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Do Patients in the Intensive Care Unit Receive Recommended Total Daily Calories with Enteral Feedings Using a Rate Based Protocol?

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DO PATIENTS IN THE INTENSIVE CARE UNIT RECEIVE RECOMMENDED TOTAL DAILY CALORIES WITH ENTERAL FEEDINGS USING A RATE BASED PROTOCOL?

A Major Paper Presented

by

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Abstract

When a patient is unable to eat or eat enough nutrients due to an illness or surgery, nutrition from another source may be required. Supplemental nutrition may be given in the form of enteral nutrition. The current practice is delivering enteral feedings on a rate based protocol to deliver calculated required calories over a specific length of time. Patients who receive enteral nutrition may have feedings interrupted due to a variety of reasons such as a procedure or diagnostic exam. Interruptions reduce the total daily calories delivered. If a patient does not achieve their total daily calories, it can be detrimental to the patient's health and may increase length of stay and costs of hospitalization. The purpose of this study was to determine if patients receive their recommended total daily calories of enteral nutrition using a rate based protocol. A retrospective research design was used to obtain data from patients who received enteral feedings while in the Intensive Care Unit. Data were collected on patients who were admitted to the unit between June 1, 2014 and August 31, 2014. 41 patients who received enteral feedings were included in this study. 80% of patients had their enteral feedings interrupted; most frequent reasons included diagnostic testing, residual volumes and procedures. Interruptions of the enteral feedings lasted between one hour and 24 hours in duration with a mean of 2.9 hours. The most frequent duration of interruption was one hour. Patients received a mean of 56.4% of their daily prescribed goal calories and 56.7% of their daily prescribed volume of enteral feedings. This study suggests that patients do not receive their daily prescribed calories using a rate based protocol. Recommendations for further research and advanced nursing practice are discussed.

Acknowledgements

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Do Patients in the Intensive Care Unit Receive Recommended Total Daily Calories with Enteral Feedings Using a Rate Based Protocol?

Statement of the Problem

Inadequate nutrition can be detrimental to a patient's health. Patients admitted to the hospital unable to eat or eat enough nutrients due to surgery or illness may require supplemental nutrition. Enteral nutrition is liquid nutrition administered to a patient via a tube and delivered directly into the gut. This form of supplemental nutrition can only be used if the patient's gastrointestinal tract is functioning well enough to absorb the supplement delivered. The goal of enteral nutrition is to maintain or improve the patient's nutritional status (National Center for Biotechnology Information, U.S. National Library of Medicine, 2006). Enteral feedings are given through different types of tubes, determined by the patient's provider based on the anticipated length of time enteral nutrition is required, the patient's clinical presentation as well as individual anatomy (National Center for Biotechnology Information, U.S. National Library of Medicine, 2006). Enteral feeding tubes may be inserted through the nose and end in the stomach or gastrointestinal tract or placed directly into the stomach or gastrointestinal tract through an incision in the abdominal wall (American Society for Parenteral and Enteral Nutrition [ASPEN], 2014). A nasogastric tube is inserted through the nose and ends in the stomach, a nasoduodenal tube is inserted through the nose and ends in the gastrointestinal tract. Gastrostomy or jejunostomy tubes are placed directly into the stomach or gastrointestinal tract through the abdominal wall (ASPEN, 2014).

Enteral nutrition is the preferred method of nutrition to deliver supplemental nutrition for critically ill patients (Kreymann et al., 2006). Preferences for enteral nutrition are based on advantages such as preservation of the function and structure of the gastrointestinal tract, fewer infections when compared to nutrition administered through a vein, or parenteral nutrition, and is lower cost (Merck Sharp & Dohma Corp., 2013).

According to the Agency for Healthcare Research and Quality (AHRQ), the incidence of enteral feeding is rapidly increasing for hospitalized patients. According to recent statistics, there was a 94% increase in females and a 112% increase in males receiving enteral feedings from 1997 to 2007 (U.S. Department of Health & Human Services, 2014). However, patients receiving enteral nutrition often do not receive their recommended daily caloric intake, putting them at increased risk for adverse outcomes.

Patients receiving rate based enteral feedings have the feeding interrupted for various reasons such as diagnostic procedures, surgery, or temporary intolerance. Placing rate based enteral feedings on-hold causes a caloric deficit in a critically ill patient with increased caloric demands due to illness. Once the enteral feeding is resumed in a rate based protocol, it is restarted at the original rate without compensating for the volume and calories lost. As many as 68% of patients receiving rate based enteral nutrition have interruptions in their daily intake (Peev et al., 2014). The resulting deficit in total daily calories can be detrimental to the recovery of the patient. Patients who do not receive adequate nutrition are at an increased risk for infection and longer hospital length of stay (Elpern, Stuts, Peterson, Gurka, & Skipper, 2004). Enterally fed patients who do not

reach their prescribed daily calorie intake also have increased costs of hospitalization as well as being at risk for malnutrition (Kim, Stotts, Froelicher, Engler, & Porter, 2012a).

