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Nutrition Support Assessment in Gastrointestinal Surgery Patients

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Chapter 1. Introduction to Nutrition Support and Encounters at UWMC Montlake

Introduction

This culminating project examines the inappropriate use of nutrition support, mainly total parenteral nutrition, at the University of Washington Medical Center Montlake. The project involves a 50-patient chart review of medical-surgical patients who received inpatient care for gastrointestinal complications from January 2019 through December 2019. The cases were chosen by Hailey Wilson, MS, RD, CD, CNSC, who worked with the gastroenterology medical-surgical patients providing nutrition consultations and support. All patients were admitted and received inpatient care on 4 NE, a medical and surgical floor that boards thoracic, neurology, neurosurgery, otolaryngology, and general surgery patients; or 7 SE, a floor specializing in gynecology, oncology, and inpatient solid tumors. The UWMC surgery teams involved with these patients' care were Surgery team A, Surgery team B, Surgery team H, Surgery team O, and Surgery team S. Surgery team A specializes in GI emergency and wound care, and other miscellaneous treatments. Surgery team B specializes in oncology/tumor. Surgery team H specializes in hepatobiliary procedures. Surgery team O specializes in upper gut procedures, including bariatric surgeries. Surgical team S specializes in small and large bowel procedures. All the patients were under the care of the UWMC dietitian team, including Hailey Wilson, who gathered the initial data set. The patients involved in the data collection were admitted to UWMC for gastrointestinal complications. The documented reasons for admissions are outlined later in this paper.

Nutrition Support Background

Nutrition support is a widely used therapeutic method that includes enteral nutrition (EN) and total parenteral nutrition (TPN or PN). Appropriate and evidenced-based use of nutrition support is associated with beneficial patient outcomes.[1] Some of the favorable outcomes associated with appropriate PN include a reduction in disease severity, a reduction in complications, a decreased length of stay in the ICU, reducing malnutrition risk, and improved patient outcomes. However, for patients with a functional GI tract, EN is the preferred support method.[2] EN provides nutrients to the GI tract and induces an immune response.[3] EN preserves

and induces effects on the gut-associated lymphoid tissue (GALT), which has been found to atrophy in PN use.[3] Benefits associated with EN include preservation of gut structure and function, reducing inflammation, and immune function preservation.[4] A 2012 review by Wheble et al. emphasized that EN should be the preferred route of post-operative nutrition in upper gastrointestinal surgery due to a reduction in hospital length of stay and is less expensive than PN.[5] Additionally, current A.S.P.E.N. guidelines recommend early initiation of EN in critically ill patients, even if bowel sounds and flatus are absent.[6] Despite the route of nutrition support delivered, early intervention is of crucial importance to prevent malnutrition.[7]

Inappropriate use of PN results in a multitude of complications.[7] Medical issues associated with inappropriate or improper use of PN include hyperglycemia, refeeding syndrome, hypertriglyceridemia, electrolyte imbalances, gastrointestinal mucosal atrophy, translocation of gut microorganisms, and cholestasis.[1] Due to the concentration of the PN solution, a central venous catheter is necessary for administration.[8] This includes the risk of complication and infection, as 5% to 10% of patients on PN experience a central venous access complication.[8] Many of these complications can affect recovery rate and time, which may lead to increased length of hospital stay.[9] There are financial considerations associated with improper use of PN, due to the high costs of preparation and administration of PN.[9] These financial considerations affect both the hospital and the patient.

Chapter 2. Background of Patient Data Collection

Hailey Wilson MS, RD, CD, CNSC was an inpatient clinical dietitian working at UWMC Montlake on the medical-surgical floors, 4 NE and 7 SE. The surgery teams she worked with included A, B, H, O, and S. Throughout her time at UWMC she repeatedly experienced improper or inappropriate use of nutrition support, mainly total parenteral nutrition (TPN or PN), by the various surgery teams. In January 2019, she began collecting information about these encounters. There were slight variations in the data collected for all the patients, but ten key outcomes remained the same. These are listed in Table 1. There were 345 patient names listed for the entirety of 2019. For 199 of these patients, there was a complete record for the ten components listed in Table 1.

Table 1: Key components included during patient data collection.
Patient names
Medical Records Number (MRNs)
Reason for admission
Days of inadequate nutrition support
Unnecessary TPN
Unnecessary EN
Difference in nutrition care plans between specialty teams
Difference in diagnosis rationale
Short term use of TPN less than 5 days
Cases where MD and RD disagreed on diagnosis

The patient information was collected in 3 sections, from January 7, 2019, through March 26, 2019, from April 29, 2019, through June 28, 2019, and June 29, 2019, through December 31, 2019. No reason was provided for the lapse in data collection. The data was collected through the electronic medical records software ORCA (Cerner North Kansas City, MO, USA).

This researcher was put in contact with Hailey Wilson, and the data was made available to create a capstone project with the findings to highlight the inappropriate practices surrounding nutrition support at UWMC. Due to the large volume of patient encounters collected, 50 patients were randomly from the data set of 199. From January to March 2019, 16 patients were selected. There were 17 patients selected from April to June 2019. There were 17 patients selected from June to December 2019. The outcomes from the 50 selected patients were obtained and collated.

UWMC Mission and Vision[10]

UWMC Mission

UW Medicine has a single mission: To improve the health of the public. The 30,000 members of our community advance this mission through the excellence of their work in patient care, medical education and research.

UWMC Vision

UW Medicine will provide: a care experience for patients and their families that helps them achieve their personal goals for wellness and disease management; an educational environment for health professionals, students and trainees that prepares them for leadership in their professional careers; and a research enterprise for scientists that enables them to advance medical knowledge and clinical innovations with groundbreaking discoveries.

This project analyzes data gathered from several disciplinary teams to highlight the inappropriate use of nutrition support on the medical-surgical floors. This project also hopes to highlight the lack of standardized care, or an unfortunate detour, from the use of evidence-based guidelines such as the UW Standards of Care and the A.S.P.E.N. guidelines for nutrition support. In keeping with the values of UWMC, it is hoped the issues raised by this assessment will bring about continued nutrition support education for all involved, improving interdisciplinary communication for improved patient outcomes, and creating a consistent standard of care for all patients. Lastly, this report will emphasize the frequency in which RD recommendations are disregarded, dismissed, and ignored.

