ECRONICON OPEN ACCESS

EC NUTRITION
Research Article

The Relation of Mini Nutritional Screening Score, Subjective Global Assessment of Nutrition, and Pneumonia Severity Index in Elderly Patients Diagnosed with Community Acquired Pneumonia Admitted at Cardinal Santos Medical Center: An Observational, Analytical, Cross Sectional Study

Marco Angelo D Tongo* and Rosa Allyn Sy

Department of Internal Medicine, Academic Wing, Cardinal Santos Medical Center, #10 Wilson Street, San Juan City, Metro Manila, 1502 Philippines

***Corresponding Author**: Marco Angelo D Tongo, Department of Internal Medicine, Academic Wing, Cardinal Santos Medical Center, #10 Wilson Street, San Juan City, Metro Manila, 1502 Philippines.

Received: July 25, 2016; **Published:** August 01 , 2016

Abstract

Introduction

Community Acquired Pneumonia is among the leading causes of morbidity and mortality among the Filipino elderly community. The Pneumonia Severity Index was developed to determine a patient's probability of mortality and morbidity. Nutrition, on the other hand, is one of the most neglected yet significant aspects in the initial evaluation of elderly patients with community acquired pneumonia, despite the availability of nutrition assessment tools such as the Subjective Global Assessment of Nutrition and Mini Nutritional Screening Score. This study, hence, aims to determine the relation of the subjective global assessment of nutrition status and mini nutritional screening score with the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

Methods

This is an observational, analytical, cross-sectional study whose target population are the elderly patients of Cardinal Santos Medical Center diagnosed with Community Acquired Pneumonia. The study was conducted among elderly patients, aged 60 years and above, diagnosed with Community Acquired Pneumonia, admitted in Cardinal Santos Medical Center during the period of August to September 2015. Upon admission, the Pneumonia Severity Index, Mini Nutritional Screening Score and Subjective Global Assessment Grade is determined. Data collected were then subsequently run in Open Epi ver. 3.03a for statistical analysis. Means, frequency distribution, and odds ratio were done for statistical analysis.

Results

A total of 106 patients were included in the study. Using the subjective Global Assessment, patients classified as being moderately to severely malnourished have 19 times greater odds to develop intermediate risk pneumonia ($p < 0.05$) and 64 times greater odds to develop high risk pneumonia ($p < 0.05$). Patients, who were stratified as being at risk for malnutrition and being malnourished using the Mini Nutritional Screening Score has 10 times greater odds of developing intermediate risk pneumonia ($p < 0.05$) and 100 times greater odds of developing high risk pneumonia ($p < 0.05$). Patients classified as being underweight using Body Mass Index, however, did not correlate significantly with determining the odds of developing intermediate or high risk pneumonia ($p > 0.05$). Although calf circumference of < 31 cm did not significantly determine the odds of developing intermediate risk pneumonia, there was evidence that this increased the odds of developing high risk pneumonia by 10 times.

Conclusion

Elderly patients, of at least 60 years of age, diagnosed with Community Acquired Pneumonia, have a higher risk for malnutrition as the disease becomes more severe. Nutrition assessment tools, including the Subjective Global Assessment of Nutrition and the

Mini Nutrition Screening Scores can be used in determining clinical outcome of elderly patients. The use of body mass index, may aid in predicting morbidity and mortality if correlated with other components of nutrition assessment tools. However, body mass index alone, did not yield a statistically significant relation to pneumonia severity. Calf circumference, on the other hand, was able to yield statistically significant odds in determining high risk pneumonia.

