The Role of Blood Urea Nitrogen / Albumin Ratio and Albumin Level in Predicting the Need for ICU Care (Intensive Respiratory and Vasopressor Support) in Community Acquired Pneumonia Patients

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Abstract
Background: *Community acquired pneumonia is an important cause of morbidity and mortality worldwide. CURB – 65 and PSI are the most frequently used scoring scales to assess disease severity. However their role regarding predicting mortality and need for ICU is low. Some studies have shown that patients with low serum albumin levels had poor outcome in CAP and those who had higher levels of BUN and lower albumin levels had higher mortality rates The aim of the study was to evaluate the role of albumin and BUN/Albumin ratio in the prediction for need of ICU (Intensive Respiratory and Vasopressor Support) and to derive a BUN/Alb ratio cut off score in predicting the need for IRVS .*

Aims and Objectives: *To assess the role of albumin and BUN/Albumin ratio in the prediction of need for ICU in adults patients >18 years of age admitted for CAP.*
To derive a cut off value for BUN/Albumin ratio in predicting the need for IRVS.

Materials: *In this study we have taken 50 patients who were of age above 18 yrs diagnosed to have Community Acquired Pneumonia. Complete blood count, serum albumin, BUN was measured and BUN/Alb ratio was calculated.Patients with immunocompromised states, chronic liver or renal failure and patients on immunosuppressive therapy were excluded.*

Results: *50 patients diagnosed as CAP were included in the study. In this study the requirement of ICU care was indirectly taken by the need for intensive respiratory i.e. invasive ventilation and vasopressor support. 32% of the patients required IRVS.*
In the IRVS group of patients (16 patients) the mean BUN, albumin and BUN/albumin ratio values were 15.08mg/dl, 3.26 g/dl and 4.73mg/dl respectively
In the non IRVS group (32 patients) then mean BUN, albumin and BUN/albumin ratio values were 14.86mg/dl, 3.54g/dl and 4.44 mg/dl respectively .
Thus it is found that in the two groups bun and bun/alb ratio was higher in the IRVS group and albumin lower in the IRVS group.

Conclusion: *In our study, we found that patients who required IRVS had a higher BUN and BUN/albumin values and further had a lower Albumin values.*
4.05 was the cut off scored derived from our study and a value equal to or above that predicts the need for IRVS with sensitivity of 62.5% and specificity of 62.8%.

Keywords: *Community Acquired Pneumonia: Intensive Respiratory and Vasopressor Support; Blood Urea Nitrogen; Albumin.*

Introduction

Pneumonia is an infection of the pulmonary parenchyma. It is one of the leading causes of significant morbidity and mortality. The need for an intensive care unit (ICU) is an important problem for clinicians to overcome during the course of CAP. CURB-65 (confusion, urea nitrogen, respiratory rate, blood pressure, $\geq$ 65 years) and Pneumonia Severity Index (PSI) are the most frequently used scoring scales to assess the disease severity. These scoring tools are useful to decide between hospitalization and outpatient treatment with an oral antibiotic. However, their accuracy is lower regarding the need for ICU treatment (Intensive Respiratory and Vasopressor Support)

Serum albumin concentration has been used as an indicator of nutritional status for years. Hypoalbuminemia was related with poor outcome in several clinical conditions, including CAP .The inflammatory reaction was reported as a primary reason for hypoalbuminemia in elderly patients with CAP . The Blood Urea Nitrogen (BUN) level is an important biochemical parameter showing renal hypo perfusion. It is one of the contributing parameters for both the CURB-65 and PSI severity scoring scales. Previous studies have shown that patients with CAP who had higher BUN levels and lower albumin levels required ICU.

Materials and Methods

Source of Data: Patients who were admitted to the Kempegowda Institute of Medical Sciences and research centre, Bengaluru diagnosed as Community Acquired Pneumonia.

Duration of the Study: 18 months (December 2017- May 2019)

Sample Size: 50 subjects

Type of Study: Retrospective study.

