Quality of Nutritional Care Assessment among Critically-ill Patients in a Tertiary Government Hospital

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ABSTRACT

Background and Objectives. Malnutrition is prevalent both at baseline admission and because of hospitalization. It is aggravated by adverse hospital practices and results in poor outcomes, reduced quality of life, and higher treatment costs. Improving quality of care involves nutritional intervention as a low-risk, cost-effective strategy which guides providers in improving practices systems-wise. This study aims to assess the quality of nutritional care and the nutritional status of critically- ill patients admitted in a low-resource setting.

Materials and Methods. This is a mixed methods study among adults admitted in intensive care units (ICUs) of a tertiary government hospital. Anthropometric and biochemical indicators were obtained through chart review. The degree of malnutrition was assessed using the Subjective Global Assessment. Quality indicators under Donabedian domains were assessed and compared to current standards. The length of ICU stay and mortality rate were recorded. Dietary prescription and provision practices of healthcare providers were supplemented by a focus group discussion (FGD). Factors causing provision interruptions were also identified.

Results and Discussion. Sixty-four ICU admissions were included. Staff-to-patient ratio was not ideal. Under process-related factors, out of 49% with actual anthropometric documentations (rest were estimates), 24% had normal body mass indices (BMI), 17% were underweight, and the rest were either overweight or obese. The baseline ICU malnutrition rate was 69%. Malnutrition screening, and assessment of risk and biochemical indicators were not done routinely. Majority (92%) had baseline dietary prescription but only 69% had specific energy and macronutrient breakdown, all done through predictive weight-based equations. Nutritional supplies arrived within 8 hours in 65% of patients. Feeding was initiated within 24–28 hours in 94% of patients. Commercial formula was the preferred type of enteral nutrition (EN). Total duration on nothing-by-mouth (NPO) (hours) throughout ICU stay was significant. Supportive measures to improve gastro-intestinal (GI) tolerance were not standardized. Common factors in delaying feeding initiation were hemodynamic instability, fasting for procedures and GI bleeding. Throughout the ICU stay, fasting for procedures, hemodynamic instability and mechanical ventilation (MV)-related factors were common. ICU mortality rate was 19% and average length of ICU stay was 5 days.

Conclusion. Malnutrition is still prevalent in our ICUs and is affected by suboptimal healthcare practices. Staff-to-patient ratios, malnutrition risk screening and assessment, dietary referrals, documentation and minimizing interruptions in nutritional care provision needs improvement. A system review and establishment of a nutrition team is imperative.

Key Words: malnutrition, nutritional assessment, quality of care, critically-ill, nutrition care, ICU process

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INTRODUCTION

Malnutrition is common at baseline in hospitalized patients but is also aggravated by hospitalization and intensive care unit (ICU) admission. It has a global prevalence of 30–50% among hospitalized adults.[1-3] In the Philippines, a study in a tertiary hospital reported a 58% prevalence in 1995 which improved to 21% in 2011.[3] Associated factors are disease severity, age, presence of comorbidities, low socio-economic status and healthcare practices.[1,4] Identified in-hospital factors include decreased intake, increased metabolic requirements and losses, plus catabolic effects of inflammation, trauma, and infection.[5] Aggravating factors are adverse hospital routines leading to insufficient nutrient intake.[1] The largest negative balances were observed during the first week of ICU stay.[6] Malnutrition is well correlated with adverse clinical outcomes, including increased morbidity in acute, chronic and peri-operative disease states as well as increased functional impairment, longer hospital stay, reduced quality of life, and increase in treatment costs.[7-9] Locally, a tertiary hospital reported a tendency toward prolonged hospitalization for at least one week among malnourished patients, regardless of diagnosis and comorbidities.[4]

Despite its high prevalence, malnutrition is seldom recognized, identified, and prioritized by medical teams. Early nutritional risk assessment and medical nutritional therapy is under-prescribed, thus worsening the patient's state.[2] Several healthcare practices contributing to decline in nutrition status have been identified.[1] Its prevalence can be reduced by proper nutritional care. Nutritional therapy resulted in a reduction of length of stay by an average of 2.5 days and treatment costs;[1] thus, nutritional risk assessment should be mandatory for vulnerable populations. Nutritional screening tools (NSTs) should direct clinicians in formulating a nutrition care plan which demonstrate benefits in cost-effectiveness and clinical outcomes.[1,8] Among the NSTs, the Subjective Global Assessment (SGA) is commonly used. It is validated internationally and locally with good sensitivity, specificity, predictive values, diagnostic accuracy and cost-effectiveness.[9–12]