During a clinical rotation at a community hospital in Warwick, Rhode Island, this researcher was given an opportunity to be part of a multidisciplinary team reviewing enteral feeding practices. The enteral protocol group included the Intensive Care Unit lead physicians, Clinical Nurse Specialists, and Clinical Dietitians. At the time of this study, patients in the Intensive Care Unit at this hospital receive enteral nutrition using a rate based protocol. ICU patients in the study site may have nutrition held for various reasons such as diagnostic procedures or surgery, and the more frequent enteral feeding interruptions are, the larger the caloric deficit. The study question was developed while participating in discussions around issues related to rate based enteral nutrition.

Many patients admitted to the hospital are already compromised nutritionally. As many as 50% of patients are malnourished on admission (Norman, Pichard, Lochs, & Pirlich, 2008). This increases the need to ensure that patients receive required total daily calories, especially when receiving enteral nutrition. The purpose of this study was to explore if patients receive their total daily calories with enteral feedings using a rate based protocol.

Next is a review and critique of the relevant literature.

Literature Review

A literature review was conducted using the following databases searching from 1978 - 2014: Cumulative Index and Allied Health Literature (CINAHL), Pub Med, and Medline. Keywords included: enteral nutrition, nutrition therapy, enteral feedings, energy needs, interruptions in enteral feedings, outcomes of enteral nutrition, and enteral guidelines.

Enteral Nutrition: Definition and Incidence

According to ASPEN, enteral nutrition is liquid nutrition given through a tube and delivered directly into the stomach or small bowel. This liquid nutrition contains protein, carbohydrates (sugar), fats, vitamins, and minerals that are needed when a patient is unable to attain an adequate oral intake (ASPEN, 2014). The aim of enteral feedings is to improve or maintain a patient's nutritional status (National Center for Biotechnology Information, U.S. National Library of Medicine, 2006).

According to AHRQ, enteral feeding is the third most rapidly growing intervention for hospitalized patients. There was a 94% increase in females and a 112% increase in males receiving enteral feedings from 1997 to 2007 (U.S. Department of Health & Human Services, 2014). To put these numbers in perspective, 613,000 hospital stays in 2010 included an enteral feeding, which means that 20% of all hospitalized patients in the United States (US) required nutritional support through enteral feedings (AHRQ, 2013).

Nutritional Support

A nutritional intervention is planned when a practitioner or multidisciplinary team assesses that an alternate means of nutrition is required for a patient with inadequate oral intake. Nutritional intervention is defined by the Academy of Nutrition and Dietetics as "A purposefully planned action intended to positively change a nutrition-related behavior, environmental condition, or aspect of health status for an individual (and his or her family or caregivers), a target group or the community at large" (Charney & Malone, 2013, p.2).

According to ASPEN guidelines, there are three main objectives for the use of nutritional support in the critically ill population. The first objective is to preserve the patient's lean body mass; the second is to maintain the body's immune function. The last objective is to avoid any metabolic complications by positively changing the immune response as well as prevent cellular injury (McClave et al., 2009). Advantages of enteral nutrition include better preservation of the function and structure of the gastrointestinal tract, fewer infections as compared to parenteral nutrition, and lower cost (Merck Sharp & Dohma Corp., 2013).

Enteral feedings should be considered for patients when they cannot take enough nutrition orally (Medlin, 2012). Reasons for enteral nutrition can range from planned surgery or an unforeseen circumstance. However, consideration of placement of a feeding tube should be a multidisciplinary decision including the physician, clinical dietitian and nursing (Stroud, Duncan, & Nightingale, 2003). Enteral feedings are indicated in patients that are unconscious, ventilated, have a neuromuscular swallowing

disorder, physiological anorexia, upper GI obstruction, malabsorption, or a specific treatment which requires additional nutritional support (National Center for Biotechnology Information, U.S. National Library of Medicine, 2006). Patients with short bowel syndrome, burns, inflammatory bowel disease, or respiratory failure can also benefit from enteral nutrition (Pearce & Duncan, 2002). Other indications for enteral nutrition are decreased appetite, inability to eat due to surgery (ASPEN, 2014) or malnutrition (Holmes, 2012).

Enteral nutrition is the preferred route of feeding in the critically ill patient (McClave et al., 2009). However, it can only be used if the patient has a functioning gastrointestinal tract (Kreymann et al., 2006). Enteral nutrition received by the patient must be digested for the patient to receive the beneficial ingredients in the formula. Digestion occurs by food breaking down in the stomach as well as the bowel and then absorbed by the bowel into the bloodstream where the nutrients are then distributed to the cells of the body (ASPEN, 2014).

The benefits of meeting daily caloric needs with enteral nutrition include improved wound healing (Drover et al., 2010) and tissue maintenance (White et al., 2012). Patients also have a reduction in mortality when they receive their optimal energy requirements from enteral feedings (Alberda et al., 2009).