Keywords: *Global Assessment; Nutritional Screening; Community Acquired Pneumonia; Nutrition; Morbidity*

Introduction

Community Acquired Pneumonia is among the leading causes of morbidity and mortality among the Filipino community. According to the 2010 guidelines for Community Acquired Pneumonia by the Philippine Society for Microbiology and Infectious Diseases and the Philippine College of Chest Physicians, it is the third leading cause of morbidity and mortality in Filipinos based on the Philippine Health Statistics. Among the elderly population, pneumonia remains to be the leading infectious cause of mortality. Identified risk factors for pneumonia include advanced age and poor nutrition status. In the evaluation of patients with the disease, the Pneumonia Severity Index is a scoring system developed to calculate the probability of mortality and morbidity of a patient with pneumonia. The Pneumonia Severity Index stratifies patients in 5 risk classifications with Class I - II as low risk, Class III as intermediate risk, and Class IV - V as high risk pneumonia. In 1999, Flanders et al. conducted a validation study on the Pneumonia Severity Index which showed that this tool has good discriminatory ability and has identified that a higher Pneumonia Severity Index score predicted higher 10 years' mortality rate. In 2010, Shah et al. further stated that the Pneumonia Severity Index was more sensitive in predicting ICU admissions for pneumonia as compared to CURB 65.

Nutrition, on the other hand, is a significant determinant of the health status of an elderly individual. However, despite its clinical significance, nutrition assessment has been understated in most clinical settings. Nutrition evaluation has been one of the most commonly overlooked aspects in the initial assessment of in-patient care, most especially that of the elderly. The Mini Nutrition Assessment Tool has been developed to accomplish rapid assessment of the nutritional status of the elderly individual. In 1999, [1] identified this as a single, rapid assessment of nutritional status in elderly patients in outpatient clinics, hospitals, and nursing homes. The scoring was noted to identify malnutrition in the elderly population with a sensitivity of 96% and specificity of 98%. Using this tool, the mini nutritional screening score is calculated and the elderly patient is stratified as being of normal nutritional status, at risk for malnutrition, or malnourished. Despite being available for perusal, however, this screening tool has not been utilized commonly in clinical practice.

Cardinal Santos Medical Center has recently recognized the significance of nutrition in patient evaluation. Implementation of nutritional evaluation has been done with the use of the Subjective Global Assessment of Nutrition, which is currently being administered in all patients. Even as early as [2] was able to demonstrate that the use of Subjective Global Assessment of Nutrition had a high inter observer agreement and was recognized as being reproducible, and easily taught to a variety of health practitioners to include medical residents, and nurses. This assessment tool considers weight loss, dietary intake, functional capacity, stress level of the disease in relation to nutritional requirements, and physical examination findings to include loss of subcutaneous fat, muscle wasting, edema, and ascites in nutritional status assessment. Based on the evaluation of each of these entities, the patient is classified as being well nourished, moderately malnourished, or severely malnourished.

Malnutrition has been one of the most common yet unrecognized medical problem in the elderly. According to [3], malnutrition has been increasingly recognized as a morbid condition involved in development of heart disease, pulmonary conditions and cancer. In the study of [4], malnutrition has also been recognized to decrease quality of life, increase fatality rate, and decrease survival rate among elderly patients with pulmonary pathology. Hence, early detection of a malnourished state is recognized as vital in the medical management of elderly patients.

Objectives

Primary Objectives

1. To determine the relation of the mini nutritional screening score and the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

2. To determine the relation of the subjective global assessment of nutrition status and the pneumonia severity index among individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

Secondary Objectives

1. To determine the relation of the body mass index and the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

2. To determine the relation of calf circumference and the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

Methods

Study Design and Settings

This is an observational, analytical, cross-sectional study whose target population are the elderly patients of Cardinal Santos Medical Center diagnosed with Community Acquired Pneumonia. The study was conducted among elderly patients, at least 60 years and above, diagnosed with Community Acquired Pneumonia, admitted in Cardinal Santos Medical Center during the period of August to September 2015.

Participants and Study Size

All patients diagnosed with Community Acquired Pneumonia, of at least 60 years old, were included in the study. The study included the entire strata of the elderly population from young old, aged 60 to 74 years, too oldest old, aged beyond 85 years. Only those with radiographic finding of Pneumonia and who fulfill the clinical criteria for the diagnosis of Community Acquired Pneumonia were included. Patients identified to be in congestive heart failure were excluded. Patients with other indication for admission unrelated to Community Acquired Pneumonia were excluded. For a 95% confidence interval, the sample size was determined to be at least 102 participants. An informed consent was obtained accordingly prior to the commencement of the study procedure for each identified potential participant.

