IJFANS

International Journal of Food And Nutritional Sciences

Volume 2, Issue 3, Jul-Sep-2013, www.ijfans.com e-ISSN: 2320-7876

Official Journal of IIFANS

INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

e-ISSN 2320 –7876 *www.ijfans.com*
Vol.2, Iss.3, Jul-Sep 2013

Research Paper *Open Access*

ADEQUACY OF NUTRITIONAL SUPPORT TO CRITICALLY ILL PATIENTS REQUIRING VENTILATOR SUPPORT IN INTENSIVE CARE UNIT AND ITS CORRELATION WITH OUTCOMES

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ABSTRACT

Nutritional support of critically ill patients is often suboptimal, due to problems with both nutrient prescription and delivery. The objective of the study is to assess the adequacy of nutritional support in terms of nutrient intake, nutritional status, severity of illness, change in biochemical parameters, and length of hospitalization, ventilation support days and mortality. 35 patients admitted in the ICU were selected and followed till discharge. Majority (71%) were males. Majority (15%) diagnosed with pulmonary disease. Initial SGA assessment showed 54% of the subjects in mild-moderately undernourished category and 46% in well nourished category. The mean requirements were 1715±220.04kcals of energy, 63.97±9.8gm of protein and 235.81±30.25gm of carbohydrate. The mean ventilation support days were 7.43. There was a significant ($p<0.01$) improvement in MAC and MAMC values of male and TLC in both gender. Finally 60% of the subjects were found to be well nourished. There was a significant ($p<0.01$) difference between initial and final values of APACHE score in all subjects which shows a reduction in the risk of mortality. The current study reinforces the importance of calorie and protein delivery to critically ill patients who are on ventilator support. Inadequate calorie and protein delivery is associated with higher odds of mortality.

Keywords: Critically ill, Intensive care Unit, Respiratory failure, Nutritional support, Nutritional status.

INTRODUCTION

Critical illness, like any other form of stress, can affect all components of nutritional homeostasis, namely requirement, intake, and losses. The importance of providing appropriately timed and quantified nutritional support during this period cannot, therefore, be overemphasized (Lafrance JP *et al*, 2005). Nutritional support of critically ill patients is often suboptimal, due to problems with both nutrient prescription and delivery (Adam S, *et al*, 1997). This scenario is more common in the developing countries, where healthcare resources are constrained and the busy intensive care units (ICUs) are generally understaffed. Although critical care is fast evolving in India, there are limited data on nutritional support of critically ill patients, while several aspects of critical illness nutrition are apparently different from those practiced in the Western countries (Navneet Singh *et al*, 2009).

Nutrition support of the patient with ventilator failure is an important adjunct to recovery. Malnutrition and respiratory failure are frequently interrelated. Ventilator dependence occurs when the patient cannot independently sustain oxygenation, carbon dioxide removal, or acid-base balance. Nutrition assessment, determination of energy requirements, and provision of nutrient solutions utilizing the most appropriate route of administration should be initiated early in the ventilator dependent patient's hospital course. Careful assessment will identify patients needing repletion along with maintenance calories, as well as special macronutrient and micronutrient needs. The nutrient prescription is designed to provide carbohydrate, protein, and fat in amounts for optimal substrate utilization. Body fluid balance, micronutrient needs, electrolyte homeostasis, and acid-base balance affect respiratory muscle function and must also be considered in developing the nutrition regimen. Properly constructed enteral or parenteral nutrition plans begun early offer the best support for ventilator-dependent patients (Borman KR *et al.*, 2009).

In the ICU setting, an unintentional weight loss from illness that is greater than or equal to 10% of the usual body weight is considered as a marker for moderate to severe malnutrition. This is a very practical way of identifying those patients whose malnutrition is severe enough to require aggressive nutritional support and is, surprisingly, accurate when compared to more sophisticated methods of body composition analysis (Gariballa S, Forster S, 2006).