Chapter 3. Chart review of UWMC GI patients

Chart Review: Outcome Results

The results of the 50-patient chart review yielded several themes that were indicative of improper use of nutrition support methods. The overarching theme of the 50-patient chart review was the failure of the medical teams to follow the RD recommendations. The resulting outcomes and trends tie into this larger issue. Some of these themes include inadequate nutrition support, unnecessary use of PN, lack of utilization of EN, short-term use of PN, and incorrect assessment of nutrition status.

One major trend present in the data was failing to provide adequate nutrition support to the patient. Inadequate nutrition support was defined as the failure to initiate EN or PN despite

RD recommendations. Table 2 displays the results of the 50-patient chart review. 16% of the patients, or 8 patients, were subject to inadequate nutrition support, for a total of 21 days. Further evidence of this practice is displayed in the difference in care plan notes. 12 patients, or 34%, received an RD recommendation to initiate EN, yet the medical teams chose not to start tube feeds. Additionally, 4%, or 2 patients, received a recommendation for TPN, and the surgery teams did not initiate. Failure to advance diet leading to prolonged NPO were not categorically defined as inadequate nutrition support, but these instances do demonstrate disregard for the RD recommendations. Several examples are included here. The length of time each patient was NPO was not included in all the patient encounter notes. There were 3 cases noted where the patient was on prolonged NPO, 5 days post-operative, despite clear reasoning or lack of solid evidence. In one of these cases, due to the patient's poor intake prior to admission and extended time NPO, the patient became high-risk for malnutrition. One patient received RD recommendations to cease EN to allow for advancement of oral diet, and the surgery teams continued EN. In 6% of cases, the RD recommended advancing the patient's diet, and the medical teams did not advance the diet. In 12% of the cases studied, the medical teams failed to follow through with the nutrition team recommendations for the transition from PN to EN.

The outcome with the strongest evidence was the unnecessary use of PN in this patient population. In the 50-patient review, 34%, or 17 patients, were found to have been on unnecessary PN for a total of 72 days. There were various reasons provided in the chart notes as to why PN was utilized over EN or the RD recommendations. Some of these explanations include malnutrition diagnoses made by the vascular team and the SICU team, not the nutrition team; advancing the EN feed to goal while continuing with PN orders; and the team stating they prefer TPN despite no contraindication for EN.

Failing to follow the recommendations of the RD leading to the underuse of enteral nutrition was another theme present in the data. This trend occurred in patients where EN was both indicated and warranted. The number of patients in the population who did receive EN was a statistic unable to verify; however, Table 2 demonstrates there were no unnecessary enteral feeding cases. This possibly alludes to the underuse of enteral nutrition in this population. This is also illustrated in the 12% of patients who received RD recommendations to transition off PN to EN but did not begin EN.

Short-term use of PN is a practice that is contraindicated, though there is no formal A.S.P.E.N. guideline. There were 4 patients who received a course of PN less than 5 days, which possibly indicates that nutrition support was not initiated as quickly as recommended or a failure to follow the RD recommendations. This is also highlighted in the malnutrition case study portion of this paper.

The final theme that is highlighted in the analysis is the incorrect assessment of patient nutrition status. The medical team did not follow A.S.P.E.N. guidelines when assessing the patients despite UW policy. Three patients were assessed based on albumin concentration, an incorrect assessment tool for nutrition status. A further explanation of albumin as a nutrition marker is covered later in this paper. Four of the patients who received nutrition assessments did not receive any note or explanation from the medical team in the note. This may indicate the medical team did not agree with the diagnosis or felt it unnecessary to comment on the diagnosis. 22% of the cases studied included a malnutrition diagnosis from the medical team that was clinically unsupported by the RD. These individual diagnoses were unable to verify and present in this report.

There were 7 cases, or 14%, documented in the chart notes of the RD making a malnutrition diagnosis and the MD disagreeing or disregarding the diagnosis. These individual diagnoses were unable to verify and presented in this report.

Of the five different UWMC surgical teams represented in the data, the following is the frequency they occur. Surgical team A is represented in 14 cases, B is represented in 1 case, H is represented in 6 cases, O is represented in 8 cases, and S is represented in 21 cases.

Table 2. Results of 50-patient chart review.

	Patients	Days
Inadequate Nutrition Support Provided	8	21
Unnecessary Parenteral Nutrition	17	72
Unnecessary Enteral Nutrition	0	0
Short term TPN course (< 5 days)	4	-
MDY/RDN	11	-
MDN/RDY	7	-

MDY or RDY = the medical team or registered dietitian states the patient warrants a malnutrition diagnosis.

MDN or RDN = the medical team or registered dietitian states the patient does not warrant a malnutrition diagnosis.

Chart Review: Reason for Hospital Admission

The charted reasons for admission for the 50 patients are as follows. Small bowel obstruction, ostomies including ileostomy, colostomy, distal gastrectomy, gastroduodenostomy, pancreatitis, abdominal pain, ischemic bowel, ileus, duodenal perforation, hemicolectomy, esophagectomy, feeding tube placement including percutaneous endoscopic gastrostomy (PEG) and jejunostomy tube (J tube), failure to thrive and malnutrition, Whipple procedure, hepatectomy, sigmoidoscopy, hernia repair, Crohn's disease, jejunal cancer, abnormal CT scan, post operative complications, adrenal tumor, and gastric cancer.

Chart Review: Differences in Care Plans

The noted differences in care plans contain quoted chart notes taken directly from the patient's ORCA electronic medical records. Additionally, there are clinical judgments and inferences made by Hailey Wilson, who was involved with the medical care teams and the patient situations. The differences in care plans for the 50-patient chart review are as follows. RD recommended patient discharged of TPN due to tube feed increase, premature TPN start, RD recommended initiating EN but team failed to initiate, RD recommended waiting on TPN, RD recommended starting TPN but never initiated, RD recommended restarting TF, EN rate not advanced, RD recommended a preoperative TPN start, RD recommended advancing diet, pt discharged with a severe malnutrition diagnosis despite RD recommendation of TF.