Inclusion Criteria

1. At least 60 years' old
2. Diagnosed with Community Acquired Pneumonia on admission
3. Admitted in Cardinal Santos Medical Center

Exclusion Criteria

1. Must not be in congestive heart failure

2. Must not have other indications for admission not related to community acquired pneumonia such as bleeding, loss of consciousness, abdominal pain

3. Must not be undergoing hemodialysis

4. Must not be a resident of a nursing home or hospice care

Definition of Terms

1. Community Acquired Pneumonia: A disease entity that may present with fever, cough, difficulty breathing; diagnosis must be confirmed by radiographic imaging.

2. Elderly: Individuals at least 60 years of age. The elderly population is stratified as young old at 60 to 74 years, middle aged old at 75 to 85 years old, and oldest old at age beyond 85 years.

3. Pneumonia Severity Index (PSI): A validated risk stratification tool for patients with community acquired pneumonia. Risk classification is based on demographic factors, coexisting illnesses, physical examination findings, laboratory and radiographic findings. The sum of all points satisfied by each elderly individual is added of which the patient is subsequently stratified. Risk class I has an PSI score of < 51, and Risk class II has a PSI score of 51 to 70. Both risk class I and II are classified as low risk pneumonia. Risk class III are those with a PSI score of 71 to 90 and the patient is classified as having intermediate risk pneumonia. Risk class IV are those patients with a PSI score of 91 to 130, and Risk Class V are those whose PSI score are above 130. Both risk class IV and V are classified as having high risk pneumonia.

4. Mini Nutritional Screening Score: Score obtained by the participant who underwent evaluation using the Mini Nutrition Assessment Tool. This screening tool evaluated food intake, weight loss, neuropsychological stress, body mass index, and calf circumference. A score of 12-14 identifies normal nutrition status; 8-11 as at risk for malnutrition, and 0-7 as malnourished.

5. Body Mass Index: Used as an indicator for appropriateness of weight for height; calculated by dividing the weight in kg by the height in m^2. Based on the WHO guidelines, Body Mass Index is classified as underweight for BMI < 18.5; normal for BMI 18.5 to 24.9; overweight or obese for BMI > 25.

6. Calf Circumference: Anthropometric measure obtained with the patient in the sitting position, ideally. This anthropometric has been shown to be in positive correlation with body mass index. In the mini nutritional assessment, 31cm was set as the upper limit for a calf circumference suggestive of malnutrition.

7. Subjective Global Assessment of Nutrition Status: A validated nutrition assessment tool which considers weight loss, dietary intake, functional capacity, stress level of the disease in relation to nutritional requirements, and physical examination findings to include loss of subcutaneous fat, muscle wasting, edema, and ascites.

Ethical Considerations

Each identified potential subject was adequately informed of the aims, methods, sources of funding, institutional affiliation of the primary investigator, the anticipated benefits and potential risks and the possible discomfort it may entail, and post - study provisions. The potential subject was informed of the right to refuse to participate in the study or withdraw consent to participate at any time. After ensuring that the potential subject has fully understood aforementioned information, the primary investigator sought the potential subject's freely given informed consent in writing. In cases wherein the patient is deemed incapable of giving informed consent, the primary investigator sought informed consent from the legally authorized representative. When a potential research subject deemed incapable of giving informed consent is able to give assent to decisions about participation in research, the primary investigator sought that assent in addition to the consent of the legally authorized representative. Once informed consent was obtained accordingly, data collection, including nutrition evaluation and pneumonia severity scoring is done.