Enteral Feeding: Modes of Delivery

Enteral feedings can be given through different types of tubes, determined by the length of time expected to feed as well as the patient's clinical presentation and their anatomy (National Center for Biotechnology Information, U.S. National Library of

Medicine, 2006). Enteral tubes can either be inserted through the nose and ending in the stomach or gastrointestinal tract or placed directly into the stomach or gastrointestinal tract through the abdominal wall (ASPEN, 2014). The first type of tube is a nasogastric tube that is inserted through the nose and ends in the stomach, nasoduodenal tubes are inserted through the nose and end in the gastrointestinal tract. Another type of tube is placed directly into the stomach or gastrointestinal tract through the abdominal wall, these tubes are called gastrostomy or jejunostomy tubes (ASPEN, 2014). When short term enteral feedings are needed or there is an unknown duration of therapy, feeding through a nasogastric tube is recommended (Loser et al., 2005). When a feeding tube is required for longer than four weeks, a gastrostomy tube should be placed (Medlin, 2012). Most patients require one month or less of enteral nutrition, and nasogastric tube feedings are the most common route of administration (Pearce & Duncan, 2002).

Patients that do not receive adequate nutritional support during their hospitalization are at risk for becoming malnourished, which can in turn cause detrimental effects to the body (Peev et al., 2014). As many as 50% of patients admitted to hospitals are malnourished (Norman et al., 2008). Therefore, some degree of malnutrition is expected in the many individuals in the Intensive Care Unit. Malnutrition is associated with many adverse outcomes such as muscle wasting, a depressed immune system (Barker, Gout, & Crowe, 2011), as well as increased hospital length of stay and increased costs associated with the admission (Norman et al., 2008). Other factors related to malnutrition are decreased wound healing and tissue maintenance (White et al., 2012). Patients that are malnourished have also been associated with increased

readmission rates and increased mortality (Lim et al., 2012). Patients that are already malnourished prior to admission have a decreased ability to survive short periods without nutrition (Dobson & Scott, 2007).

Patients that do not receive recommended total daily calories also have a longer hospital length of stay (Elpern et al., 2004) as well as increased costs related to the hospitalization (Norman et al., 2008). According to a study by Rubinson, Diette, Song, Brower, and Krishnan (2004), patients that received less than 25% of their recommended calories a day are associated with an increased risk for nosocomial blood stream infections.

Contraindications

Contraindications for use of enteral nutrition include intestinal obstruction, ileus, high output small bowel fistula, and patients on high doses of positive inotropic agents (Pearce & Duncan, 2002). If the gastrointestinal tract is working, feeding via the enteral route is the preferred method of feeding a critically ill patient (Kreymann et al., 2006).

Potential complications of enteral feeding depend on the type of tube inserted into the patient. Gastrostomy tubes can be associated with abdominal pain if the tube is incorrectly positioned, thus potentially causing gastric contents to leak into the abdominal cavity. Leakage of gastric contents can lead to peritonitis (Holmes, 2012). Complications associated with nasogastric tubes are rhinitis, esophageal reflux or esophageal strictures. However, these complications are seen less today due to the fine bore nasogastric tubes that are currently in use (Pearce & Duncan, 2002). Other complications that can occur with enteral tubes include mechanical issues such as

inability to insert the tube, blockage of the tube, hoarseness, diarrhea or constipation, bloating, abdominal distention, nausea, cramps, and unexpected removal of the tube (Charney & Malone, 2013). More serious complications that can occur are aspiration pneumonia, and electrolyte abnormalities (Charney & Malone, 2013). Formula-related complications of enteral feedings can include electrolyte disturbances, hyperglycemia, volume overload or hyperosmolarity (Merck Sharp & Dohma Corp., 2013). Finally, another potential complication is infection; high nutrient enteral feeding formulas are an excellent medium for the growth of bacteria. Formula is sterilized when packaged, however once opened growth of bacteria can occur quickly. Protocols to reduce the potential for contamination include closed delivery systems and daily disposable infusion set replacement (Lloyd & Powell-Tuck, 2004).

Aspen Guidelines for Nutritional Support Therapy

According to ASPEN guidelines, early nutritional support is optimal for patient outcomes. Enteral feedings should be started within the first 24 to 48 hours after admission (McClave et al., 2009), especially if the patient is not expected to eat within the next three days (Kreymann et al., 2006). Post-surgical patients that are not tolerating oral intake should be considered for enteral feeding within two days of a surgical procedure (Stroud et al., 2003).

When determining what type of enteral feeding tube is to be inserted into a patient, ASPEN recommends that if a patient is at risk for aspiration, enteral feedings should be given to a patient via a feeding tube placed into the small bowel. If a patient is not tolerating gastric feedings as evidenced by high gastric residuals, a feeding tube

placed in the small bowel is also recommended (McClave et al., 2009). According to ASPEN guidelines, gastric residuals should be monitored to determine a patient's tolerance of the enteral feedings. Enteral feedings should be not be held for a gastric residual of less than 500 ml without any other signs of intolerance (McClave et al., 2009). However, some institutions have internal policies to hold enteral feedings with a lower gastric residual threshold.

Prior to starting a patient on enteral feedings, a target caloric goal should be determined. ASPEN recommends calculating caloric requirements using a predictive equation such as Harris-Benedict, or by using indirect calorimetry. The predictive equations provide a less accurate measure of requirements than indirect calorimetry and therefore should be used with caution, especially with an obese patient. Caloric needs can also be calculated a third way, which is with a simplistic formula that calculates 25-30 kcal/kg/day. However, regardless of which calculation is used, an ongoing assessment of the patient needs is recommended (McClave et al., 2009).

