000 total adult and pediatric patients in 1992.² Although there are many studies evaluating the role of EN during hospitalization,³ there are limited data on the clinical outcomes of patients discharged from the hospital with EN despite this growing population. Patients discharged with EN are noted to have increased hospital readmissions,⁴ but data on the causes for readmissions are limited. Understanding the causes may allow for designing interventions to reduce readmissions.

The primary aim of this study was to assess the frequency, timing, and proportion of readmissions related to EN in patients discharged with EN through an EAD (DCENs) and categorize the causes for these readmissions. Regarding non-EN-related readmissions, a secondary aim was to assess the frequency of EN plan adjustment as a surrogate for the need for EN plan optimization.

METHODS

Study setting and population

Using electronic health record (EHR) data, we conducted a retrospective, cohort study of all hospital encounters at the Hospital of the University of Pennsylvania (HUP) from July 2017 to December 2019 with DCENs to find all readmissions to HUP within 90 days. We excluded encounters that were planned readmissions (ie, for scheduled surgeries or scheduled infusions) or readmissions at hospitals other than HUP. For patients transferred from other institutions, we maintained the date of initial presentation. These were collected by using an existing registry of all hospital discharges and evaluating for readmissions.

HUP is an academic, tertiary care, 800-bed hospital with an on-site Clinical Nutrition Support Service (CNSS), a multidisciplinary team including registered dietitians that manages all inpatients referred for

nutrition-related needs. All patients initiated with EN are evaluated and managed by the CNSS until discharge. A nutrition-focused data registry collects discrete data on EN-related care, including provider assessments and recommendations. All recommendations regarding care are documented in progress notes by the team in the EHR as well, and the care plan upon discharge is documented by the primary provider in the discharge summary. There is no coordinated outpatient EN support service within the healthcare system.

Data collection

Each readmission was chart reviewed by a physician (S.P.) and research assistant (A.P.) to obtain the chief complaint and hospital course summary, days to readmission from prior discharge, demographics (age, sex), and codiagnosis of malnutrition during initial assessment by CNSS.⁵ We evaluated whether discharge documentation identified the primary cause of readmission to be attributed to EN.

For EN-related readmissions, we obtained the following information from the documentation: presence of malnutrition codiagnosis, initial admission chief complaint, days to readmission, days since EAD insertion as a proxy for EN initiation, EAD-related procedures (surgery or interventional radiology), and EN-related plan adjustments and actions taken to address the causes of readmission upon discharge (procedure, medications, formula type or rate change, and water flush change). From the chief complaint and documentation, we categorized the cause of admission to be EAD issues, gastrointestinal (GI) symptoms attributed to EN (nausea, vomiting, diarrhea, and abdominal pain), sodium imbalance (hyponatremia or hypernatremia), constipation (which was not clearly attributed to EN), and other.

For non-EN-related readmissions, we obtained the following information: cause of readmission (aspiration pneumonia, bacteremia, other infection, stroke, GI bleeding, or other) and whether there was a documented change in the EN care plan upon discharge in the categories as described above.

Study data were collected and managed using Research Electronic Data Capture (REDCap) tools hosted at the University of Pennsylvania.^{6,7}

Outcome variables

For the primary aim, the primary outcome variables were whether the readmission was related to EN, the number of days to date of readmission from EAD placement as a proxy for EN initiation, and the categorized cause for readmission. For the secondary aim regarding non-EN-related readmissions, the outcome variable was whether there was an EN-related plan adjustment upon discharge.

Statistical analysis

To evaluate the demographic and clinical differences between EN-related and non-EN-related readmissions, we used a

Wilcoxon rank sum test for continuous variables and Fisher exact test for binary and categorical variables. All analyses were performed using STATA version 13.0 and Microsoft Excel. This study was reviewed and determined to qualify as Quality Improvement by the University of Pennsylvania's Institutional Review Board.

RESULTS

Over the 30-month period, there were 224 encounters for unplanned readmissions within 30 days of discharge with EN through an EAD and 442 within 90 days of discharge with EN through an EAD. EN-related readmissions accounted for 20.5% (46 out of 224) of 30-day readmissions and 16.7% (74 out of 442) of 90-day readmissions.

For 90-day readmissions, the median number of days from EN initiation to readmission was 86, in which 52.0% (230 out of 442) were within 90 days and 16.0% (71 out of 442) were within 30 days of EN initiation. For EN-related readmissions, 56.9% (41 out of 72) and 20.8% (15 out of 72) were within 90 and 30 days of EAD placement, respectively. Median length of stay for all readmissions was 7 days (interquartile range, 4–14) (Table 1). 90-day readmissions that were EN-related, compared with those that were not, had a higher proportion of females ($P < 0.001$) and a higher proportion of a codiagnosis of malnutrition (0.034).