All data collected was saved in a password protected computer wherein only the researcher has access to. Hard copies of the nutritional assessment and pneumonia severity score were placed in an envelope and placed in a locker where only the primary investigator has access to. All nominal data that will identify individual patients who took part in the study will not be publicly disclosed. No conflict of interest is identified concerning the primary investigator in the conduct of this study. This study is in no way sponsored by any company, institution, or organization. The entire research protocol was reviewed and approved by the ethics review board of Cardinal Santos Medical Center.

Data Measurement

All potential participants were identified using the aforementioned inclusion criteria. Upon obtaining informed consent, the patient subsequently underwent evaluation using the Pneumonia Severity Index. Based on the score obtained, the patient was subsequently stratified as low, intermediate, or high risk.

The patient subsequently underwent the Mini Nutritional Screening and Subjective Global Assessment, which included anthropometric measurements such as weight, height, and calf circumference. Weight was measured in standing position with the patient standing, without foot wear, stepping on the platform of the Manual Detecto® weighing scale with weight evenly distributed on both feet. Weight was measured to the nearest kilogram. Height was measured, with the patient standing straight, without foot wear, against the stadiometer, with weight distributed equally on both feet. The patient was instructed to maintain head in an upright position avoiding it to tilt sideways, forward nor backward. The stadiometer was lowered until it made contact with the top of the patient's head. Height was subsequently recorded to the nearest centimeter. Body mass index was subsequently computed using the patient's weight and height. Body mass was recorded in kilograms per square meter. The calf circumference was measured with the patient in the sitting position with weight evenly distributed on both feet. The patient was asked to roll up their trouser. The medial tibial plateau was palpated, and the point 4cm distal to this site was measured. At this point, the calf circumference was subsequently measured. In cases wherein the patient is unable to tolerate the sitting position, the patient is asked to lie supine, with the knee positioned in 90degrees flexion. The calf circumference was subsequently recorded to the nearest 0.1 cm.

All data collected was recorded accordingly on the Mini Nutritional Assessment form, Subjective Assessment for Nutrition Form, and Pneumonia Severity Index. Data collected from the study were encoded in Microsoft Excel 2010 and stored in a password protected computer. Hard copies of the nutrition assessment forms and pneumonia scoring were placed in an envelope and stored in a locker where only the primary investigator has access to. Files, both soft and hard copies will be maintained in their aforementioned storage for one year. This time period will be allotted for statistical analysis of gathered data and will be made available should there be a need to review collected data.

Statistical Approach and Design

This research is an observational, analytical, cross-sectional study. Nutritional risk stratification scores, including the Mini Nutritional Screening Score, and Subjective Global Assessment were correlated with the Pneumonia Severity Index. The body mass index, and calf circumference measurements were also correlated with the Pneumonia Severity Index. Data collected were then subsequently run in Open Epi ver. 3.03a for statistical analysis. Means, frequency distribution, and determination of odds ratio were done for statistical analysis.

Results

Participants

Among the patients admitted under the Department of Internal Medicine from August to September 2015, a total of 116 patients were identified to satisfy the inclusion criteria. However, six (6) patients refused to sign the informed consent form and hence was not included in the study. Two (2) patients were noted to have concomitant upper gastrointestinal bleeding which may potentially affect the nutritional assessment scores, as well as the pneumonia severity index hence was also excluded from the study. Two (2) patients were noted to have concomitant congestive heart failure and hence was also excluded from the study. A total of 106 patients were included in the study.

Table 1 shows the baseline demographics of the 106 participants for this study. There was no significant difference in the age of the participants among all the three groups of Pneumonia severity. 41.5 % of the total participants were male and 58.5% were female.

	Baseline Demographic Characteristics of Study Participants			
	Group 1 PSI I - II (n = 17)	Group 2 PSI - III (n = 43)	Group 3 PSI IV - V (n = 46)	
Age (yrs.), mean	65.76 ± 5.0932	75.95 ± 7.5654	84.65 ± 7.2149	p = 0.20332
Sex				
Males	47% (n = 8)	46.5% (n = 20)	34.8% (n = 16)	41.5% (n = 44)
Females	53% (n = 9)	53.5% (n = 23)	65.2% (n = 30)	58.5% (n = 62)

Table 1: *Demographic Characteristics of Study Participants stratified according to Pneumonia Severity Index (PSI). Group 1 with PSI I - II (n = 17); Group 2 with PSI III (n = 43); Group 3 PSI IV-V (n=46).*

Outcome Data

The Pneumonia Severity Index was tallied against the nutritional assessment scores. The frequency distribution of the Pneumonia Severity Index in relation to the Subjective Global Assessment Grade is shown on table 2.