Quality of care (QoC) is measured by quality indicators (QIs). These are measurement tools used as guides to monitor, evaluate, and improve care provision, clinical support services, and organizational functions which affect patient outcomes.[13] Improving the quality and efficiency of hospital care involves examining the challenge of malnutrition and its role in patient recovery. Nutritional intervention is a low-risk, cost-effective strategy to improve QoC.[14] This employs the multidimensional Donabedian model, composed of measures of STRUCTURE (attributes of the service / provider e.g. facilities, staff to patient ratio), PROCESS (the way the system and processes work to deliver desired outcomes), and OUTCOME (impact on patients, economy and end-results).[15] The quality performance of providers can be assessed by measuring adherence to an accepted care process.[16]

Gaps between prescribed caloric/protein requirement and actual intake do exist. A study found that > 40% of food was wasted and the average protein and energy intake was < 80% of the recommended requirements.[17] Another study reported that actual patient intake did not meet 50% of the computed calorie requirement.[18] Under-prescription combined with insufficient delivery of nutrients results in inadequate intake. Inappropriate stopping and delay in restarting enteral feedings cause a large volume of feeding to be wasted. Interruptions due to GI intolerance, displacement or obstruction of the feeding tube, airway management, diagnostic or therapeutic procedures, and routine nursing procedures result in underfeeding.[18,19] Bridging all these gaps should be the goal of a multidisciplinary nutrition team.

Significance of the Study

This study highlights the burden of malnutrition and identify contributory factors or barriers to adequate nutritional care provision. Quality-of-care studies allow assessment of past performances, identify suboptimal practices, and draw conclusions for improvement. These help healthcare professionals, hospital managers and decision-makers to benchmark the level and variation in quality of care to improve patient status and resource allocation efficiency. Systems wise, a standardized process leads to comparable and better outcomes. It can guide healthcare providers to improve current practices and fill the identified gaps with available resources to influence large-impact outcomes such as reduction of hospital stay and treatment costs.

OBJECTIVES

General Objective

1. To assess the quality of nutritional care and nutritional status of critically ill patients admitted in a tertiary government hospital

Specific Objectives

1. To assess the quality of nutritional care rendered to critically ill patients and the factors affecting it through quality-of-care indicators in terms of dietary prescription practices and nutritional support provision
2. To assess the nutritional status of critically ill patients using anthropometric and biochemical indicators

STUDY DESIGN

This study employed mixed methods - a cross-sectional study design for QoC and nutritional status assessment through chart review and a qualitative method through a focus group discussion (FGD) to elicit data not captured in patient charts such as factors affecting dietary prescription practices and interruptions/delays in nutritional care provision.

MATERIALS AND METHODS

Study participants and Study Duration

The study included adult patients aged 19 years old and older admitted in ICUs in the Philippine General Hospital (PGH), specifically in the medical, surgical, neurologic, and neurosurgical ICUs who stayed for at least 24 hours. PGH is a 1500-bed tertiary government hospital which is also designated as the country's National University hospital. The FGD was done with two ICU physicians, three ICU nurses and one dietitian. The study lasted for six months from data collection to analysis.

Sample size estimation

Using the 21% prevalence estimated for malnutrition in critically ill patients at 95% confidence interval and margin of error designated at 0.10, the sample size of this study was set at a minimum of 64 ICU admissions.

Sampling Procedure and Informed Consent Process

Participants for nutritional assessment were recruited among admitted ICU patients through purposive sampling. FGD participants were selected as to ICU exposure. Participants and/or legal representatives were given oral and written information regarding the study and voluntary and informed consent were obtained by the principal investigator. In the absence of capacity or competency to provide informed consent, a legally authorized representative provided consent on behalf of the participant, using the substituted judgment or best interest standard.