Nutritional Requirements and Delivery Rates

Nutritional needs are calculated by determining a patient's daily energy requirements (Frankenfield & Ashcraft, 2011). This is calculated by determining daily energy expenditure, which consists of physical activity, resting metabolic rate, and diet-induced thermogenesis. There are several different equations used to determine a patient's nutritional needs. Some examples include the Harris-Benedict and Mifflin-St. Jeor for healthy patients and the Swinamer, Penn State equation or Brandi for critically ill patients (Frankenfield & Ashcraft, 2011). Which standard equation used may be

determined by the individual facility, however they all will calculate a patient's daily nutritional needs. After determining the patient's daily nutritional needs, in a rate based protocol an hourly rate is calculated for the patient by dividing the calculated nutritional needs by twenty-four or the number of hours a patient is to receive the supplement based on number of calories per ml of supplement (Mahan & Escott-Stump, 2008).

Enteral feedings can either be given to a patient by a continuous feeding or in divided boluses several times a day (Merck Sharp & Dohma Corp., 2013). Patients with a continuous feeding are often started at a lower rate and gradually titrated up to reach the desired rate. This practice is followed to reduce the incidents of abdominal pain and bloating (Lloyd & Powell-Tuck, 2004). However, when followed, these patients will not achieve their total daily calories until the calculated target rate is reached.

Research Related to Interruptions of Enteral Nutrition

Patients that are receiving enteral nutrition often have interruptions to their therapy, resulting in less than the recommended total daily calories. These interruptions can include reasons such as a procedure, diarrhea, gastrointestinal intolerance, delivery delay of formula to the unit (Morgan, Dickerson, Alexander, Brown, & Minard, 2004), surgery, vomiting or problems with the tube such as a blockage or removal (O'Meara et al., 2008). Other reasons that can cause interruptions in nutritional therapy include abdominal distention, large gastric residuals or other medical compilations. Medical complications can include cardiac arrest, respiratory complications or seizures (Williams, Leslie, Leen, Mills, & Dobb, 2013). Patients who have prolonged interruptions are more likely to be underfed than patients who have fewer interruptions (Kim et al, 2012b).

Elpern et al. (2004) investigated daily caloric intake compared to goal calorie intake to determine frequency, duration and reasons for interruption of enteral feedings as well as patients' intolerance to feedings. Using a prospective, descriptive study, 39 patients admitted to a medical Intensive Care Unit during a three-month period were observed until enteral feedings were discontinued or the patient was discharged from the unit or expired. Patients were included in this study only if they remained in the unit for greater than forty-eight hours. Results indicated that patients received on average 64% of total daily goal calories. Interruptions included testing and test preparation, procedures, unstable conditions, high gastric volume, medication administration, changes in body positions, blocked tube, aspiration, nausea, vomiting, and diarrhea. Testing and procedures accounted for the highest reasons for interruptions (35.7%) (Elpern et al., 2004).

Morgan et al. (2004) studied to determine the factors causing interruptions in enteral nutrition delivery to patients as well as determining if patients received their total daily caloric intake goal. Using a retrospective, observational study, adult patients in a Trauma Intensive Care Unit that had nutritional support for at least three days were included in the study. Data were collected for a maximum of one week or until the patient was discharged from the unit or enteral feedings were discontinued. Results of this study showed that patients received 67% of their total daily caloric intake goal. Highest number of interruptions included diagnostic procedures and surgery, accounting for 42% of all interruptions. Other reasons identified included gastric intolerance,

pharmacy delay in delivery, mechanical tube problems or unknown factors (Morgan et al., 2004).

A study conducted by Peev et al. (2014) investigated the causes and consequences of interruptions to enteral feedings and categorized the interruptions into two categories: avoidable and unavoidable. Using a prospective, observational design, Intensive Care Unit adult patients who had at least 72 hours of enteral feedings were included. Ninety-four patients met the eligibility criteria and data collection occurred over 10 months. Sixty eight percent of subjects had interruptions in their enteral feedings. When categorizing the interruptions into the two separate categories, unavoidable interruptions included re-intubation, intubation, tracheostomy placement, PEG tube placement, high gastric residual, and surgery. Avoidable interruptions included imaging studies or diagnostic procedures, and orthopedic procedures. 26% of all interruptions were considered avoidable events. Patients with as few as one interruption were three times more likely to be underfed and have a longer ICU length of stay, when compared to patients that did not have any interruptions in their enteral feedings (Peev et al., 2014).

Overall, studies indicated that there are numerous reasons patients have interruptions to their enteral feedings. Interruptions result in a patient not receiving their recommended total daily calories, which can be detrimental to recovery of the patient. Knowing the consequences of inadequate nutritional support, there is a need to improve practice and reduce interruptions to provide adequate enteral nutrition. To do this, it must first be determined if patients are receiving their total daily calories with a rate based protocol in our community hospital setting.

The purpose of this study was to explore if patients receive their total prescribed daily calories with enteral feedings based on a rate based protocol.

Next, the theoretical framework for this study will be discussed.

Theoretical Framework

Virginia Henderson is a nursing theorist who developed the Nursing Need Theory. She was known for being a nursing educator and author. Initially her goal was not to develop a new nursing theory, but to define the focus of nursing and its uniqueness (Nursing Theory, 2013). However, out of her passion for nursing, and her experience with nursing practice and education, the Nursing Need Theory emerged.