Chart Review: Difference in Diagnosis Rationale

The noted differences in diagnosis rationale contain quoted chart notes taken directly from the patients' ORCA electronic medical records. Additionally, Hailey Wilson, who was involved with the medical care teams and the patient situations, made many clinical judgments and inferences. The diagnosis difference rationale for the 50-patient chart review is as follows. Justification for nutrition support, TPN justification, malnutrition due to ischemic bowel diagnosed by the vascular team, hypoalbuminemia, MD used albumin to assess status, unknown reasons, MD not using A.S.P.E.N. to evaluate status, RD assessed the patient as well-nourished, and the MD states the patient needs TPN, diagnosis made by the Surgery Intensive Care Unit (SICU), not by nutrition team, no comments were included in the chart by the MD team, RD did not make the diagnosis due to inability to obtain history.

Chapter 4. Case Study: Malnutrition and Perforated Diverticulitis in Patient X

The following is a case study included to highlight several of the issues brought to light by this report, the lack of documentation by the medical teams surrounding malnutrition diagnoses. This in-depth chart review outlines the patient's hospital course and is compiled from the notes of the surgery teams, dietitians, nursing, and other specialties.

Malnutrition and Perforated Diverticulitis Case Report

Introduction

Carney syndrome is a rare genetic disorder associated with an increased risk of several types of tumors.[11] Only 750 individuals worldwide have been diagnosed with Carney complex.[12] Mutations in the PRKAR1A gene, a tumor suppressor gene, is the main cause of Carney syndrome.[13] Patients with Carney complex often suffer from metabolic dysregulation due to the development of multiple benign tumors affecting the endocrine system.[11] 25% of those afflicted with Carney complex develop primary pigmented nodular adrenocortical disease (PPNAD), which is characterized by tiny nodules affecting the adrenal glands.[10] In 2003, Patient X underwent a right adrenalectomy, thought to be due to adrenocortical carcinoma. Patient X also developed melanotic schwannoma, a rare tumor affecting the Schwann cells of the peripheral nerve sheath.[12] These tumors can occur anywhere along the nervous system but most often occur throughout the gastrointestinal tract, including the esophagus.[12] In 2015, Patient X underwent bilateral neck dissections for treatment of the melanotic schwannoma. Patient X was admitted to UWMC with poor PO intake, nausea, and emesis. He underwent an exploratory laparotomy which resulted in a sigmoid colon resection, appendectomy, and end colostomy placement. Patient X presented to the hospital in severely malnourished state, having poor PO intake prior to admit. Due to nausea, emesis, and no flatus, he was placed on NPO orders for a possible ileus. Despite meeting ASPEN guidelines, Patient X did not receive adequate nutrition support (PN) within the time frame recommended.

Admit – HD 4

The patient is a 49-year-old male who presented to the UW Emergency Department (ED) with nausea, chills, and abdominal pain. Upon examination, the patient was found to have perforated diverticulitis.

The patient underwent an exploratory laparotomy, a sigmoid colon resection, appendectomy, and end colostomy placement on 6/19. The patient was transferred

to the SICU for ventilator and pressor management and resuscitation. On HD 2 the patient was transferred to the 7SE general surgery floor. HD 3 the team began to advance oral intake for the patient. However, due to nausea and vomiting and lack of flatus, the patient was placed on NPO status.

HD 5: 1st Nutrition Assessment

HD 5 was the first assessment the patient had by the nutrition team. Per the nutrition and weight history assessment, the patient estimated meeting < 25% needs through PO intake 10 days prior to admit and experienced having emesis after many of the meals. Additionally, there was an estimated 4% weight loss in the previous 4 months with much of the loss occurring in the past 2 weeks. It was reported that fluid retention was possibly masking greater weight loss. Low BUN supported reports of poor PO intake while electrolytes were all within normal limits. The nutrition diagnosis was 3 parts. Inadequate energy intake related to nausea and vomiting, as evidenced by NPO status; Severe malnutrition present on admission: d/t meeting < 50% for > 5days; weight loss of > 2 % in 1 week; Predicted suboptimal energy intake related to therapy as evidenced by known side effects of regimen. The dietitian recommended initiating nutrition support in next 24-48 hours due to minimal to no oral intake since admit and meeting < 30% needs through PO intake PTA. Recommendations for TPN were included in the note along with cautioning for risk of refeeding syndrome.

TPN was initiated on HD 7 with the target goal of 2139 kcals, 335g carb (GIR 2.2 based on 108kg), 125g protein, 23% fat. Lipids were to be held until day 5 and 100 mg of thiamin was to be given due to risk of refeeding. Electrolytes were also to be monitored due to refeeding.

HD 8 – HD 10: 2nd Nutrition Assessment

On HD 8 there was noted gas in the ostomy bag, so the patient's diet was advanced. In addition, Patient X continued on TPN. HD 9 Patient X's diet advanced to general diet, with a noted slow start due to some nausea and vomiting. HD 10 was the second nutrition assessment by the nutrition team.

Patient X's energy needs were estimated to be 2259-2635 kilocalories and his protein needs to be 98-113 grams. His PO intake was increasing but was not high enough to meet his estimated needs. The RD recommended to hold TPN tonight if Patient X can demonstrate good intake at lunch which includes a protein source. The nutrition team also advised against discharging Patient X on TPN due to increased risk of infection and having a functioning gastrointestinal tract. TPN was discontinued after this consultation.

HD 13: Discharge

The day of the patient's discharge, HD 13, Patient X was tolerating a general diet and stool output in the ostomy bag. Patient X was ambulating throughout the day and demonstrated knowledge of ostomy bag change. Patient X denied any nausea or vomiting and was discharged midday.