Data Collection and Outcome Measures

The patients' demographic and clinical profile (age, sex, admitting service, location, admission category, diagnosis), baseline Acute Physiologic Assessment and Chronic Health Evaluation (APACHE II) score, quick Sequential Organ Failure Assessment (qSOFA) score and Glasgow Coma Scale (GCS) were recorded at baseline ICU admission. The dates of admission and disposition were obtained to generate the length of ICU stay. Anthropometric and biochemical indices upon admission were documented. Anthropometric indices included were weight and height as measured by a standard weighing and height scale, with a calculated body mass index (BMI). If undocumented, these indices were measured. If actual weighing was not feasible, weight extrapolation was done using a weight-estimation formula modified and applied by Alibutod et al. (Personal communication, 2019) on inpatients in PGH, using knee height (KH) measured by a caliper and mid-arm circumference (MAC) using a flexible meter. The formula is as follows:

Male: Weight (kg) = 1.116008 (KH, cm) + 2.739891 (MAC, cm) – 73.66444

Female: Weight (kg) = 1.158898 (KH, cm) + 2.457202 (MAC, cm) – 69.10557

Biochemical indicators available in our laboratory such as proteins (total protein, albumin), electrolytes (magnesium, calcium, phosphorus) and an immune competence marker (total lymphocyte count) were obtained through chart review. The SGA tool was used to determine the degree of malnutrition.

QoC indicators were identified under the structure-process-outcome Donabedian model (Table 1),[15] the American Society for Parenteral and Enteral Nutrition (ASPEN), Critical Nutrition Care and Society of Critical Care Medicine (SCCM) Guidelines[19] and the Academy Nutrition Care and Process Model.[16] Nutritional support provision was assessed in terms of route, preparations and caloric prescription. Time stamps on arrival of nutritional supplies, initiation of feeding and interruptions were documented along with reasons and causative factors for delay. Clinical outcomes such as length of ICU stay, and mortality rate were recorded. A data collection form was used. Other factors not captured from charts were assessed through an FGD of healthcare providers with these discussion points: 1) If baseline nutritional screening and assessment was being done for all ICU patients, 2) Assessment of dietary prescription and caloric computation practices, 3) Identifying processes affecting quality of nutrition care and 4) Identifying factors causing interruptions and gaps in nutritional support provision. The FGD supplemented the observed nutritional care provision practices as these factors may not be apparent in chart reviews alone.

Data Management and Analysis

Data was expressed as frequency and proportion for nominal variables, median and range for ordinal variables, and mean and standard deviation for interval/ratio variables. Results were analyzed under the structure-process-outcome domains (Table 1). Evaluation of QoC indicators was done in terms of percentage of compliance set by the current clinical guidelines as reference.

RESULTS

A total of 64 ICU admissions were included in this study comprising of 63 patients with 1 readmission. The mean age was 54 years, ranging from 22 to 85. Males comprised 64%. Most were from the Medical ICU. The top three primary diagnoses were cardiovascular, respiratory and infectious, though most have mixed and multiple comorbidities. Of the patients scored, median APACHE II scores were 19, estimating risk for mortality at 24% for non-operative patients and 12% for post-operative patients (ranging from 4% to 85%). Patients who were scored with qSOFA all met the criteria for sepsis. Most patients had good sensorium upon admission with a median GCS of 15. The patient profiles and characteristics are summarized in Table 2.

The patients' nutritional profile are shown in Table 3. Only 49% had actual weights and heights documented in the