Henderson developed her theory as a guide for nursing in all practice settings. The Nursing Need Theory contains four major concepts which include; the individual, the environment, health, and nursing. These concepts are defined within the framework of the theory (Henderson & Nite, 1978). The nurse cares for the individual or patient with consideration for biological, psychological, and spiritual needs. Patients are assisted by the nurse to reach a state of comfort and health or to achieve a peaceful death. The environment includes the external conditions of the hospital as well as the patient's relationship with their families. The nurse ensures that the environment is conducive to the patient's healing. A state of health is a challenge for the nurse to help the patient achieve. Overall health includes the balance of the cultural, physical and emotional needs of the patient. Nurses educate their patients on both health promotion and prevention topics. Finally, nursing care is the fourth major concept of the Nursing Need Theory (Current Nursing, 2012). Nurses assist the patient to meet their needs as well as carry out the physician's therapeutic plan to provide individualized care. Each patient is unique and by individualizing his or her plan of care, the nurse can help the patient achieve a state of overall health (Henderson & Nite, 1978).

The nurse is defined in this theory as one that helps the patient to increase their independence and progress towards the goal of discharge home and beyond. The nurse prepares the patient for discharge and beyond by constantly advancing their autonomy. This is one of the assumptions of the Need Theory. Another assumption is the patient aspires to return to a state of health. The focus of the Nursing Need Theory is basic human needs and how the nurse helps the patient reach these goals (McEwan & Willis, 2011).

The Nursing Need Theory has fourteen components that encompass nursing activities and are based on human needs. According to Henderson (1997), these components include:

1. Breathe normally.
2. Eat and drink adequately.
3. Eliminate body wastes.
4. Move and maintain desirable postures.
5. Sleep and rest.
6. Select suitable clothing. That is, dress and undress appropriately.
7. Maintain body temperature within normal range by adjusting clothing and modifying the environment.
8. Keep body clean and well groomed and protect the environment.
9. Avoid dangers in the environment and avoid injuring others.
10. Communicate with others in expressing emotions, needs, fears, or opinions.

11. Worship according to one's faith.
12. Work in such a way that there is a sense of accomplishment.
13. Play or participate in various forms of recreation.
14. Learn, discover, or satisfy the curiosity that leads to normal development and health and use the available health facilities.

The fourteen components are the fundamentals of nursing care (Henderson, 1997), and use a holistic approach to address the patient's physiological, psychological, spiritual, and social needs (Nursing Theory, 2013). Henderson's Need Theory puts a name to the focus of nursing practice; it defines nursing as holistic and encompasses all aspects of patient care.

Nurses take on many different roles to care for their patient's immediate needs. These roles have changed over time, as well as the situations in which nurses practice (Henderson, 1997). Nurses also practice in many different settings such as a hospital, nursing home, hospice, public health, schools or other settings. However, the concept of nursing remains the same; to understand the needs of the patient and to provide them with their basic human needs (Henderson, 1978).

Virginia Henderson's model defines the need of the nurse to engage in health promotion and disease prevention as well as engaging in the curing of the patient's disease. There are many different factors that affect health such as the patient's age, cultural background and origin, emotional balance, and other individual factors. Overall, Virginia Henderson's Need Theory defines what nurses do each day to help the patient

return to a state of health or to achieve a peaceful death, referred to by Henderson as the final act of life (Henderson & Nite, 1978).

The Nursing Need Theory depicts the nurse on an intensive care unit caring for their patients. In an Intensive Care Unit, nurses are concerned with helping a patient return to a state of health. Although all nurses help their patients return to a state of health, often patients in the Intensive Care Unit cannot participate in their care due to their state of illness. Enteral feeding is one of the mechanisms through which the nurse cares for the patient. Food is a basic human need and one of the fourteen nursing activities as defined by Henderson's Need Theory. This need cannot be achieved by the patient that is unable to eat due to illness. However, a nurse is able to aid the patient in achieving this need by providing optimal nutrition through enteral feedings.

Methodology

Purpose

The purpose of this study was to determine if patients received their total ordered daily calories with enteral feedings based on a rate based protocol.

Research Question

The research question was: Do patients in the Intensive Care Unit receive their total ordered daily calories with enteral feedings based on a rate based protocol?

Design

This research study utilized a retrospective design with chart audits.

Site and Sample

This study was conducted in an adult Intensive Care Unit at a community hospital in Warwick, Rhode Island. The sample included patients in the Intensive Care Unit receiving enteral feedings. Inclusion criteria were all patients admitted to the intensive care unit who received continuous enteral tube feedings for greater than 24 hours while in the ICU. Exclusion criteria included: enteral tube feedings that were not at continuous rate; missing data regarding the enteral feeding such as inaccurate or incomplete intake of enteral feedings and flushes included as part of the intake of the recorded enteral feeding; concurrent oral or parenteral nutrition; and enteral feedings for less than a total of 24 hours. Enteral feedings were considered held if stopped for greater than one hour.

Method

Permission to conduct this study was obtained from the lead physician of the Intensive Care Unit, the hospital's Institutional Review Board (IRB) (Appendix A) and the Rhode Island College IRB.