Subjective Global Assessment of Nutrition	Pneumonia Severity Index		
	I - II	III	IV - V
Well nourished	9.43% (n=10)	2.83% (n=3)	0.94% (n=1)
Moderately malnourished	5.66% (n=6)	36.79% (n=39)	32.08% (n=34)
Severely malnourished	0.94% (n=1)	0.94% (n=1)	10.38% (n=11)

Table 2: Frequency Distribution of Subjective Global Assessment Grade in relation to Pneumonia Severity Index.

Subgroup analysis was done to determine the odds of having intermediate and high risk pneumonia when a patient was stratified as well-nourished or moderately to severely malnourished. Table 3 shows a subgroup analysis between those classified under the subjective global assessment as being well nourished and being moderately to severely malnourished, in determining the odds of developing intermediate risk pneumonia.

Subjective Global Assessment of Nutrition	Pneumonia Severity Index			
	I - II	III	Odds Ratio (95% CI)	p-value
Well nourished	9.43% (n=10)	2.83% (n=3)	19.0476 (4.1671,87.0652)	0.0000523164
Moderately malnourished	6.6% (n=7)	37.74% (n=40)		
Severely malnourished	9.43% (n=10)	2.83% (n=3)		

Table 3: *Odds Ratio of patients classified by the Subjective Global Assessment of Nutrition as well-nourished and moderately to severely malnourished in developing intermediate risk pneumonia.*

Table 4 presents a subgroup analysis between those classified by the Subjective Global Assessment as well-nourished and as moderately to severely malnourished in determining the odds of developing high risk pneumonia.

Subjective Global Assessment of Nutrition	Pneumonia Severity Index			
	I - II	IV-V	Odds Ratio (95% CI)	p-value
Well nourished	9.43% (n = 10)	0.94% (n = 1)	64.2857 (7.0909, 582.81)	0.0000010417
Moderately to Severely malnourished	6.6% (n = 7)	42.45% (n = 45)		

Table 4: *Odds Ratio of patients classified by the Subjective Global Assessment of Nutrition as well-nourished and moderately to severely malnourished in developing high risk pneumonia.*

Table 5 shows the frequency distribution of the Pneumonia Severity Index in relation to the Mini Nutritional Screening Score, with patients stratified as having normal nutrition status, at risk for malnutrition, and malnourished.

Mini Nutritional Screening score	Pneumonia Severity Index		
	I – II	III	IV - V
Normal Nutrition status	11.32% (n = 12)	7.5% (n = 8)	0.94% (n = 1)
At risk for malnutrition	3.8% (n = 4)	32.08% (n = 34)	27.36% (n = 29)
Malnourished	0.94% (n = 1)	0.94% (n = 1)	15.1% (n = 16)

Table 5: *Frequency Distribution of Mini Nutritional Screening Score in relation to Pneumonia Severity Index.*

Subgroup analysis was done to determining the odds of developing intermediate and high risk pneumonia when a patient was stratified as normal, at risk for malnutrition, or malnourished using the Mini Nutritional Screening Score. Table 6 shows a subgroup analysis between those classified under the Mini Nutritional Screening Score as having a normal nutrition status and being at risk for malnutrition and malnourished and the odds of developing intermediate risk pneumonia.