Overfeeding can result in increase in carbon dioxide production. To remove the gas from the patient's blood, ICU physicians would need to raise the ventilation rate for the patient on the mechanical ventilator, a task that may be quite difficult if the patient has emphysema or is already, for some other reason, on a high ventilation protocol. Therefore, as a consequence of this concern, avoiding overfeeding carbohydrate calories is important since carbohydrates potentially produce the most CO^2 (Shearer A *et al*., 2009).

Thus the current study "Assessment of Nutritional Support to Critically Ill Patients on Ventilator Support and its correlation

with outcomes in Intensive Care Unit" was carried out with an objective to assess the adequacy of nutritional support in terms of nutrient intake, nutritional status, severity of illness, change in biochemical parameters, length of hospitalization, ventilation support days, gastrointestinal complications and mortality to patients requiring mechanical ventilation in the Intensive Care Unit and correlate with outcomes.

MATERIALS AND METHODS

All adults between the age group of 19 to 60 years who were admitted in the respiratory intensive care unit during the period of January 2012 to March 2012 were included in the study. The inclusion criteria for the present study were patients who are on ventilator support ≥24 hrs, ICU stay of ≥7 days, patients on Enteral and Parenteral nutrition support. Informed consent was obtained from each patient participating in the study.

Baseline information's like demographic characteristics (Age, Gender, Diagnosis, Past Medical History), Anthropometry including Height (Ht), Ideal Body Weight (IBW), Mid Arm Circumference (MAC), Triceps Skin Fold thickness (TSF), Mid Arm muscle Circumference (MAMC) , Biochemical values (Albumin, Total Lymphocyte Count), nutritional status using Subjective Global Assessment (SGA) and severity of illness by APACHE score were collected.

PLANNING THE NUTRITIONAL REQUIREMENTS

The nutritional requirements were determined based on the Nutrition (A.S.P.E.N.) Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Guidelines, 2009. Energy was provided at the rate of 25-30 kcal/kg/day which is likely to be adequate for the patients who are severely malnourished or critically ill patients. Protein was given at the rate of 1.2-2.0 g/kg/d which appears to be the most important macronutrient for healing wounds, supporting immune function, and maintaining lean body mass. Providing carbohydrate in amounts that exceed 50 – 55% can increase the respiratory quotient beyond 1 and significantly increase work of breathing in severely stressed patients and patients on ventilator support (Ireton-Jones CS, Jones JD, 1998) and thus 50 – 55% of the total kilocalories was provided for the patients in this study.

NUTRITIONAL SUPPORT

All the subjects received enteral nutrition support administered according to the ASPEN guidelines. The enteral nutrition was initiated within the first 24- 48 hours following admission and was advanced toward goal over the next 48-72 hours. The initiation was done at the rate of 30cc/hour and gradually advanced to 60, 90,100 and 120 cc until the estimated goals are achieved. The tolerance of the feeds was checked by measuring the gastric residuals every 6 hours. The feed tolerance was considered good if the gastric residual was less than 150ml. The days of attainment of the goals (50% 75%, 100%) were recorded on daily basis. The formulas used were both commercial and home based formulas. A recent meta-analysis noted that initiating feeding within 24 - 48 hours of ICU admission and achieving at least 60-70% of (14-18 kcal/kg) of the patient's overall caloric needs during the first week of ICU admit is associated with shortened length of stay, ventilator time and reduced number of infectious complications. (Kattelmann KK et al, 2006)

OUTCOME MEASURES

Anthropometry (MAC, TSF,MAMC), Biochemical values (Albumin, TLC), Length of ICU stay, Hospital stay, Ventilation support days Overall Mortality (Daily Basis),Final SGA and APACHE SCORE were assessed as the outcome measures

STATISTICAL ANALYSIS

The characteristic data were expressed using percentage, mean and standard deviation. Pearson's correlation was done for the comparison between the initial and the final parameters

RESULTS AND DISCUSSION

A total of 30 subjects were included in the study comprising both male (71%) and female (29%) subjects. Thirty one percentage of the subjects were falling under age group greater than 60yrs, 23% between 41 – 50 yrs, 20% between 21 – 30 yrs, 14% between 51 – 60 yrs and 11% between 31 – 40 yrs. Forty three percentage of the subjects were diagnosed with pulmonary diseases, 26% renal diseases, 17% cardiovascular diseases, nine percent neurological disorders and six percent with orthopedic conditions, hepatic disorders and other conditions such as tablet overdose and systemic lupus erythematosus. Forty percent of the patients were known case of diabetes mellitus and 29% hypertensive. The characteristic profile of the subjects is shown in table I.