Past Medical History

Due to his diagnosis of Carney complex, Patient X has an extensive medical history. Current aliments include autoimmune hepatitis, chronic steroid use due to adrenalectomy, gastrointestinal reflux, colitis, uveitis, and dermatitis. Past medical history includes metastatic melanocytic schwannoma resulting in a left neck dissection, polycythemia vera, an adrenalectomy due to adrenocortical carcinoma, a resection of chest wall due to a recurrence of ACC, and basal cell carcinoma.

Interventions, Medical Nutrition Therapies, Evidence-Based Guidelines

Post admit and procedures, Patient X was placed on a clear liquid diet with small intake. Despite small intake, Patient X had no flatus, nausea and emesis and was changed to NPO status until bowel functions returned. Due to nausea and emesis prior to admit, it was estimated Patient X had met less than 25% of his total energy needs prior to admit. Therefore, the intervention of parenteral nutrition was recommended due to a diagnosis of malnutrition.

PN is not recommended for short term use, less than 5 days, unless the patient is severely malnourished. Although Patient X received PN for less than 5 days, there was a diagnosis of severe malnutrition that was present on admission. Despite short term PN being contraindicated, there is no evidence-based guideline published to support this recommendation.[13]

The ASPEN guidelines recommend initiation of PN as soon as is feasible for patients with baseline moderate or severe malnutrition in whom oral intake or EN is not possible or sufficient. The ASPEN guidelines for critically ill patients state *"Based on expert consensus, in the patient determined to be at high nutrition risk or severely malnourished, when EN is not feasible, we suggest initiating exclusive PN as soon as possible."* [6,7]

Discussion and Conclusion

There was no mention of malnutrition in any of the inpatient surgery notes. This occurred despite a documented nutrition and weight history which highlighted low PO intake prior to admit, a diagnosis of severe malnutrition on HD 5, along with a recommendation of starting PN within 24 to 48 hours.

The patient population in which Patient X was drawn has the potential to admit already under-nourished due to their gastrointestinal symptoms. UWMC standards of care for parenteral nutrition includes the recommendation that for severely malnourished patients, PN is indicated when an impairment of the GI tract occurs. Appropriate timing and use of PN improves hospital outcomes while malnutrition prior to admit and during hospitalization is associated with increased morbidity and mortality.[14] UWMC also utilizes A.S.P.E.N. guidelines for determination of appropriate use of PN. Further research may include how and when this protocol is being followed.

This in-depth case report illustrates both the positives and the negatives of nutrition support at UWMC. Patient X received the nutrition support needed for his complicated case history and current symptoms. The RD recommendations for initiation of nutrition support

within 24 to 48 hours were followed, as were commencing with PN. However, the surgery teams did not document the malnutrition diagnosis, and the patient was on a short course of PN, less than 5 days. Additionally, Patient X was severely malnourished but did not receive nutrition support until hospital day 7. This delay of care is cause for concern.

Chapter 5. Discussion Points

The findings of this capstone project indicate a need for further research into the nutrition support practices among the UWMC medical-surgical teams on 4NE and 7SE. Protocol states the nutrition team follows current A.S.P.E.N. guidelines for nutrition support along with the UW Standards of Care for Parenteral Nutrition, which is in the process of being revised. The UW Standards of Care for Parenteral Nutrition are listed in Appendix 1. Surgery and medical teams do not possess a separate protocol or guideline for nutrition support, and procedure would indicate they follow the UW Standards of Care and A.S.P.E.N. guidelines. A Nutrition Support Protocol, aimed at surgery teams, is included in Appendix 2. The medical or surgical teams request a nutrition consult within the EPIC charting system; however, the discretion of initiation and method ultimately lies with the medical and surgical teams. No explanation or rationale needs to be listed or included for the use of nutrition support by the medical-surgical teams.

While the data for this capstone project involves inpatients at UWMC, this project and the resulting proposals are not applicable hospital wide. The information collected is specific to the medical-surgical floors of 4NE and 7SE, and the surgical teams of A, B, H, O, and S. The protocol, timeline, and structure of nutrition support procedures differ according to the specific medical teams and the dietitian covering that specialty. For instance, the ICU medical team encourages the RD to place the EN or TPN orders through EPIC after the nutrition consult is placed. Other medical teams prefer to have the EN or TPN recommendations charted and then place the orders themselves. Care must also be taken when examining the breakdown of nutrition support occurrences and surgical teams. Surgical team S represents 42% of the cases in the chart review. However, their specialty is small and large bowel surgeries, which would require a higher frequency of nutrition support than other specialties. Further research is recommended, including ongoing QI projects for 4NE and 7SE medical-surgical floors, outlined later in this paper.

ERAS Protocols Within the Sample Population

The Enhanced Recovery After Surgery (ERAS) Society is a collective of international healthcare professionals with the aim of improving surgery recovery through peri and post-operative evidence-based care. ERAS Society publishes consensus statements offering recommendations found to improve outcomes for patients undergoing various surgeries. The population studied in this report are patients with gastrointestinal complications. Due to their various diseases and complications, the patient's nutrition status is likely to be affected. Prior to hospital admission, these patients may have experienced suboptimal nutrient intake. In a 2015 article, Allard et al. found that 45% of 1,015 gastrointestinal patients were considered malnourished at inpatient admission.[15] The first protocol outlines the strong evidence supporting a shorter preoperative fasting time, 6 hours, and avoidance of an overnight fast, which is common practice. The benefit of this preoperative carbohydrate loading includes maintaining glycogen storage, reduced post-operative insulin resistance, improved muscle strength, and a decrease in protein catabolism.[16] ERAS protocols also encourage early post-operative introduction of fluids and solids.[16] This recommendation is associated with maintaining fluid homeostasis and avoiding fluid overload.[3] Early feeding has also been shown to enhance the recovery of gastrointestinal function, thereby preventing post-operative ileus.[17] Despite the high rates of malnutrition within this population and the strong evidence supporting the ERAS protocols, the information gathered from this data set indicates resistance to early oral nutrition, low rates of EN, and an overabundant and improper use of PN.