Mini Nutritional Screening Score	Pneumonia Severity Index			
	I – II	III	Odds Ratio (95% CI)	P value
Normal Nutrition status	11.32% (n = 12)	7.5% (n = 8)	10.500 (2.8744, 38.356)	0.00039232
At risk for malnutrition & Malnourished	4.72% (n = 5)	33.02% (n = 35)		

Table 6: *Odds Ratio of patients classified by the Mini Nutritional Screening Score as normal nutrition status, and at risk for malnutrition and malnourished in developing intermediate risk pneumonia.*

Table 7 shows a subgroup analysis between those classified under the Mini Nutritional Screening Score as having a normal nutrition status and being at risk for malnutrition and malnourished and the odds of developing high risk pneumonia.

Mini Nutritional Screening Score	Pneumonia Severity Index			
	I – II	IV-V	Odds Ratio (95% CI)	P value
Normal Nutrition status	11.32% (n = 12)	0.94% (n = 1)	108 (11.503, 1013.98)	0.000000027
At risk for malnutrition & Malnourished	4.72% (n = 5)	42.45% (n = 45)		

Table 7: *Odds Ratio of patients classified by the Mini Nutritional Screening Score as normal nutrition status, and at risk for malnutrition and malnourished in developing high risk pneumonia.*

The Pneumonia Severity Index was also tallied against the body mass index as shown in Table 8.

Body Mass Index (kg/ m^2)	Pneumonia Severity Index			
	I - II	III	IV - V	
< 18.5	0.94% (n = 1)	0.94% (n = 1)	9.43% (n = 10)	
18.5 - 24.9	11.32% (n = 12)	20.75% (n = 22)	26.42% (n = 28)	
> 24.9	3.77% (n = 4)	18.87% (n = 20)	7.55% (n = 8)	

Table 8: Frequency Distribution of Body Mass Index in relation to Pneumonia Severity Index.

Subgroup analysis was done to determine the odds of developing intermediate and high risk pneumonia in patients who are underweight and those with normal body mass index. Table 9 shows a subgroup analysis of patients who are underweight with a BMI < 18.5 and those with normal BMI of 18.5 - 24.9 and its odds in developing intermediate risk pneumonia with a PSI III.

Body mass index (kg/ m^2)	Pneumonia Severity Index				
	I – II	III	Odds ratio (95% CI)	p value	
< 18.5	0.94% (n = 1)	0.94% (n = 1)	0.5455 (0.0312,9.5217)	0.736397	
18.5 - 24.9	11.32% (n = 12)	20.75% (n = 22)			

Table 9: *Odds ratio of patients who are underweight BMI < 18.5 and those with normal BMI at 18.5 - 24.9 in developing intermediate risk pneumonia.*

Table 10 shows a subgroup analysis of patients who are underweight with a BMI < 18.5 and those with normal BMI of 18.5-24.9 and its odds in developing high risk pneumonia with a PSI IV-V.

Body Mass Index (kg/m^2)	Pneumonia Severity Index				
		I – II	IV-V	Odds ratio (95% CI)	p value
	< 18.5	0.94% (n = 1)	9.43% (n = 10)	4.2857 (0.4923,37.3127)	0.30837
	18.5 - 24.9	11.32% (n = 12)	26.42% (n = 28)		

Table 10: *Odds ratio of patients who are underweight BMI < 18.5 and those with normal BMI at 18.5 - 24.9 in developing high risk pneumonia.*

The Pneumonia Severity Index was also tallied against the body mass index as shown in table 11.

Calf Circumference (cm)	Pneumonia Severity Index			
		I – II	III	IV - V
	< 31	2.8% (n = 3)	17.92% (n = 19)	29.24% (n = 31)
	> 31	13.2% (n = 14)	22.6% (n = 24)	14.15% (n = 15)

Table 11: *Frequency Distribution of Calf Circumference in relation to Pneumonia Severity Index.*

Subgroup analysis was done to determine the odds of developing intermediate and high risk pneumonia in patients with a calf circumference of < 31 cm and > 31 cm. Table 12 shows a subgroup analysis of patients using calf circumference in determining the odds of developing intermediate risk pneumonia. (table-12)