The Clinical Dietitian of the community hospital's Intensive Care Unit maintains a log of patients receiving enteral nutrition. The enteral nutrition log was utilized to identify patients who received enteral feedings for a three-month period from June 1, 2014 to August 31, 2014.

Data collection began after IRB approval. Data collection was completed by the student and documented on a Microsoft Excel® spreadsheet for the purposes of organizing, tracking, and analyzing the data. Data were collected through a retrospective review of the Electronic Medical Record and documented on the data collection tool (Appendix B). Due to the study's retrospective chart review design, it presented no risk to patients and patient consent was not required. Eligible patients for the study were obtained from an enteral feeding list obtained from the hospital clinical nutrition department. Patients on this list were identified by the encounter specific record number (financial identification number). Each patient in the study was assigned a sequential number prior to data collection. The financial identification number (FIN), used to access the individual patient record was used to ensure patient information was not duplicated, the FIN was only used to identify potential subjects and was not recorded. A copy of the patient identified list was not retained. The financial identification number was used as an identifier because it is a number unique to a patient's single admission.

Data were collected on identified patients from the Electronic Medical Record and documented on the data collection tool starting on the day of admission to the Intensive Care Unit. Each patient's Electronic Medical Record was reviewed for a total of one week or until enteral feedings were discontinued, patient was discharged from the Intensive Care Unit, or patient expired.

Only the student and primary investigator of record had access to the data. Anonymity and confidentiality were maintained throughout the study.

Data for this study was collected over a three-month time period. IRB application was completed in November 2014 and data collection started after approval from IRB and notification to the Rhode Island College IRB. Evaluation of collected data occurred in March 2015. Dissemination of research findings occurred in April 2015.

Measurement

A data collection tool that was developed by this researcher was used to collect needed data after determination of eligibility. This data collection tool was developed based on studies found in the literature and pilot tested to determine usability at the study site.

Data Analysis

After completion of data collection, basic descriptive statistics on study variables were calculated. The number of patients who did not receive the total recommended calories compared to the number of patients who did receive the total recommended calories were calculated. Reasons for not receiving enteral feeding were analyzed, categorized and tabulated.

Results

A total of 58 medical records were reviewed, with 41 (71%) comprising the study sample and 17 (29%) excluded. Reasons for exclusion included: nine (53%) patients who received enteral feeding for less than 24 hours; one (6%) patient who received bolus enteral feedings; five (29%) patients not started on enteral feedings as planned; two (12%) records were excluded due to incomplete documentation.

The sample included 18 (44%) males and 23 (56%) females; the mean age was 68.3 years with a range from 36 – 90. In the study sample, the most frequent enteral feeding delivery method was an orogastric tube (OGT) at 27 (66%) patients. Other delivery methods included 10 (24%) nasogastric tubes (NGT), three (7%) gastrostomy tubes (GT), and one (2%) nasojejunal tube (NJT).

The data revealed that patients received between 16.5 % and 86.7 % of their daily prescribed goal calories, with a mean of 56.4%. Patients received between 16.9% and 86.7% of their daily prescribed goal volume of enteral feeding, with a mean of 56.8%.

Eighty percent of patients in the study had enteral feedings interrupted for a number of different reasons. The reasons for interruptions as well as the number of times an interruption occurred during the study period are presented in Table 1. Each reason for interruption is also displayed as a percentage of the total number of interruptions.

Table 1

Reasons, Number of Times, and Percentage of Times Occurred for Enteral Feeding Interruptions

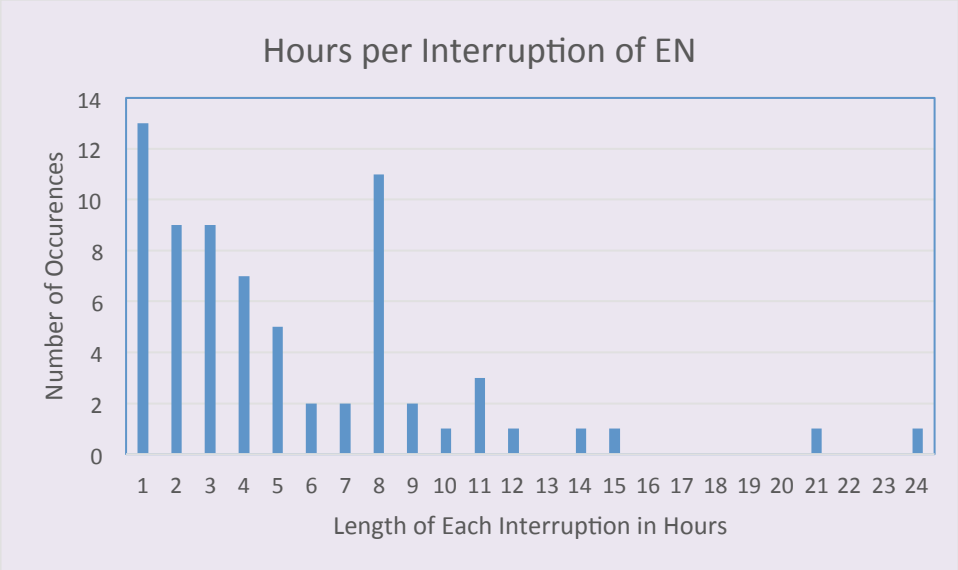
Reason for Enteral Feeding Interruption	# of Occurrences	% of Total Interruptions
Diagnostic test	24	31%
Residual	17	22%
Procedure	16	21%
Patient pulled tube	3	4%
Surgery	2	3%
Vomiting	2	3%
Abdominal pain	1	1%
Large amount secretions	1	1%
Diarrhea	1	1%
Medication	1	1%
Unknown	1	1%
Medical issues		
Respiratory problem	5	6%
GI bleed	2	3%
Seizure	1	1%
Fluid overload	2	3%

Diagnostic testing was the most frequent reason for the enteral feeding to be interrupted, followed by residual volumes and procedures.