Albumin Not an Indicator for Malnutrition

The 2020 A.S.P.E.N. position paper, *The Use of Visceral Proteins as Nutrition Markers*, outlines the lack of evidence and incorrect practice of utilizing plasma albumin as an indicator for nutrition status. Hypoalbuminemia should not be a marker for commencement of nutrition support, nor should a patient with albumin concentrations within normal limits be considered nourished.[18] This practice continues to be applied by some surgery teams at UWMC, despite recommendations from the dietitian team. This was highlighted in several ways. The results of the diagnosis difference rationale listed 3 cases out of 50 whose initiation or non-initiation of nutrition support was based on plasma albumin concentrations. Additionally, while completing

my clinical rotation with Hailey Wilson at UWMC, I witnessed the surgery teams asking for TPN consults on patients with hypoalbuminemia and resistance to nutrition support initiation due to the patient's albumin falling within normal limits. The Executive Summary from the A.S.P.E.N. position paper has been included in the hopes that it may be shared out with the various surgery teams.

> ***The Use of Visceral Proteins as Nutrition Markers: An ASPEN Position Paper***
>
> ***Executive Summary*** [18]
>
> *Serum albumin and prealbumin are not components of currently accepted definitions of malnutrition.*
>
> *Serum albumin and prealbumin do not serve as valid proxy measures of total body protein or total muscle mass and should not be used as nutrition markers.*
>
> *The serum concentrations of albumin and prealbumin decline in the presence of inflammation, regardless of underlying nutrition status.*
>
> *Serum albumin and prealbumin declines must be recognized as inflammatory markers associated with "nutrition risk" in the context of nutrition assessment rather than with malnutrition per se. Nutrition risk is broadly defined as the risk of developing malnutrition and/or poor clinical outcomes if nutrition support is not provided.*
>
> *The role of serum albumin and prealbumin in monitoring delivery and efficacy of nutrition support remains undefined. Their normalization may indicate the resolution of inflammation, the reduction of nutrition risk, a transition to anabolism, or potentially lower calorie and protein requirements.*

Limitations

A number of patient outcomes and information were not included in this project, possibly due to the inability to ascertain or verify. These may have led to limitations on this project. These limitations include lack of total number of UWMC surgery patients per year, cost of TPN and EN spent at UWMC annually, the cost of a course of TPN versus the cost of EN, number of surgical readmissions per year, percentage of patients who have private health insurance and

those on Medicaid and Medicare, amount of reimbursement UWMC receives annually for medical nutrition services.

Chapter 6. Nutrition Support Protocol Guideline

The results of this initial research project illustrate the need for a specific nutrition support protocol for the 4NE and 7SE medical-surgical teams. A guideline was developed to increase communication and involvement between the nutrition and medical-surgical teams. The full nutrition support guideline is outlined in Appendix 2. The nutrition support guideline includes elements of the A.S.P.E.N. Adult Nutrition Care Pathway and the A.S.P.E.N. Parenteral Nutrition Care Pathway, as both are critical to patient nutrition support.[19,20] The use of evidence-based templates in creating the protocol will assist in a return to evidence-based care. This protocol should be a step in revising the nutrition support care plan at UWMC. Additionally, A.S.P.E.N. suggests these guidelines for reducing the risk of complications associated with PN.[9] The first recommendation states that standardized processes should be in place for the management of PN. Second, PN administration measures should be implemented into organizational policies and procedures. Thirdly, an interprofessional team of clinicians schooled in nutrition support should be leading the management of PN. Lastly, all PN prescribers should be educated and demonstrate prescribing competencies.[9]

Chapter 7. UWMC Nutrition Team Presentation

The dissemination of this report and its findings will occur in two ways. The first will involve a presentation to the nutrition care team at UWMC Montlake. The audience will include the clinical nutrition manager, Alysun Deckert, along with other dietitians who may or may not work with the surgical teams included in this report. The other plan for dissemination includes sending a copy of the finished report to Alysun Deckert. Her intention is to distribute the paper to the nutrition care team.

Chapter 8: QI Project topics and Further Research

For the culture of inappropriate use of PN to change, there needs to be an acknowledgement that PN is being improperly prescribed and the recommendations of the registered dietitians are being rejected. This acknowledgment needs to be made by all involved in the process, including the medical-surgical teams, hospital administrators, and management. The soundest way to present this argument is with solid evidence and facts. This requires continued data collection by the nutrition team to allow QI projects and other research to be conducted surrounding this topic.

QI Projects

The addition of an annual PN QI project in the nutrition support protocol creates an ongoing data set to judge the efficacy and effectiveness of the guidelines and the state of nutrition support. This may include a chart review of a proposed number of patients from the various medical-surgical teams, which would help to facilitate further study or investigations into the use of PN at UWMC by the various medical-surgical teams.

In addition to the suggestions previously mentioned, possible future research projects could investigate the frequency of post-operative NPO status along with the basis for the order, the average length of time a sample of patients are NPO including for procedures, an examination of duration of NPO along with an intake assessment and whether the patient fits threshold for nutrition support or malnutrition guidelines. Other outcomes could determine use of albumin as a nutritional marker, and the frequency and details of malnutrition diagnosis. Discussions with the hospital nutrition team may elicit necessary research projects for other floors and specialties. A standardized method for nutrition consults and nutrition support orders may also be warranted, as there appears to be a lack of consistency.

Other standards that would need implementing in the UWMC system include proper diagnosing and documentation of malnutrition in their patient population, which includes adding it to the patient problem list. Discontinuation of albumin as a nutritional marker is of utmost importance, as this would lie in evidence-based care. Further emphasis must be placed on the use of EN for patients with a functional gastrointestinal tract. Added significance needs to be placed on the practice that EN is the preferred method and the first course of action, PN is an option

once other options have been attempted. One practice that will assist with this is the requirement of documentation listing reasons EN is not the choice for nutrition support.

A continued process of advocacy for their patient's rights needs to be a priority within the nutrition team. However, continually advocating for best practices in the face of continually dismissed recommendations is a difficult task. Interprofessional collaboration on the side of the medical-surgical teams needs to improve, and a return to evidence-based medicine needs to happen to improve patient care.

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Appendix 1

Parenteral Nutrition UW Standards of Care

Parenteral Nutrition: Standards of Care

Step 1: Assess appropriateness for PN.