Calf Circumference (cm)	Pneumonia Severity Index				
		I – II	III	Odds Ratio (95% CI)	p value
	< 31	2.8% (n = 3)	17.92% (n = 19)	3.6944 (0.9252,14.7531)	0.104159
	> 31	13.2% (n = 14)	22.6% (n = 24)		

Table 12: *Odds ratio of patients who have calf circumference of < 31 cm and > 31cm in relation to odds of developing intermediate risk pneumonia.*

Calf Circumference (cm)	Pneumonia Severity Index				
		I – II	IV - V	Odds Ratio (95% CI)	p value
	< 31	2.8% (n=3)	29.25% (n=31)	9.644 (2.3997,38.7609)	0.0012314
	> 31	13.2% (n=14)	14.15% (n=15)		

Table 13: *Odds ratio of patients who have calf circumference of < 31 cm and > 31cm in relation to odds of developing high risk pneumonia.*

Discussion and Conclusion

Community acquired pneumonia has been a growing concern for public health. Its incidence has increased from 5 to 11 per 1,000 persons worldwide. Locally, the Department of Health demonstrates pneumonia as among the top 5 leading causes of adult mortality. The diagnosis and management of this disease entity has been progressively evolving, with the advent of new technologies and new medica-

tions. However, the need to correctly stratify the patient as being low, intermediate or high risk is still imperative. The Pneumonia Severity Index is a clinical tool that has been demonstrated to have good discriminatory ability since 1999, as demonstrated by [5].

Table 2 demonstrates a significant correlation between the Pneumonia Severity Index and the Subjective Global Assessment as shown by the significant difference among the three strata of pneumonia. There were 14 patients classified as being well nourished. Of these, 10 patients have low risk pneumonia with Pneumonia Severity Index Score I - II. The most number of patients identified to be moderately malnourished were those with intermediate risk pneumonia with a Pneumonia Severity Index III. In table 2, among the 13 patients classified as severely malnourished, 11 of which were noted to have a Pneumonia Severity Index of IV to V.

The subgroup analysis in Table 3 shows the odds between those classified under the subjective global assessment as being well nourished and being moderately to severely malnourished in developing intermediate risk pneumonia. From the data gathered, those classified as being moderately to severely malnourished have 19 times greater odds to develop intermediate risk pneumonia compared from the well-nourished population (p=0.0000523164).

Table 4 shows a subgroup analysis between those classified by the Subjective Global Assessment as well-nourished and as moderately to severely malnourished in developing high risk pneumonia, with a PSI of IV-V. Data gathered shows that being moderately to severely malnourished increases the risk of developing high risk pneumonia by 64 times greater compared to those classified as well nourished (p=0.0000010417).

Table 5, showing the frequency distribution of the Mini Nutritional Screening Score in relation to the Pneumonia Severity Index, further reinforces the trend seen in Table 2. A statistically significant difference was also noted among the three groups. In table 5, there were 21 patients with normal nutrition status identified across all three strata of pneumonia severity. The most number of those with normal nutrition status were those with low risk pneumonia, Pneumonia Severity Index I - II. Most patients were identified to be at risk for malnutrition with the most number of these having intermediate risk pneumonia, Pneumonia Severity Index III. Of the 18 patients identified to be malnourished, 16 had high risk Pneumonia, Pneumonia Severity risk IV – V.

Table 6 demonstrates that being classified by the Mini Nutritional Screening as at least being at risk for malnutrition increases the odds of developing intermediate risk pneumonia by 10 times compared to those with normal nutrition status (p=0.00039232). Moreover, table 7 has shown that being at least at risk for malnutrition, under the mini nutritional screening increases the odds of developing high risk pneumonia by more than 100 times compared to those with normal nutrition status (p=0.000000027).

Body Mass Index among the three groups also had statistically significant difference as demonstrated in table 8. In the WHO classification of Body Mass Index, those with < 18.5 kg/m2 were considered underweight. In table 8, there were 12 patients identified to be underweight, and the most number of which had high risk pneumonia. Majority of the participants had a normal BMI of 18.5 to 24.9 kg/m2. However, 28 out of the 62 patients with normal BMI still had high risk pneumonia. Majority of those classified as overweight with a BMI > 24.9 kg/m2 only had intermediate risk pneumonia.