Table 1. Quality of care assessment using the Donabedian Model

Measured Areas	Quality of Care Indicators
Structure	
1. Personnel	• Staff-to-patient ratio (physicians, nurses, dietitians)
2. Availability of screening and assessment tools	• Number of referrals to dietary service at baseline • Dietary referral response rate
Process	
1. Nutritional Screening, Assessment and Diagnosis	• Malnutrition Screening Rate (Number of patients with baseline nutritional screening) • Malnutrition Assessment Rate (Number of patients with baseline nutritional diagnosis in chart)
2. Dietary prescription practices	• Number of patients with baseline dietary prescription and breakdown
3. Nutritional intervention / nutritional care provision	• Time to arrival of nutritional supplies (include reason for delay) • % of admitted patients unable to maintain volitional intake (with a functional GI tract) who have enteral nutrition (EN) initiated within 24 - 48 hours of admission. • Time to initiation of feeding (include reason for delay) • % of patients receiving EN who have feedings held for GRVs < 500 mL without signs of EN intolerance. • % of patients receiving EN with greater than one hour per day of interrupted enteral feeding. • Number of hours on NPO during ICU stay (include reason for interruption) • % of high risk or severely malnourished patients unable to receive EN who have parenteral nutrition (PN) initiated within 24-48 hours following ICU admission. • Percentage of patients given pro-kinetic agents for GI intolerance
4. Supportive measures	• Percentage of patients placed on continuous/drip feeding to improve GI intolerance • Percentage of patients provided with enteral feeding protocols to promote delivery of EN • Documentation of anthropometrics (height, weight, BMI)
5. Documentation	• Documentation of feeding interruptions
Outcomes	
1. Mortality	• All-cause mortality rate
2. Patient Satisfaction	• Length of ICU stay (days), Home Against Advice (HAMA) Rate

Table 2. Admission profiles and patient characteristics

	Frequency (%); Median (Range)
Age, years [n=63] (Mean ± SD)	53.79 ± 15.66
Sex [n=63]	
Male	40 (63.49)
Female	23 (36.51)
ICU location	
MICU	54 (84.38)
SICU	4 (6.25)
NICU	2 (3.13)
NSSCU	4 (6.25)
Admission category	
Medical	52 (81.25)
Surgical	10 (15.63)
Neurologic	2 (3.13)
Primary diagnosis	
Cardiovascular	35 (54.69)
Respiratory	8 (12.5)
Sepsis / Infectious	8 (12.5)
Neurologic	6 (9.38)
Gastrointestinal	2 (3.13)
Renal	3 (4.69)
Endocrinologic	1 (1.56)
Trauma	1 (1.56)
APACHE II Score [n=17] (Median, Range)	19 (11 to 35)
Admission qSOFA Score [n=8]	2 (1 to 2)
Admission GCS (Median, Range)	15 (3 to 15)

Table 3. Baseline nutritional patient profiles

	Median (Range); Frequency (%)
Anthropometric Indicators	
Weight (actual/ estimated), kg [n=63]	57.7 (25.6 to 83)
Height, m [n=42]	1.6 (1.2 to 1.7)
Knee Height, cm [n=32]	48.5 (30 to 54.5)
Mid-arm Circumference, cm [n=32]	25 (19 to 37)
BMI, kg/m^2 [n=42]	24.6 (13.7 to 39.6)
BMI classification [n=42]	
Underweight	7 (16.7)
Normal	10 (23.8)
Overweight	9 (21.4)
Obese	16 (38.1)
Biochemical Indicators	
Total Protein, g/dL [n=2]	41.6 (7.2 to 76)
Serum Albumin, g/dL [n=55]	33 (16 to 49)
Serum Magnesium, mmol/L [n=56]	0.9 (0.5 to 1.5)
Serum Corrected calcium, mmol/L [n=56]	2.3 (1.9 to 4.3)
Serum Phosphorus, mmol/L [n=35]	1.4 (0.3 to 9.5)
Total lymphocyte count [n=63]	1120 (309 to 5328)
SGA Classification	
A (well-nourished)	19 (30.2)
B (mildly/moderately malnourished)	32 (50.7)
C (severely malnourished)	12 (19.1)

chart. Using the WHO Asia-Pacific classification, 24% had normal BMI. 17% were underweight and the rest were either overweight or obese. Most were slightly hypoalbuminemic but had acceptable electrolyte levels and total lymphocyte counts. Assessment of these indicators at baseline was not routine for all patients. A complete blood count, serum albumin, magnesium and calcium were taken in 86 to 98% but surrogate parameters such as total protein (taken only when serum-to-body fluid gradients are needed) and phosphorus (patients with renal disease, malnourished, difficult to wean off ventilation) were only measured in specific subset of patients. Based on the SGA tool, the ICU malnutrition rate in these patients at baseline was 69%.