Indications for PN:

- For critically ill patients PN is indicated if EN is not possible and hyper metabolism is expected to last > 5days
- Complete bowel obstruction or pseudo-obstruction needing bowel rest > 7days
- For the severely malnourished patient, PN is indicated when an impairment of the GI tract occurs.
- Persistent Ileus
- Bowel ischemia
- GI perforation
- Severe exacerbation of IBD
- Short bowel or malabsorptive syndromes
- High output enterocutaneous fistula (>500 ml)
- Chemotherapy resulting in regimen related toxicities (~ 7 -10 days)
  -Nausea
  - vomiting
- Severe mucositis
- Excessive diarrhea with output consistently greater than > 1 L for lasting for 7-10 days
- Hyperemesis gravidarum when N/V persists > 5-7 days and post-pyloric EN not possible
- Major surgery / stress when EN not expected to resume within 7-10 days
- Intractable vomiting when jejunal feeding not possible
- Chylous ascites or chylothorax when low fat / fat-free EN does not adequately decrease output

PN NOT APPROPRIATE – Contraindications for PN:

- Functioning gut
- Treatment anticipated for < 5 days in patients without severe malnutrition
- Inability to obtain venous access
- A prognosis that doesn't warrant aggressive nutrition support
- Patients classified as well-nourished & had inadequate enteral nutrition (EN) for less than 7 days
- Those receiving adequate EN

Step 2: Determine dosing weight

- Actual body wt if < 120% IBW
- Use IBW > 120% IBW

- Please refer to BMT standard guidelines for calculating dosing weight (BMT uses adj. weight IF % IBW> 120%)

Step 3: Determine nutritional needs

Calculate needs according to the standards of care for that particular disease state

- Goal calorie provision for PN (will be less than goal estimated for EN/PO)
  Based on ASPEN:
- -For general hospitalized adult 20-25 Kcal/kg; Protein: 0.8-1gm/kg
- For postoperative or critically ill patients, provide 80% of these needs with adequate protein (unless contraindicated by disease state such as renal failure) during the first week of PN provision. Then, increase to 100% as appropriate
- Acute renal failure, chronic kidney disease: 30-35 Kcals/kg ND: 0.8gm/kg; HD: 1.2+gm/kg; CRRT: 1.5-2.5; pd: 1.2-1.3+gm/kg
- Cancer: 30-35 Kcals/ kg; Protein: 1.5 mg/kg; for high GI losses> 2 L /day: 2gm/kg due to protein losing enteropathy

- Energy needs dropped for PN given hepatic compromise associated with parenteral overfeeding (although pathophysiology for PN-associated liver disease is not entirely clear, it is strongly associated with prolonged PN providing >30 kcal/kg)

Step 4: Design the Formulation

- **Dextrose**
- Provides 3.4 kcal/g
- Should generally provide 45-60% of total calorie: ensure total CHO content do not exceed 7g/kg/day in adults
- For patients with poor glucose control, start with 100-150g CHO. For other patients, start with a max dose of 150-200 g CHO.
- Use actual weight to calculate GIR
- To calculate GIR: take grams CHO divided by weight divided by 1.44
- 1.44 comes from 1440 minutes/day, divided by 1000 (instead of multiplying g CHO by 1000 on top)
- GIR should not exceed 5.7mg/kg/min
- For adults with pre-existing diabetes, do not exceed <3mg/kg/min
- Ensure GIR 4-5 mg/kg/min for critically ill patients
- Limit dextrose < 4-5mg/kg /min in effort to reduce risk of hepatic steatosis

- **Amino Acids**
- Provides 4 Kcal/kg
- AA can be started at / near goal (at least low-end of goal, e.g. 1.2 g/kg) – has not demonstrated to have an effect on fluid / electrolyte shifts

- **IV Fat Emulsion:**
- To provide 30% or less of total calories
- Provides 2 kcal/ml
- Ensure total lipids < 2.5 g/kg/day. There are 20 g fat/100 mL in 20% IVFE
- Unless the patient is very large & tall, high lipid doses (i.e. > 250 ml/day) likely exceed recommended dose and may be detrimental to the patient.
- Essential Fatty Acid Deficiency (EFAD) can develop in 1-3 weeks in adults receiving no lipids. To prevent EFAD, provide 250 ml of 20% lipids 2x/week.
- Fat: 30% or less of total kcals
- No IVFE while on propofol
- **SMOF** (soy bean, mono unsaturated olive oil, fish oil) Lipid can be used on patients for liver impairment, hypertriglyceridemia and if prolonged use of TPN is indicated
- Non – formulary lipid formulation available to order
- -fill the form number: UH0127 from form repository

- **Vitamins:**
- Add standard vitamin package daily if unable to provide oral form
- **For dialysis:** Give multivitamin pkg 3/week or every other day
- **Refeeding syndrome:** Add Thiamine 100mg for 7 days
- **Trace minerals:**
- Remove copper, Manganese if patients have T-bili> 3.5. Customize and add zinc, selenium, chromium

- **Additional Vitamin C & Zinc**
- 500mg Vit. C added to TPN s/p HSCT for repletion and repair of cells
- 5 mg zinc given for prolonged diarrhea > 1 L stool
- Certain populations should not receive such a high dose of vitamin C
- Monitor Urinary Analysis – if excreting vitamin C, consider discontinuing it in the PN

- **Step 5: PN Initiation, Advancement & Monitoring (CPN – Central Parenteral Nutrition)**

- PN is advanced by dextrose concentration
- For patients at risk for hyperglycemia, start with 150 g Dextrose daily or less. For other patients, ok to start with up to 200 g Dextrose daily or less
- Modest initiation appropriate to minimize hyperglycemia, electrolyte abnormalities

- **At risk for refeeding syndrome** → provide ½ dextrose or GIR < 2 on day 1, increase 200-400 Kcals depending on lytes. Advance only if electrolytes and BG within acceptable range
- Patients should be checked on daily during initial PN advancement toward goal [dextrose]
- Check electrolytes, glycemic control (80- 150mg/dl)
- Not unusual to see electrolyte abnormalities even after a week of TPN initiation
- ***If you don't know if the patient is at risk for refeeding syndrome (e.g. they're intubated/sedated and no family is present at bedside and it's not clear in the notes), it's prudent to assume that they are and advance more slowly.