Table 2 illustrates the length of time of each interruption. The length of interruption was determined based on the patient's intake and output record in the electronic medical record. Enteral feedings were considered held if stopped for greater than one hour.

Table 2

Length in Hours of each Interruption of Enteral Feedings



Each interruption of enteral feeding lasted between one hour and 24 hours in duration with a mean of 2.9 hours. The most frequent duration of interruption was one hour. There were nine interruptions that lasted two hours in duration as well as three hours in duration.

Table 3 illustrates the range of time for each interruption that occurred in more than one instance. The average duration of time per interruption is also displayed in Table 3. Any reason for interruption that occurred a single time is displayed under other. These single interruptions include abdominal pain, large amount of secretions, diarrhea, medication, seizure, and unknown. These are also listed on Table 1 and include the percentage of time they occurred.

Table 3

Range in Hours for each Enteral Feeding Interruption and Average Duration of Interruption in Hours.

Reason for Enteral Feeding Interrupted	Range in Hours	Average Duration of Interruption in Hours
Diagnostic test	1 - 8	2.8
Residual	1 - 8	3.9
Procedure	1 - 8	3.6
Pulled out tube	5 - 24	14
Surgery	6 - 21	14
Vomiting	8 - 10	9
Resp. problem	6 - 24	13
GIB	8	8
Fluid Overload	3 - 10	6.5
Other	2 - 9	6

Diagnostic testing, residual, and procedures were the three most frequent reasons for interruption of enteral feedings. These interruptions each ranged in duration from one to eight hours and had the lowest average duration of interruption. Patients that pulled out their feeding tube and patients that had their enteral feedings stopped for surgery had the longest average duration of interruption at 14 hours.

Summary and Conclusion

According to ASPEN (2014), enteral nutrition is liquid nutrition given through a tube and delivered directly into the stomach or small bowel. This liquid nutrition contains protein, carbohydrates (sugar), fats, vitamins, and minerals that are needed when a patient is unable to attain an adequate oral intake. Enteral feedings should be considered for patients when they cannot take enough nutrition orally (Medlin, 2012). Reasons for enteral nutrition can range from planned surgery or an unforeseen circumstance; other indications for enteral nutrition are decreased appetite, inability to eat due to surgery (ASPEN, 2014) or malnutrition (Holmes, 2012).

Patients that do not receive adequate nutritional support during their hospitalization are at risk for becoming malnourished, which can in turn cause serious health implications (Peev et al., 2014). Malnutrition is associated with many adverse outcomes such as muscle wasting, a depressed immune system (Barker et al., 2011), as well as increased hospital length of stay and increased costs associated with the admission (Norman et al., 2008). Other factors related to malnutrition are decreased wound healing and tissue maintenance (White et al., 2012). According to a study by Rubinson, Diette, Song, Brower, and Krishnan (2004), patients that received less than 25% of their recommended calories a day were at an increased risk for nosocomial blood stream infections.

Patients receiving enteral nutrition often have interruptions to their therapy, resulting in less than the recommended total daily calories. These interruptions can occur for such reasons such as a procedure, diarrhea, gastrointestinal intolerance, delivery delay

of formula to the unit (Morgan et al., 2004), surgery, vomiting or problems with the tube such as a blockage or removal (O'Meara et al., 2008). Testing and procedures accounted for the highest reasons for interruptions (35.7%) (Elpern et al., 2004). Morgan et al. (2004) studied factors that contributed to interruptions in enteral nutrition delivery and found that that patient received 67% of their total daily caloric intake. Peev et al. (2014) investigated the causes and consequences of interruptions to enteral feedings and determined that 68% of subjects had interruptions in the enteral feedings.

This study evaluated if patients received their total daily prescribed calories of enteral nutrition using a rate based protocol. Henderson's Nursing Need Theory (Henderson & Nite, 1978) was used to guide the study. A retrospective research design was utilized to obtain data from the electronic medical record for all patients who were admitted to the adult ICU from June 1, 2014 to August 31, 2014 who received rate based enteral feedings. Data collection occurred on all patients who were prescribed enteral feedings during the review period. These charts were reviewed to determine if the enteral feeding was interrupted, and if so the reason for and length of interruption.

It was determined that 80% of patients in this study had interruptions to their enteral feedings and received only 16.5 % to 86.7 % of their daily prescribed goal calories with a mean of 56.4%. Patients received between 16.9% and 86.7% of their daily prescribed goal volume of enteral feeding, with a mean of 56.8%. These interruptions occurred mostly due to diagnostic testing, procedures and gastric residual volumes, and ranged from one hour to twenty-four hours in duration for each interruption.