The quality of nutritional care indicators in terms of structure and processes vis-a-vis the corresponding recommendations/goals from current clinical guidelines *(in gray)* are shown in Table 4 while outcomes are presented in Table 5.

Structure Indicators

The staff-to-patient ratio was not ideal. No ICU does routine malnutrition screening and assessment but the FGD showed that when referred to the Dietary Service, a modified Nutrition Risk Scoring (NRS) tool is used for screening of these patients but not documented in the chart. The Dietary Service tries to see all ICU patients, whether formally referred or not.

Process Indicators

Majority (92%) had baseline physician dietary prescription orders but only 69% had specific energy and macro-

Table 4. Quality of nutritional care indicators vs. Standard recommendations

	Frequency (%)	Corresponding Standard/ Goal/ Recommendations
Personnel (Staff-to-Patient Ratio)		
Physicians	1:3-4	No standard
Nurses	1:4	1:2 or less
Dietitians	~1:100	No standard
Nutritional Screening, Assessment, and Diagnosis		
Malnutrition screening rate	0	Assess patients on admission for nutrition risk Goal: 100%
Malnutrition assessment rate	0	
Dietary Prescription Practices		
% with baseline dietary prescription	59 (92.19)	Calculate both energy and protein requirements to determine goals of nutrition therapy.
Generic	18 (30.51)	
Specific (TCR and macronutrient targets)	41 (69.49)	
TCR (kcal/day) [n=33]	1500 (700 to 2100)	
Protein (g/kg/day) [n=18]	1 (0.9 to 2)	
% of Referrals to Dietary Service	10 (15.63)	
Time to Assessment by Dietitian [n=10]	All in 24 hours	Within 24-48hrs of Referral
Nutritional Support Provision		
Time to arrival to nutritional supplies (admission), hours		Initiate enteral EN within 24-48hrs following admission to the ICU, and increase goals over the first week of ICU stay;
<4	18 (28.13)	
4-8	24 (37.5)	
8-24	9 (14.06)	
>24	13 (20.31)	—
Time to initiation of feeding from admission, hours		Start parenteral nutrition early when EN is not feasible or sufficient in high-risk or poorly nourished patients.
<8	41 (64.06)	
8-24	10 (15.63)	
24-48	9 (14.06)	
Total of patients initiated within 24-24hrs	60 (93.75)	
>48	4 (6.25)	—
Route of feeding:		In patients determined to be at high nutrition risk or who are severely malnourished and unable to receive EN, exclusive PN should be initiated as soon as possible following ICU admission. Goal: 90%
Oral	26 (40.63)	
Enteral – Nasogastric Tube (NGT)	23 (35.94)	
Parenteral feeding	1 (1.56)	
Both enteral and parenteral (TPN)	2 (3.13)	
Enteral - NGT then Oral	12 (18.75)	
Patients unable eat (but with a functional GI tract) who have EN initiated 24-48 hours of admission [n=38]	34 (89.47)	Nutrition support in the form of early (EN) should be initiated within 24 -48 hours in a patient unable to maintain volitional intake Goal: 90%

Table 4. Quality of nutritional care indicators vs. Standard recommendations *(continued)*

	Frequency (%)	Corresponding Standard/ Goal/ Recommendations
Type of feeding		
Food trays	27 (42.19)	
Blenderized formula	2 (3.13)	
Milk feeding	0	
Commercial formula	24 (37.5)	
Total parenteral nutrition	2 (3.13)	
Mixed (BF + Commercial formula)	5 (7.81)	
D5-containing fluid only	4 (6.25)	
Total number of hours of NPO during ICU stay [n=63]		Inappropriate cessation of EN should be avoided. (% of patients receving EN with >1 hour per day of interruption) Goal: <20%
<8	12 (19.05)	
8-24	28 (44.44)	
24-48	10 (15.87)	
48-72	5 (7.94)	
>72	8 (12.7)	
Median (IQR) in hours:	13.5 (31.5)	
Supportive Measures		
With documented GRVs	3 (4.69)	Do not use GRV as part of routine care to monitor ICU patients receiving EN. In ICUs where GRVs are still utilized, holding EN for GRVs <500 mL in the absence of signs of intolerance should be avoided. Goal: <10%
GRV volume:		
200 ml – Feeding held		
50 ml – Feeding continued		
450 – Feeding held		
Patients given pro-kinetic agents for GI intolerance [n=5]	1 (20)	Take steps to improve tolerance to gastric feeding (use prokinetic agent, continuous infusion, divert level of feeding)
Patients placed on continuous/drip feeding to improve GI intolerance [n=5]	2 (40)	
Patients provided with enteral feeding protocols to promote delivery of EN	0	Implement enteral feeding protocols with institution-specific strategies to promote delivery of EN.
CBG monitoring done	51 (79.69)	Target blood glucose of 140-180 mg/dL for the general ICU population Goal: 90%