Peripheral Parenteral Nutrition (PPN)

- Assess appropriateness of PPN:
- Good peripheral venous access, able to tolerate large volumes of fluid (2.5-3 Liters), use < 2 weeks
- Contraindications of PPN: significant malnutrition (if long-term), severe metabolic stress, large nutrient or electrolyte needs, fluid restriction, need for prolonged PN (>2 wks), renal or liver compromise
- Osmolality should not exceed 950 mOsm/L
- Osmolality = (grams dextrose per liter x 5) + (grams protein per liter x 10) + 300 (to account for additives / electrolytes / micronutrients- Check with pharmacy to discuss which nutrients are priority.)
- Lipids are isotonic , should run over 24 hours to prevent vein irritation or heparin 500u/L may decrease irritation

Complications associated with parenteral nutrition:

- **Hypertriglyceridemia:** Check TG before lipid infusion. if levels 350-500, provide 12-15% total calories, if levels greater than >400, hold lipids
- Try decreasing dextrose in TPN since this can contribute to high TG

- **Hyperglycemia**: Limit CHO to < 4mg.kg/min.
- - Recommend to consult glycemic/ endocrinology team for insulin recommendations. Touch base with endo team if changes made to dextrose
- Consult with providers regarding insulin plan. Usually patients get started on sliding scale correction and insulin is added to the TPN the next day depending on the sliding scale needs

- **Liver impairment**

- -If pt noted to have increased liver enzymes: Recommend cycle TPN for 18 hours , slowly taper to 12 hours depending on BG levels
- Decrease dextrose to < 4mg/kg/min
- Use SMOF lipids if noted to have consistently high liver enzymes and or hypertriglyceridemia, on prolonged TPN (>1 month) and no plans to wean off, and not contraindicated with medication (**Pt receiving chemotherapy cannot receive SMOF lipids d/t interaction with chemo)**
- Pt with soy allergy cannot receive SMOF lipids

- **Hypersensitivity:**
  -Lipid formulations contain soybean, peanut oil, fish oil and egg phospholipids. Do not add lipids if these allergies are present in patient

References:

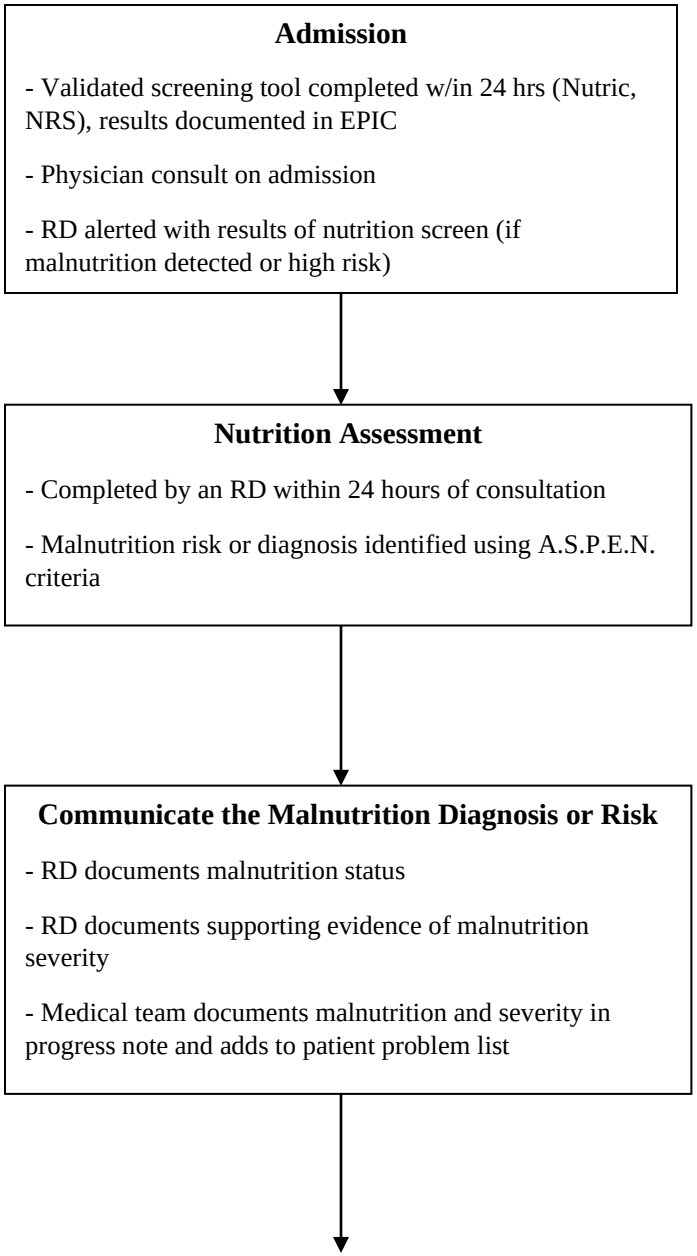
Karenski, Karrie et al. Parenteral Nutrition Basics for the Clinician caring for the Adult Patient