EN-related admissions

Among EN-related readmissions, 44.6% (33 out of 72) documented EAD-related issues, 40.5% (30 out of 74) cited symptoms the team attributed to EN, and 14.9% (11 out of 74) attributed sodium imbalance from dehydration (Figure 1). Four patients with GI symptoms also had EAD issues. One admission with GI symptoms also had sodium imbalance, and one other admission with GI symptoms also had constipation. Only 5.6% of all EN-related readmissions (4 out of 72) were not attributed to any of these three issues (three for failure to thrive not attributed to symptoms, and one for hypoglycemia in setting of EN not running).

During the readmission, 44.6% (33 out of 74) addressed the cause of readmission with a procedure regarding the EAD (Figure 2). Procedures included tube exchange to address malpositioning or local symptoms (20), conversion in the tube entry site (8), size modification (2), and declogging (4). Oral medications used were primarily antiemetics (12 out of 74) and also included laxatives, loperamide, aprepitant, and gabapentin. Bedside procedure includes one nasogastric tube placement and two EAD decloggings.

EN-unrelated readmissions

There were 368 readmissions with a primary indication not related to EN. Causes for readmission included bacteremia (11.1%), aspiration

TABLE 1 Demographics of all readmission patients within 90 days of discharge with enteral nutrition through an EAD

Characteristics	All	Non-EN-related readmissions	EN-related readmissions	P value
N	442	368	74	
Age, median (IQR), years	63 (50–72)	63 (49–71)	63 (55–73)	0.39
Sex, n (%), female	171 (38.7)	127 (34.5)	30 (59.5)	<0.001
Codiagnosis of malnutrition	287 (64.9)	231 (62.8)	56 (75.7)	0.034
Discharge location, n (%)				
Home with homecare	169 (38.2)	138 (37.5)	31 (41.9)	0.68
Skilled nursing facility	119 (26.9)	103 (28.0)	16 (21.6)	
Home	86 (19.5)	70 (19.0)	16 (21.6)	
Rehabilitation center	64 (14.5)	54 (14.7)	10 (13.5)	
Other/unknown	4 (0.9)	3 (0.8)	1 (1.4)	
Days to readmission, median (IQR)	27 (8–50)	30 (8–51)	19 (8–36)	0.15
Days since EAD placement, median (IQR)	86 (44–245)	86 (45–252)	74.5 (35.5–238)	0.28
Readmission length of stay, median (IQR), days	7 (4–14)	7 (4–14)	7 (5–14)	0.51

Note: The following statistical tests were utilized: Wilcoxon rank sum test (age, days to readmission, days since EAD placement, and readmission length of stay) and Fisher exact test (sex, malnutrition codiagnosis, discharge location).

Abbreviations: EAD, enteral access device; EN, enteral nutrition; IQR, interquartile range.

FIGURE 1 Causes for readmission in DCENs. X-axis represents number of encounters, of total $N = 74$. Each encounter can have more than one cause listed. EAD, enteral access device; GI, gastrointestinal; Na, sodium

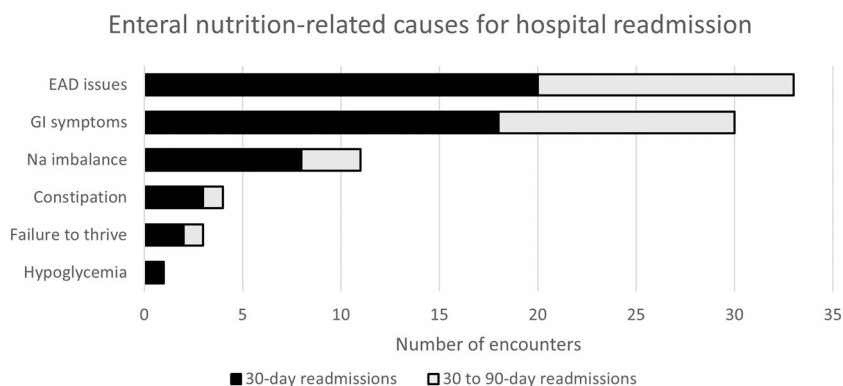
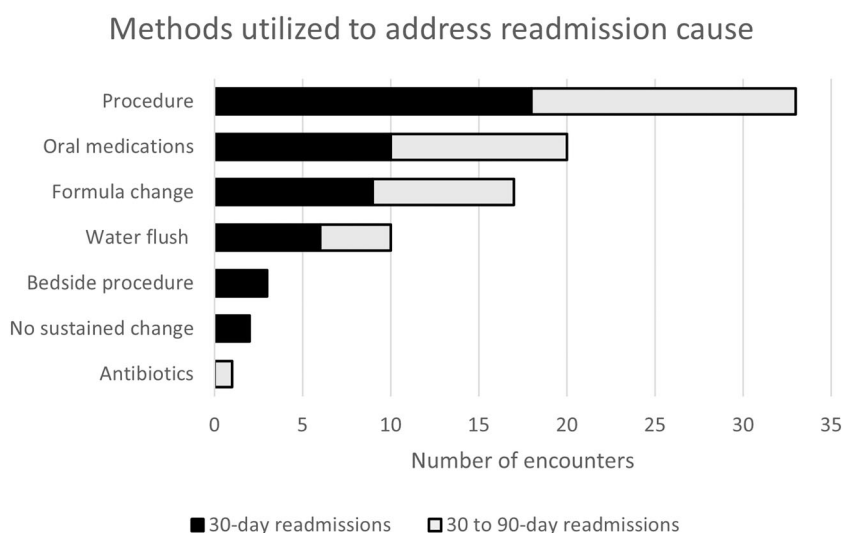


FIGURE 2 Methods utilized during hospitalization to address readmission cause in DCENs. X-axis represents number of encounters (total $N = 74$). Each encounter can have more than one method listed



pneumonia (5.2%), other infection (27.8%), GI bleeding (3.2%), and stroke (2.0%).