Table I - Baseline Characteristic profile of the Patients (N=35)

Male (n)	25
Female (n)	10
Mean Age (mean ± SD) years	51±21
Anthropometry	
Height (cm) (mean ± SD)	161.96±05.34
Mid arm circumference (cm) (mean ± SD)	22.88±01.0
Triceps skin fold thickness (mm) (mean ± SD)	14.88±02.50
Mid arm muscle circumference (mm) (mean ± SD)	182.08±14.5
Albumin (g/dl) (mean ± SD)	2.710±0.69
Total lymphocyte count (mm^3) (mean ± SD)	1985.39±1670.21
SGA	
Well nourished (n)	16

Mild – Moderately Malnourished (n)	19
APACHE score (mean ± SD)	17.71±5.199 (25% mortality rate)
Diagnosis	
Pulmonary disease (n)	15
Renal disease (n)	9
Cardiovascular disease (n)	6
Neurological disease (n)	3
Orthopedics (n)	2
Hepatic disorders (n)	2
Others (n)	2
Nutrient requirement	
Energy (Kcal/day) (mean ± SD)	1715.00±220.04
Protein (g/day) (mean ± SD)	63.97±9.8
Carbohydrates (g/day) (mean ± SD)	235.81±30.25
Hospital Stay	
Overall	13.37
Respiratory ICU	10.37
Ventilator support days	7.43

The mean nutrient requirements were estimated based on the ASPEN guidelines and the mean values of energy, protein and carbohydrate were 1715±220.04 (kcals/day), 63.97±9.8 (g/day) and 235.81±30.25 (g/day) respectively. Initiation of nutritional support was done in 1.8±0.63 days and the 100% requirement of the nutrients was achieved in five days as shown in table II. The nutritional support was initiated within 24 – 48 hours. The feedings were advanced toward goal over the next 48-72 hours. The subjects stayed in the ICU at an average of 10.37 days with a minimum of seven days and maximum of 23 days. The average stay of patients in hospital was 13.37 days with a maximum of 24 days and a minimum of 8 days. The mean number of ventilation support days was 7.43 days with a maximum of 21 days and a minimum of two days. A similar observation was found in a study conducted by E.Y.Tang et al, 2003 wherein the mean ICU length of stay was 6.5 days. Mean hospital length of stay was 13.9 days and the mean number of ventilation support days was 5.3 days.

Table II - Nutritional support of the Patients (N=35)

Nutritional support	Days (Mean±SD)		
	Energy(kcal)	Protein(gm)	CHO (gm)
Initiation	1.8±0.63		
25%	1.14±0.64	0.97±0.61	0.94±0.63
50%	1.91± 1.17	1.68±1.23	1.57±1.21
75%	3.28± 1.60	2.37±1.80	2.51±1.83
100%	5.8± 2.28	5.2±2.48	5.28±2.49

Table III shows the comparison of initial and final Anthropometry, Biochemical, nutrient intake, SGA and apache scores were done. Subjective Global Assessment score indicates that initially 46% of the subjects were well nourished and finally 60% of the subjects found to be well nourished similarly 54% of the subjects were under mild-moderately malnourished category and finally 40% of the subjects were falling under this category. There was a significant ($p<0.01$) improvement in the visceral muscle and fat stores among the male subjects of the study population, whereas the female subjects had no significant improvement. No significant improvement was observed between initial and final values of albumin levels and total lymphocyte count. Significant ($p<0.01$) improvement between initial and final values of energy, protein and carbohydrate intake was seen among subjects. The mortality rate also improved significantly ($p<0.01$) from 17.71±5.199 (25% mortality rate) to 14.26±2.501 (15% mortality rate) APACHE score. These finding proves that adequate nutritional support at right time not only reduces the length of hospital stay, ventilator support days but also improves the overall nutritional status of the patients from mild-moderately malnourished status to well nourished status. Proper nutrition also has proven to reduce the mortality risk of the patients in the present study.