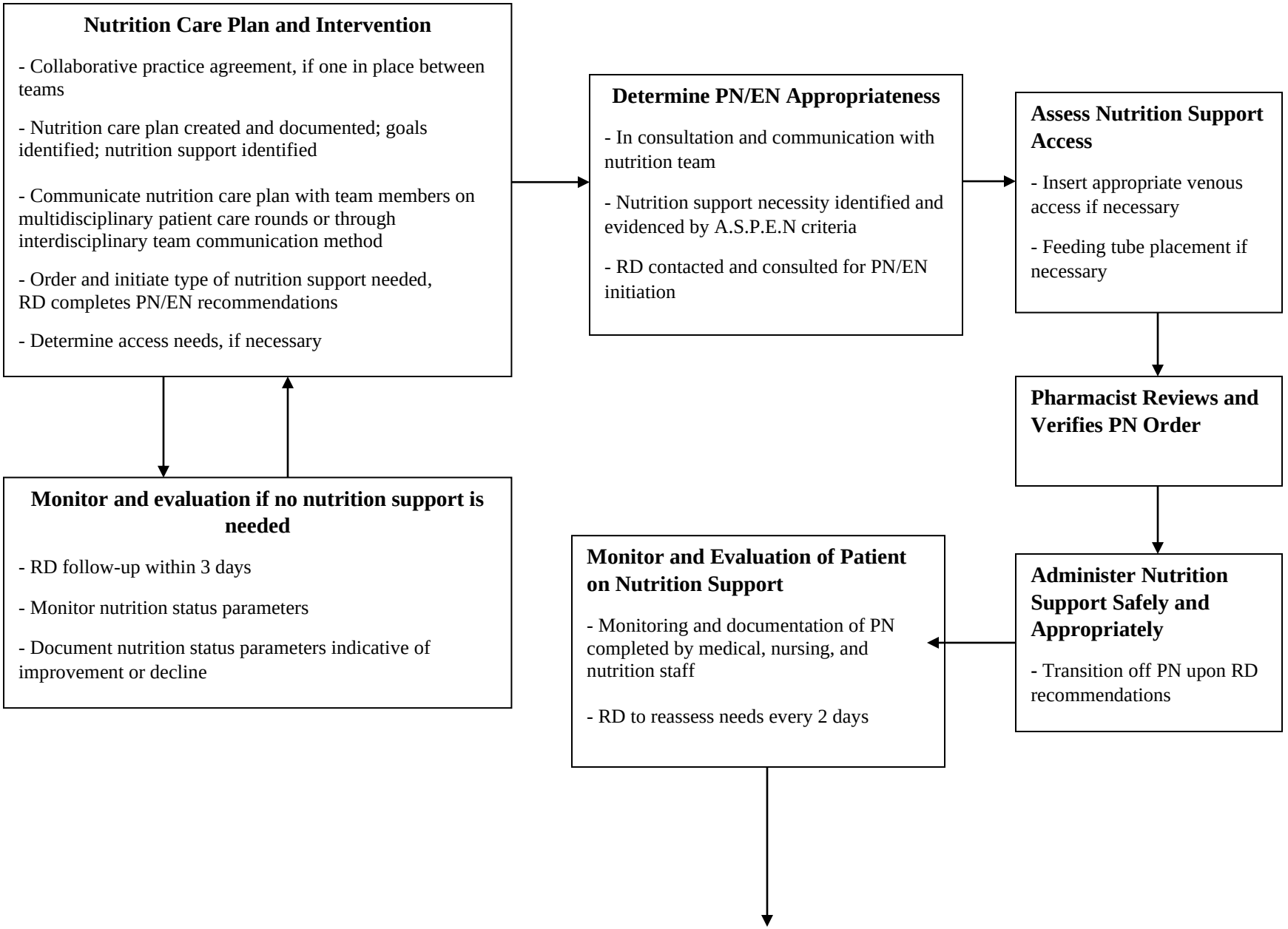
The ASPEN: Adult Nutrition Support Core Curriculum, 2nd edition

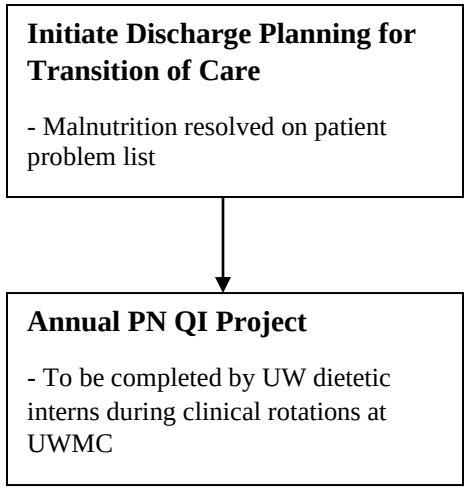
Hematopoietic Stem Cell Transplantation, Nutrition Care Criteria, 3rd edition

Appendix 2

Nutrition Support Protocol


Admission
- Validated screening tool completed w/in 24 hrs (Nutric, NRS), results documented in EPIC
- Physician consult on admission
- RD alerted with results of nutrition screen (if malnutrition detected or high risk)
Nutrition Assessment
- Completed by an RD within 24 hours of consultation
- Malnutrition risk or diagnosis identified using A.S.P.E.N. criteria
Communicate the Malnutrition Diagnosis or Risk
- RD documents malnutrition status
- RD documents supporting evidence of malnutrition severity
- Medical team documents malnutrition and severity in progress note and adds to patient problem list


Nutrition Care Plan and Intervention
- Collaborative practice agreement, if one in place between teams
- Nutrition care plan created and documented; goals identified; nutrition support identified
- Communicate nutrition care plan with team members on multidisciplinary patient care rounds or through interdisciplinary team communication method
- Order and initiate type of nutrition support needed, RD completes PN/EN recommendations
- Determine access needs, if necessary
Determine PN/EN Appropriateness
- In consultation and communication with nutrition team
- Nutrition support necessity identified and evidenced by A.S.P.E.N criteria
- RD contacted and consulted for PN/EN initiation
Assess Nutrition Support Access
- Insert appropriate venous access if necessary
- Feeding tube placement if necessary
Pharmacist Reviews and Verifies PN Order
Administer Nutrition Support Safely and Appropriately
- Transition off PN upon RD recommendations
Monitor and Evaluation of Patient on Nutrition Support
- Monitoring and documentation of PN completed by medical, nursing, and nutrition staff
- RD to reassess needs every 2 days
Monitor and evaluation if no nutrition support is needed
- RD follow-up within 3 days
- Monitor nutrition status parameters
- Document nutrition status parameters indicative of improvement or decline


Initiate Discharge Planning for Transition of Care
- Malnutrition resolved on patient problem list
Annual PN QI Project
- To be completed by UW dietetic interns during clinical rotations at UWMC