Table 5. Patient Outcomes

Patient Outcomes	Frequency (%)
Disposition	
Direct discharge	12 (18.75)
Transferred out to wards	40 (62.5)
Home Against Medical Advice	0
ICU Mortality Rate	12 (18.75)
Cause of death [n=12]	
Cardiogenic shock	3 (25)
Septic shock	8 (66.67)
Disseminated intravascular coagulation	1 (8.33)
Length of ICU stay, days (Median, Range)	5 (1 to 37)

nutrient breakdowns. The average total caloric requirement (TCRs) was at 1500 kcal/day; some were hypocaloric, with 1g/kg/day of protein prescription. All were done through predictive equations. Only 15% of patients were referred to the Dietary Service, and all seen within the target time frame of 24 hours. Once ordered, nutritional supplies arrived within 8 hours in 65% of patients. Delays were identified during procurement of supplies from the pharmacy and that the Dietary Service have cut-offs in food trays and blenderized feeding formulations at 4 PM daily. Feeding was initiated within 24–48 hours in 94% of patients and in 89% of those unable to maintain volitional intake (well within the recommended goal of 90%). Around 40% of patients were fed orally, followed by enteral feeding by nasogastric tube (NGT) while only 4% were started on total parenteral nutrition (TPN) when unable to tolerate enteral nutrition (EN). Only 6% of the patients did not receive any nutritional support all throughout and were maintained on D5-fluid only. For those on EN, majority were given commercial formula and 18% of patients were able to transition from NGT to oral feeding (mostly after weaning off mechanical ventilation). Throughout the ICU stay, the total number of hours on NPO (median of 13.5 hours, IQR 31.5) due to various factors was still significant. This adversely exceeded the goal that NPO hours must be < 20% of total ICU stay. The factors causing feeding interruptions are identified

in Table 4. On supportive measures, only about 5% have documented gastric residuals and holding feeding for specific volumes are not standardized. One was held at a GRV of 450 ml, another at 200 ml and continued at 50 ml. The lack of standard practice was echoed in the FGD. Only a few patients were documented to have been given measures to improve GI tolerance. Among patients included, no feeding protocol was documented. Capillary blood glucose (CBG) monitoring was done in 80% of patients but reaching actual CBG targets was difficult to assess since individual measurements are variable and will require a time-in-range analysis.

Outcome Indicators

Majority (62%) were transferred out to the wards while almost 20% were directly discharged, most of which were admitted for post-procedural monitoring. The ICU mortality rate was 19%, mostly from septic shock. The average length of ICU stay was 5 days, ranging from 1 to 37 days.

The reasons for interruptions in provision of nutritional therapy are summarized in Table 6. During admission, patients were placed on NPO or had a delay in initiation of feeding mostly because of shock and hemodynamic instability (38%), fasting or withholding feeding for procedures, both pre- and post- (27%) and GI bleeding (15%). Throughout the course of ICU stay, the most common reasons for feeding interruptions were fasting for procedures (40%), shock or hemodynamic instability (22%) and MV-related factors such as intubation or extubation (13%).