Of these EN-unrelated readmissions, 32.3% (119 out of 368) involved a change in the EN plan by CNSS by time of discharge. 23.5% (28 out of 119) involved a change in oral diet recommendations, in which 25 patients had their diet advanced and 3 had their diet more restricted. EAD-related procedures occurred in 21.8% (26 out of 119). Changes in formula or water flush occurred in 43 cases, of which 13 involved increasing the rate to meet energy needs better. CNSS recommended symptom management medications in 13 patients, including 9 for constipation.

DISCUSSION

Hospital readmissions adversely impact patients' quality of life and are costly. As such, hospital readmissions are an established quality measure by many groups including the Centers for Medicare and Medicaid Services (CMS),⁸ and strategies are needed to reduce readmission rates. DCENs are at increased risk for readmissions,⁴ but there are very limited data on the causes for readmissions or how to prevent them. In this study, we evaluated the causes of readmission

for DCENs with the goal to provide data that can lead to implementing interventions designed to reduce them.

Many hospital and healthcare networks, including ours, lack coordinated outpatient nutrition support services for EN care. Many of the methods utilized during the readmissions to address EN-related readmission causes, like EAD-related procedures and formula and water flush adjustments, do not require the hospital setting and may be routinely performed in the outpatient setting. Our study suggests that close follow-up within the first 90 days of initiating EN may identify 52% of the problems leading to readmissions and allow for outpatient interventions that may prevent these readmissions.

Our strict criteria for assessing whether an admission was EN-related is likely to have underestimated the role of EN in readmissions. A high proportion of this population has a codiagnosis of malnutrition,⁴ which also has been associated with higher likelihood for readmissions^{9,10} as well as risk for infection.^{11,12} Among the large proportion of infection-related readmissions, it is feasible that some were partially correlated with their nutrition status, and some may have been avoided by better EN care over a longer period. A sizeable proportion of patients with non-EN-related admissions had their nutrition plans adjusted to increase energy intake, thus likely leading to better addressing nutrition needs and patient quality of life for those with advancement in oral feeds.

A major strength to our study is that this was performed in a large tertiary care hospital with an active data registry in which we were able to identify a sizeable population of DCENs and subsequent readmission and evaluate the details of the readmission using chart review. Our results are likely to be generalizable to other tertiary care centers in major metropolitan areas. Whether these results are generalizable to other settings is unknown. Furthermore, the retrospective and observational nature of the study limited the ability to assess the impact of other parameters or confounding factors, like practice differences between providers, discharge location, and tube type.

In conclusion, 20.5% of 30-day readmissions for patients discharged receiving EN are due to causes attributed to EN. A majority of these readmissions are within 90 days of initiating EN. The three most common causes, accounting for nearly 95% of readmissions, were GI symptoms of intolerance, issues with the EAD, and sodium imbalance attributed to dehydration. A significant proportion of those with readmissions unrelated to EN also had EN plan adjustments, suggesting there was a need for EN plan optimization. Quality improvement interventions targeting postdischarge care to address these causes may decrease hospital readmissions in this high-risk and medically complex population.

CONFLICT OF INTEREST

None declare.

FUNDING INFORMATION

Grants T32-DK007740 (to Dr. Sonali Palchaudhuri), P30-DK050306 (Penn Center for Nutritional Science and Medicine) financially supported this article.

AUTHOR CONTRIBUTIONS

Sonali Palchaudhuri, Shivan J. Mehta, and Octavia Pickett-Blakely contributed to conception/design of the research; Sonali Palchaudhuri, Shivan J. Mehta, Christopher K. Snider, Afshin Parsikia, Lauren Hudson, Charlene Compher, and Gary D. Wu contributed to acquisition, analysis, or interpretation of the data; Sonali Palchaudhuri drafted the manuscript; Shivan J. Mehta and James D. Lewis critically revised the manuscript; and Sonali Palchaudhuri agree to be fully accountable for ensuring the integrity and accuracy of the work. All authors read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

Data and analytic methods can be made available upon request to the corresponding author.

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How to cite this article: Palchaudhuri S, Mehta SJ, Snider CK, et al. Causes of readmissions for patients discharged on enteral nutrition. *J Parenter Enteral Nutr*. 2022;46:1672-1676. doi:10.1002/jpen.2331