An Early Enteral Nutrition (EEN) Protocol for Adult Critically Ill Patients

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Abstract

Background: Enteral nutrition (EN) is the preferred feeding route for critically ill patients who are unable to maintain volitional intake due to intubation with mechanical ventilation, as it attenuates the metabolic response to critical illness. Established guidelines support early EN (EEN) initiation within the first 24-48 hours of intubation to improve various clinical outcomes.
Objectives: To determine if implementation of an EEN protocol increases the number of patients that receive EEN within 48 hours of intubation, as well as to assess the effect of EN timing on certain nutritional and clinical patient outcomes.
Methods: A quasi-experimental, single-center, retrospective study involving analysis of electronic medical record (EMR) data of critically ill, intubated and mechanically ventilated, adult patients admitted to two ICUs of a community hospital was performed before (control group) and following implementation of the protocol (intervention group). The EEN protocol involved a flowchart and education sessions for staff. Demographic, clinical, and nutrition data were collected and analyzed.
Results: The EEN protocol resulted in a statistically significant increase the number of patients that received early EN (p = <0.001), from 33.3% to 74.1% of patients, but this did not translate into a reduction in the primary nutrition endpoints of constipation and pressure injury progression or development, nor other clinical patient outcomes of reduced mechanical ventilation duration, mortality, or ICU and hospital length of stay (LOS).
Conclusions: Implementation of an EEN protocol successfully increased the number of patients that received EEN within the recommended 48 hours of intubation, however, patient outcomes did not improve as intended. A larger study of longer duration may have been more efficacious.

Introduction

- Nutrition plays an essential role in the clinical outcomes of critically ill patients.[1]
- Early initiation of EN support within 48 hours of intubation is a best practice guideline recommended by the American Society for Parenteral and Enteral Nutrition (ASPEN) due to its association with reduced morbidity and mortality.[1]
- Despite this recommendation, delayed EN remains a prevalent occurrence in ICUs due to various barriers that impede timely initiation.[2,3]
- The catabolic state and severe inflammatory response to critical illness can quickly lead to metabolic complications that increase the risk for prolonged hospitalization and ICU LOS, delayed wound healing, difficulty weaning from the ventilator, and increased morbidity and mortality.[1]
- EEN during critical illness can reduce disease severity and infectious complications, decrease ICU and hospital LOS, and improve patient outcomes overall.[1]
- Until now, the literature has failed to show the effects of an EEN protocol on pressure injuries or bowel regularity specifically—two nutritional endpoints of particular interest in the critically ill.[4]
- The purpose of this study was to determine the prevalence of delayed EN (DEN), identify barriers to early EN initiation, and implement an EEN protocol aimed at addressing those barriers to increase the number of patients to receive EEN within 48 hours of intubation.
- It was hypothesized that increasing the number of patients who receive EEN would result in improved skin integrity and bowel regularity.

Methods

- The study was conducted in the two ICUs at Ellis Hospital in Schenectady, NY.
- Data from patient's EMRs were retroactively collected and analyzed, including demographic data and patient characteristics (table 1), and nutritional and clinical outcomes (table 2).
- Only patients intubated greater than 48 hours were included.
- Outcome changes were assessed by comparing data from a pre-intervention/control group (n = 45 patients) to a post-intervention group (n = 27 patients).
- The intervention was designed to address the barriers to EEN initiation and provide clear guidance to staff regarding how to safely initiate EN in a timely manner in the absence of dietitian recommendations or availability, along with EN formula selection and rate initiation.
- The EEN protocol involved a written flowchart created by the author utilizing current evidence-based research and guidelines, which was posted throughout the ICUs.
- Group educational sessions were provided to nurses and providers to increase knowledge of ASPEN's recommendation to initiate EN within 48 hours of intubation (including the purpose and benefits of EEN), explain the new EEN protocol, review the pre-intervention data highlighting the need for this intervention, and clarify each discipline's role in the protocol.
- The pre-intervention and post-intervention groups were further split into early (EEN = <48 hours) and delayed (DEN = >48 hours) groups based upon timing of EN initiation.
- Using SPSS software, two-way ANOVA tests were run for the continuous variables and Pearson's chi-squared tests were used for the categorical variables. A p-value of 0.05 was considered statistically significant.