Table 6. Factors causing interruptions in feeding

	Frequency (%)
Patients placed on NPO during admission due to the following factors (n=26 patients)	
Shock or hemodynamic instability	10 (38.5)
Fasting for Procedures	7 (26.9)
Gastro-intestinal Bleeding	4 (15.4)
Hyperglycemia	3 (11.5)
Mechanical Ventilation-related	1 (3.8)
Gastro-intestinal Intolerance	1 (3.8)
Feeding Tube Problems	0
Decreased sensorium	0
Factors Causing Interruptions in Feeding throughout the ICU stay (n=67 events)	
Fasting for Procedures	27 (40.3)
Shock or hemodynamic instability	15 (22.4)
Mechanical Ventilation-related	9 (13.4)
GI Bleeding	6 (8.9)
GI Intolerance	4 (5.9)
Hyperglycemia	4 (5.9)
Status Epilepticus	1 (1.5)
Lapse on Healthcare Provider	1 (1.5)
Feeding Tube Problems	0
Decreased sensorium	0

ASPEN Recommendation: Inappropriate cessation of EN should be avoided

DISCUSSION

Burden of Malnutrition

Malnutrition in the ICU is an issue that a healthcare system should address to significantly and positively impact on patient outcomes and economics. It is well-correlated with adverse clinical outcomes, including increased morbidity and mortality, functional impairment, longer hospital stay and reduced quality of life and economically, increased resource requirements and treatment costs.[1] Studies have shown that it results from an interplay of patient factors and healthcare practices. From baseline ICU malnutrition rate was 69%. This is higher than the global prevalence estimated at 30–50%[2] but comparable with local prevalence reported by Dominguez et al.[4] (73%) in a public tertiary ICU while that of Manuales et al.[3] from a private tertiary ICU reported a 58% malnutrition prevalence in 1995 which improved to 21% in 2011.

Quality of Nutritional Care Assessment

Structure

As to personnel, nursing staff-to-patient ratio was not ideal although there is no current standard on ICU physician- and dietitian-to-patient ratio in present practice.

Process

Malnutrition screening and risk assessment is not routine in our ICUs. Studies show that patients at high nutrition risk are more likely to benefit from early EN with improved outcomes.

As to anthropometric indices, only 49% had actual weight and height measurements in the chart. The rest were either physician- or patient-estimated, for which the modified KH-MAC formula was employed, as physicians were found to overestimate body weight by at least 10% in that study. This problem stems from unavailability of a bed weighing scale which is the standard in most centers since most ICU patients are intubated, hemodynamically unstable or have decreased sensorium. In terms of biochemical indicators, 86% to 98% of patients had at least one visceral protein marker (total protein, albumin), electrolytes involved in muscle metabolism (Mg, Ca and P) or immune competence marker (TLC) documented but these were not compared from admission to discharge in this study. In other studies, these markers are associated with mortality, morbidity, incidence of infection and can reflect metabolic stress in most patients though they may not be sensitive to indicate the effectiveness of nutrition therapy.[1] Sungurtekin et al.[9] reported a significant correlation between albumin levels and SGA classification while Hejazi et al.[20] reported that a significant decrease in serum magnesium was documented among ICU patients and is a predictor of disease severity and mortality. Locally, Bernardino et al.[21] reported that the SGA and NRS scores correlate significantly with mortality and length of hospital stay.

The dietary prescriptions are at par and in compliance to recommendations though all utilized predictive weight-based equations in lieu of the gold standard, indirect calorimetry. More than 200 predictive equations have been published, with accuracy rates ranging from 40%–75% when compared with calorimetry but no single equation emerges as being more accurate in an ICU.[19] They are also less accurate in obese and underweight patients.[19]

Most patients unable to eat per orem (89%) are initiated EN within 24-48 hours of admission in our ICUs, at par with the goal of 90%. This is done to maintain gut integrity, modulate stress and the systemic immune response, and attenuate disease severity.[19] This good performance can be attributed to improved availability and ease of use of commercial formulas. But medical residents expressed discomfort in using parenteral feeding when indicated as these are usually done by surgical services and only fixed TPN packs are available in the institution, limiting flexibility in caloric computations. As to supportive measures, few patients had documented GRVs and withholding of feeding has not been standardized in our ICUs. ASPEN recommends not using it as part of routine care. Decreasing the cutoff value does not protect the patient from complications of aspiration and it leads to inappropriate cessation of EN, consumption of nursing time and reduced volume of EN delivered.[19] Though no feeding protocol was documented, the Surgical ICU has an existing Enhanced Recovery After Surgery Protocol that ensures early feeding for post-operative patients. Studies have shown that the use of ICU or nurse-driven protocols have been successful in increasing the overall percentage of goal energy provided.[19]