A limitation of this study was the size of the sample and the length of time of the data collection period. Other limitations were encountered during the data collection process. First, some of the patients that were originally identified as receiving enteral feedings were never started on the feedings. Also, there were a number of patients that received enteral feedings for less than 24 hours. Both situations are exclusion criteria, decreasing the sample size in this study. Although these limitations were identified, the results of this study were consistent with the literature. This study only reviewed the volume and caloric value of enteral feedings received by patients as well as reasons for interruptions. Patients were not reviewed for severity of illness or other clinical variables.

Based on the findings of this study, the incidence of enteral feeding interruptions does result in the patient receiving less than the total daily prescribed calories using a rate based protocol. The highest number of interruptions were due to diagnostic testing and procedures, which was consistent with the literature reviewed.

Next, recommendations and implications will be discussed.

Recommendations and Implications

One of the roles of the Advanced Practice Nurse is to improve the quality of patient care. Through this study, it was identified that there is an opportunity to improve the nutritional status of patients receiving enteral feedings. The hospital where this study was conducted uses a rate based protocol for enteral feedings, a common practice identified in the literature. It is a challenge to meet a patient's daily prescribed enteral feedings using a rate based protocol due to numerous interruptions. These interruptions are both avoidable and unavoidable; by decreasing avoidable interruptions, the patient will receive a larger percentage of their daily prescribed enteral feedings.

Several suggestions to reduce interruptions that could be utilized at any institution where patients receive enteral feedings are offered. Decreasing off unit diagnostic testing and when possible, have the testing completed at the bedside, would reduce unnecessary off-unit trips that require enteral feedings to be held. Another suggestion would be to book actual times for diagnostic testing, which could potentially decrease wait times in the other departments and facilitate timely patient return to the unit.

A recommendation to improve the amount of daily caloric intake is to develop a volume based enteral feeding protocol. Such a protocol prescribes an algorithm for the nurse to compensate feeding volume missed during interruptions. A study conducted by Heyland et al. (2010) investigated the feasibility of a volume-based protocol where the patient is prescribed a total volume for 24 hours. The rate corresponds to an algorithm based on hours and volume; when the enteral feeding is interrupted, the remaining

volume is calculated. Then, using the algorithm, the new rate is determined to ensure that the twenty-four hour volume is administered as prescribed (Heyland et al., 2010). By creating a similar protocol, the patient is more likely to receive their total prescribed calories daily.

An Advanced Practice Nurse could be the leader in creating a new protocol using a volume-based intervention for enteral feedings. The creation of a new protocol would need to involve the interdisciplinary team to ensure that all aspects of the patients' nutrition are addressed. A new policy would also be developed for the volume-based enteral feeding protocol. Development of a tool within the electronic medical record to calculate the rate, based on the developed enteral feeding volume-based protocol, would be helpful for the nursing staff. This innovative technology would also help to ensure the correct rate is selected based on the new protocol. After the protocol and policy are approved, the Clinical Nurse Specialist would take the lead in creating an educational program about the new protocol of volume-based enteral feedings. Implementation of a volume-based protocol could start on an identified unit and later be spread to an entire organization and beyond. Creating such a protocol may be beneficial to any patient receiving enteral feedings.

The involvement of an interdisciplinary team is essential for quality improvement initiatives in a healthcare organization. An Advanced Practice Nurse could lead the team in creating a new protocol and implementing a system-wide change. The CNS would be an integral part of the team, prepared to assume a leadership role to aide in assuring high quality patient care.

Future research would be beneficial after implementation of a volume-based protocol to determine if patients receive a greater percentage of their total daily prescribed caloric intake over rate based protocols. This research, compared to the current research on rate based protocols could determine which method of administration gives the patients their greatest percentage of daily prescribed calories from enteral feedings. Based on the findings of this future research, new protocols could be written to help improve enteral feedings.

The creation of new policy and procedures to deliver enteral feedings could be beneficial to patients at all institutions. By helping patients receive a greater percentage of their daily prescribed enteral feedings, we can help decrease hospital length of stay; improve wound healing and the overall health of the patients.

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Appendix A

KENT HOSPITAL

IRB FORM CRF-1

Kent Hospital
Clinical Record Research Form

Title of Project:
Do Patients in the Intensive Care Unit Receive Recommended Total Calories with Enteral Feedings Using a Rate Based Protocol?

Principal Investigator (s):
Barbara Bird, MSN, CCNS, RN-BC

Joseph F. Cortellini — 11/28/2014
Joseph Cortellini, HIPAA/Privacy Officer — Date

The above approval signature must be obtained prior to submission of the study for review by Kent Institutional Review Board.

Investigators are not responsible for obtaining signatures in the section below.

Jonathan Gates, MD, IRB Chairperson	11/28/14 Date	Approve	Yes ☑ No ☐
Patricia Racioppi, MS, RPh	11/28/14 Date	Approve	Yes ☑ No ☐
Joseph Cortellini	11/28/14 Date	Approve	Yes ☑ No ☐

Rev. 6.2014

Appendix B

Enteral Feeding Data Collection Tool