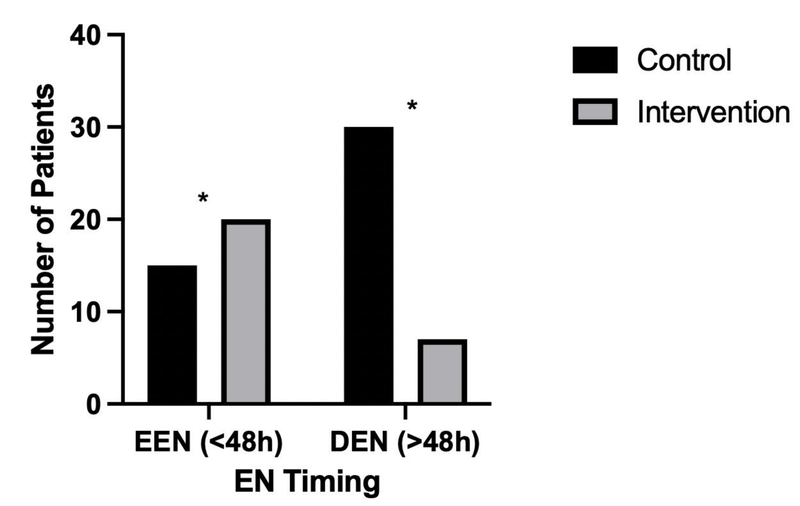
Results

Table 1: Baseline Patient Characteristics

	Pre-Intervention			Post-Intervention			
	All Patients (n=45)	**EEN (< 48 hr) (n=15)**	**DEN (> 48 hr) (n=30)**	**All Patients (n=27)**	**EEN (< 48 hr) (n=20)**	**DEN (> 48 hr) (n=7)**	***P*-value**
Admission Reason							
Medical	39 (86.7%)	15 (100%)	24 (80%)	21 (77.8%)	18 (90%)	3 (42.9%)	0.007[b]
Surgical	6 (13.3%)	0 (0%)	6 (20%)	6 (22.2%)	2 (10%)	4 (57.1%)	
Sex							
Male	20 (44.4%)	6 (40%)	14 (46.7%)	10 (37%)	7 (35%)	3 (57.1%)	0.874[b]
Female	25 (55.6%)	9 (60%)	16 (53.3%)	17 (63%)	13 (66%)	4 (42.9%)	
Age (y)	62.6 (20-93)	59.5 (20-82)	64.2 (20-93)	70.3 (53-89)	71.7 (55-89)	68.6 (53-87)	0.612[a]
BMI (kg/m^2)	30.0 (16.9-52.3)	29.5 (16.9-52.3)	30.3 (21.7-51.1)	27.3 (18.3-47.5)	27.5 (18.6-47.5)	27.7 (18.3-35.0)	0.94[a]
Vasopressors at 48 hrs	19 (42.2%)	4 (26.7%)	15 (50%)	7 (25.9%)	5 (25%)	2 (28.6%)	0.228[b]
High dose	8	0	8	1	0	1	
Low dose	11	4	7	6	5	1	0.063[b]

Abbreviations: EEN, early enteral nutrition; DEN, delayed or no enteral nutrition
[a] Two-way ANOVA test
[b] Pearson's Chi-Square test

Figure 1: Comparing EN timing of pre-intervention to post-intervention



* = $p < 0.05$

Table 2: Patient Outcomes

	Pre-Intervention			Post-Intervention			
	All Patients (n=45)	**EEN (< 48 hr) (n=15)**	**DEN (> 48 hr) (n=30)**	**All Patients (n=27)**	**EEN (< 48 hr) (n=20)**	**DEN (> 48 hr) (n=7)**	***P*-value**
Time to EN initiation (hours)	68 (0-168)	22.6 (0-43.8)	93.2 (48.8-168)	55.5 (3.9-282.1)	24.6 (3.9-43.3)	143.9 (64.4-282.1)	<0.001[a]
Mechanical ventilation (days)	13.3 (2-47)	14.7 (2-47)	12.6 (3-45)	8.8 (2-36)	9.2 (2-36)	7.7 (3-19)	0.837[a]
ICU LOS (days)	16.7 (4-48)	17.9 (4-48)	16.1 (5-44)	11.4 (4-42)	12.3 (4-42)	8.9 (4-19)	0.671[a]
Hospital LOS (days)	23.7 (6-61)	27.1 (8-61)	22.0 (6-57)	15.1 (5-42)	14.9 (5-42)	15.7 (5-37)	0.487[a]
In-hospital mortality	17 (37.8%)	7 (46.7%)	10 (33.3%)	4 (14.8%)	3 (15%)	1 (14.3%)	0.138[b]
Constipation (≥ 4 days)	19 (42.2%)	5 (33.3%)	14 (46.7%)	9 (33.3%)	5 (25%)	4 (57.1%)	0.313[b]
Pressure injury development or progression	19 (42.2%)	6 (40%)	13 (43.3%)	8 (29.6%)	5 (25%)	3 (42.9%)	0.595[b]

Abbreviations: EEN, early enteral nutrition; DEN, delayed or no enteral nutrition; EN, enteral nutrition; ICU, intensive care unit; LOS, length of stay
[a] Two-way ANOVA test
[b] Pearson's Chi-Square test

Results continued

Table 3: Reason for delayed EN (> 48 hr)

Reason for delayed EN (DEN)	**Pre-Intervention (n=30)**	**Post-Intervention (n=7)**
Hemodynamic instability	7	1
Abdominal surgery	6	3
Unknown reason	5	1
Gastric tube output	4	0
Weekend	4	0
GI bleeding	3	2
IABP	3	0

Abbreviations: IABP, intra-aortic balloon pump

Discussion

- Implementation of the EEN protocol resulted in a statistically significant increase in the number of patients to receive EN within 48 hours of intubation, which was the primary endpoint of the study.
- Contrary to prior research, this study failed to find any correlation between EN timing and the clinical outcomes of mechanical ventilation duration, ICU and hospital LOS, and in-hospital mortality.[1] The duration of data collection and subsequent small and unmatched sample sizes of this study were major limitations that may have affected our ability to achieve results similar to that in the literature.
- This was the first study of its kind to analyze the effects of EEN on the nutritional endpoints of constipation and pressure injury progression or development, for which no correlation was found.
- The reasons patients received delayed EN decreased from 7 to 3 reasons post-intervention (two of which were valid reasons to withhold EN initiation—use of high-dose pressors and gastrointestinal bleeding).
- Recent abdominal surgery remained the number one inappropriate reason for delaying EN, which was likely due to a combination of the author's inability to reach the General Surgery group for educational sessions and their typical practice of awaiting return of bowel function before feeding.

Conclusion

Implementation of the early EN protocol successfully increased the number of intubated patients to receive EEN. Although this did not translate into improved patient outcomes, a larger study of longer duration may have. Adoption of the protocol by all involved departments is imperative for optimal compliance.

References

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