Table III - Comparison of Initial and final Anthropometry, Biochemical, nutrient intake, SGA and apache scores of the patients

Category	Initial	Final	"t" Value
MAC (cm) (mean ± SD)			
Male	22.88 ±1.0	22.56±1.08	2.874**
Female	23.70±2.1	23.80±2.15	0.557^{NS}
TSF (mm) (mean ± SD)			
Male	14.88±2.50	14.96±2.20	0.527^{NS}
Female	16.40±1.64	16.50±1.26	0.429^{NS}
MAMC (mm) (mean ± SD)			
Male	182.08±14.5	178.63±13.88	2.813**
Female	189.50±16.9	193.30±17.35	0.857^{NS}
Biochemical Parameter (mean ± SD)			
Albumin(gm)	2.71±0.69	2.50±0.63	1.556^{NS}
TLC (mm^3)	1985.39±1670.21	2148.47±1919.47	0.488^{NS}
Nutrient Intake (mean ± SD)			
Energy (kcal)	598.66±168.753	1727.09±217.738	28.954**
Protein (gm)	19.98±5.67	64.54±8.87	25.845**
Carbohydrate (gm)	88.71±33.226	237±28.064	21.412**
APACHE (mean ± SD)			
SCORE	17.71±5.199	14.26±2.501	5.773**
SGA n (%)			
Well nourished	16 (46)	21 (60)	2.478**
Mild – moderately malnourished	19 (54)	14 (40)	2.053**

** $p<0.01$, NS-Not significant

CONCLUSION

The findings of the current study reinforces that adequate nutritional support at the right time is essential for minimising the number of days on ventilator support, severity

of the disease condition, the length of stay in Intensive care unit and the nutritional status among the patients. Inadequate nutritional support is associated with higher odds of mortality.

REFERENCES

- Lafrance JP, Leblanc M. Metabolic, electrolytes, and nutritional concerns in critical illness. Crit Care Clin 2005; 21(2):305-327.
- Adam S, Batson S. A study of problems associated with the delivery of enteral feed in critically ill patients in five ICUs in the U.K. Intensive Care Med 1997;23(3):261-266.
- Navneet Singh MD DM, Dheeraj Gupta MD DM, Ashutosh N Aggarwal MD DM,Ritesh Agarwal MD DM, and Surinder K Jindal MD, An Assessment of Nutritional Support to Critically Ill Patients and Its Correlation With outcomes in a Respiratory Intensive Care Unit, Respiratory Care, December 2009 Vol 54 No12.
- Borman Gariballa S, Forster S. Effects of acute-phase response on nutritional status and clinical outcome of hospitalized patients. Nutrition. 2006 Jul–Aug;22(7–8):750–7.
- Shearer A, Boehmer M, Closs M, et al. Comparison of glucose point-of-care values with laboratory values in critically ill patients Am J Crit Care. 2009 May; 18(3):224–30.
- ASPEN Board of Directors and the Clinical Guidelines Task Force. Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients [published correction appears in *JPEN J Parenter Enteral Nutr*. 2002; 26:144]. *JPEN J Parenter Enteral Nutr*. 2002; 26(1 suppl):1SA–138SA.
- Ireton Jones CS, Jones JD. Is there an accurate equation for predicting energy expenditure? Nutr Clin Pract. 1998; 13: 141-143.
- EYTang,LF Hsu,KN Sin Fai Lam, WS Pang, Critically ill elderly who require mechanical ventilation: the effects of age on survival outcomes and recourses utilisation in medical care unit of a general hospital, annual academy of medicine, Singapore 200332:691-6.
- Kettlemann KK, Hise M, Russell M, Preliminary evidence for a medical nutrition therapy protocol: enteral feedings for critically ill patients, journal of American dietetic association, 2006, Aug 106:8 1226:41.