Malnutrition can be further aggravated by adverse hospital routines that lead to insufficient nutrient intake.[22] Several studies suggest that hospitalized patients often receive less than an optimal level of nutritional care due to lack of training and awareness of hospital staff.[6] Early nutritional risk assessment and medical nutrition therapy is underprescribed, thus worsening the patient's state.[2] A number of practices that contributed to the decline in nutritional status of patients include diffusion of responsibility for patient care, prolonged use of saline or glucose parenteral nutrition, poor observation and documentation of patients' dietary intake, failure to recognize malnutrition, and failure to provide nutrition support.[1] In this study, the most common factors causing interruptions of feeding both during admission and throughout the course (shock and hemodynamic instability, pre- and post-procedural, GI bleeding and MV-related) are also consistent with other studies. Literature shows that inappropriate stopping and delay in restarting enteral feedings wastes a large volume of enteral formula. Interruptions due to gastrointestinal intolerance of enteral feedings, displacement or obstruction of the feeding tube, airway management, diagnostic or therapeutic procedures, and routine nursing procedures result in marked underfeeding in ICU patients.[18,23] Surmised from the chart review and the FGD, it is important to note that the number of hours of placing these patients on NPO are not standardized, some are physician-dependent, and are confounded by other healthcare system factors such as surgical or procedure slots. These are the areas that providers should investigate to minimize interruptions and standardize NPO times.

Outcomes

ICU mortality rate of 19% is comparable but slightly lower than 28% reported by Manuales et al.[3] in a local tertiary hospital. Average length of ICU stay of 5 days is also consistent with the duration of 5.1 ± 4.9 days reported by Dominguez et al.[4] in a local tertiary ICU among severely malnourished patients.

This study is limited as it included only critically ill patients admitted in the four ICUs but equal sampling distribution was not done. The pool was heterogenous in terms of diagnosis and disease severity. Only anthropometric and biochemical indices that are measurable with present hospital resources were included. Amongst the many existing in literature, only quality-of-care indicators that are measurable by available methods and resources were included. Dietary prescription practices were assessed but actual caloric and protein intake analysis was out of the scope of this study. The ICU's performance cannot be graded subjectively as to 'good' or 'bad' as we currently do not have standards for grading. The study was not powered to generate a direct statistical correlation between quality-of-care indicators and patient outcomes.

Implications to Clinical Practice

Based on our institution's performance on the quality-of-care indicators considered, it is recommended that our ICUs go through the evaluations presented to identify each unit's strengths and areas for improvement in line with current standards and recommendations (Table 4). Nutritional risk screening, assessment and proper documentation should be universal using appropriate and validated tools and diagnostics. Constant monitoring of timeliness, appropriateness, accuracy and adequacy of nutritional care provision should be part of routine quality of care evaluations, planning and policymaking. A multidisciplinary nutrition team (composed of a physician, nutritionist-dietitian, nurse, and pharmacist in coordination with specialties such as Endocrinology, Gastroenterology and Medical Nutrition, if available) with adequate staff-to-patient ratio should be established to integrate nutritional care in patient management. This quality-of-care study can be further expanded to include non-critically ill patients in the wards and its domains and component indicators can be used as a model of performance evaluation in similar low-resource settings and institutions.

CONCLUSION

Malnutrition in the ICU is still highly prevalent and result from an interplay of various factors. Nutrition care

processes are not at par with standards, which may affect outcomes. Based on performance indicators, our ICUs still needs improvement in terms of staff-to-patient ratios, malnutrition risk screening and assessment, timely and accurate nutritional care provision, documentation and minimizing interruptions in feeding. A system evaluation of these processes in each ICU and a creation of a clinical nutrition team is recommended.

Ethical Considerations

The study was conducted in accordance with the National Ethical Guidelines for Health Research, Declaration of Helsinki regarding biomedical research and the Data Privacy Act of 2012. Prior to commencement, the protocol was approved by the institutional technical board and ethics review board.

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Statement of Authorship

All authors participated in the data collection and analysis and approved the final version submitted.

Author Disclosure

All authors declared no conflicts of interest.

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