Tables 9 and 10, however, show that being underweight, with a BMI < 18.5 does not significantly correlate with the odds of developing intermediate and high risk pneumonia respectively ($p > 0.05$).

Table 11 shows a significant difference among the three groups in terms of calf circumference. A calf circumference of less than 31 cm was identified as high risk for malnutrition in the Mini Nutritional Assessment. Of the 53 patients who had a calf circumference < 31 cm, indicative of malnutrition, 31 had high risk pneumonia. On the other hand, most patients with calf circumference above 31 cm only had intermediate risk pneumonia.

Table 12 shows a subgroup analysis using the calf circumference in determining the odds of developing intermediate risk pneumonia. This anthropometric measurement was unable to yield statistically significant odds in having intermediate risk pneumonia ($p > 0.05$).

However, table 13, showing a subgroups analysis using calf circumference in determining the odds of developing high risk pneumonia, shows otherwise. Having a calf circumference less than 31 cm increases the odds of developing high risk pneumonia, with a PSI of IV - V, by almost 10 times compared to those with greater than 31 cm calf circumference (p=0.0012314).

These findings suggest that nutrition is thus, vital in the disease state of an elderly individual, particularly those with community acquired pneumonia. An adequate nutritional assessment aids the clinician in predicting severity of pneumonia among the elderly population. Being stratified as severely malnourished using the subjective global assessment or as malnourished using the Mini Nutritional Screening is indicative that the patient is at higher risk to have a more severe pneumonia compared to one with a normal nutrition status. Body mass index has been used more commonly in nutritional assessment, and can also aid in the prognostication of an elderly patient diagnosed with community acquired pneumonia, especially when correlated with other components of the widely available nutrition assessment tools such as the Subjective Global Assessment Score and Mini Nutritional Screening Score. Calf circumference was also noted to statistical significance among those with high risk pneumonia. This anthropometric measure, when noted at < 31cm, was able to significantly determine greater odds of having a high risk pneumonia by almost 10 times. Hence, in the absence of equipment to accurately measure a patient's weight or height, calf circumference may be used instead, for the assessment of nutrition status of the elderly patients and may aid in determining the prognosis in this population.

This study further re-emphasizes the significance of a thorough nutritional assessment for elderly patients with community acquired pneumonia. The determination of the nutrition status of patients of this age group is a helpful tool in prognosticating clinical outcomes, and hence aids in strategizing a therapeutic approach for the elderly patients.

Recommendations

It is recommended that further studies be conducted on the nutrition of elderly patients with community acquired pneumonia, specifically one with more study subjects and with a longer duration of study. A longitudinal study, monitoring an elderly patient's nutrition status on admission until discharge, comparing with clinical outcomes is recommended. Furthermore, a thorough correlation study is recommended to define the significance of nutrition assessment in the determination of disease severity and prediction of clinical outcomes in the elderly population.

Bibliography

1. Vellas B., *et al.* "The mini nutritional assessment and its use in grading the nutritional state of elderly patients". *Nutrition* 15.2 (1999): 116-122.

2. Detsky., *et al.* "What is Subjective Global Assessment of Nutrition Status". *Journal of Enternal and Parenteral Nutrition* 11.1 (1987): 8-13.

3. Wells J., *et al.* "Nutrition and aging: assessment and treatment of compromised nutritional status in frail elderly patients". *Clinical Interventions in Aging* 1.1(2006): 67-79.

4. Zhang L., *et al.* "Assessing the nutritional status of elderly Chinese lung cancer patients using the Mini Nutritional Assessment tool". *Clinical Interventions in Aging* 8 (2013): 287-291.

5. Flanders., *et al.* "Validation of the Pneumonia Severity Index". *Journal of General Internal Medicine* 14.6 (1999): 333-340.

Volume 4 Issue 4 August 2016