Inclusion Criteria

Age above 18 years

Diagnosis of Community Acquired Pneumonia based on history, examination findings and chest x-ray features .

Exclusion Criteria

Patients diagnosed as Hospital Acquired Pneumonia, Ventilator Associated Pneumonia

Patients on immunosuppressant, Chemotherapy, Immunocompromised state –HIV

Chronic renal or liver failure

Method of Collection of Data

Detailed medical history along with co-morbidities and thorough examination was done. Severity of the disease was assessed using CURB-65 and PSI scoring systems Blood sampling – venous blood samples were obtained from patients at the time of admission before starting antibiotic treatment and sent for complete blood count, serum albumin, CRP, BUN, Sputum analysis, Blood c/s, ABG, Chest x-ray etc

Results

50 patients diagnosed as community acquired pneumonia were included in the study and results were derived.
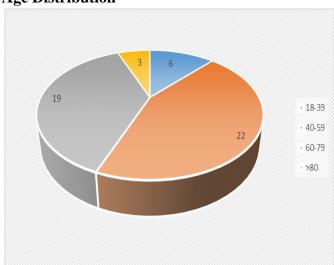
Age Distribution

Figure 1: Age distribution among study population

In this study all patients were above 18 years and most of them were in the age group of 40-59 age group (44%).
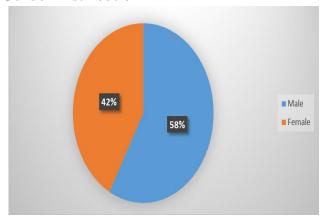
Gender Distribution

Figure 2: Gender distribution

In the given study there were male patients of 29 (58%) and female patients of 21(42%).

Distribution-Serum Albumin Levels (g/dl) in Patients

Table 1-Distribution of serum albumin levels (g/dl) in patients

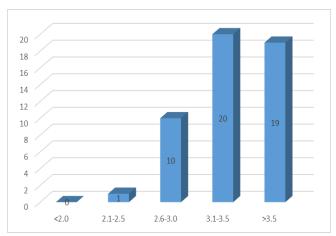| Ser Alb Cat	Frequency	Percent
<2.0	0	0
2.1-2.5	1	2.0
2.6-3.0	10	20.0
3.1-3.5	20	40.0
>3.5	19	38.0
Total	50	100.0

Figure 3 Distribution of serum albumin levels (g/dL) in patients

Table 2 -Distribution of serum albumin levels in patients

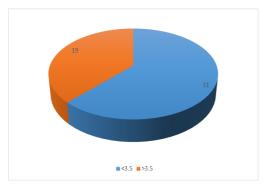| SerAlbCat	Frequency	Percent
≤3.5	31	62
>3.5	19	38
Total	50	100

Figure 4 Distribution of serum albumin levels (g/dl)

In the given study 40% of the patients had serum albumin levels of 3.1-3.5g/dl.

Bun Levels in Patients their Distribution (mg/dl)

Table 3 Distribution of BUN levels

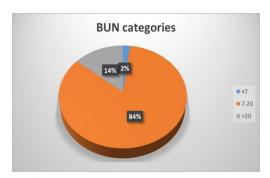| BUNcat	Frequency	Percent
<7	1	2.0
7-20	42	84.0
>20	7	14.0
Total	50	100.0

Figure 5 -Distribution of BUN levels

In the given study 84% of the patients had bun levels in the range of 7-20 mg/dl

Table 4 Comparison of mean values of the lab parameters

	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error
BUN	50	4.66	43.80	14.9352	6.78416	.95942
S.ALB	50	2.4000	4.6000	3.446800	.4967258	.0702476
BUN/ALB	50	1.22	16.22	4.5414	2.65076	.37487

In the given study the mean value of BUN/Alb is 4.5414 mg/dl

Number of Patients Who Required IRVS

Table 5 Number of patients who required IRVS

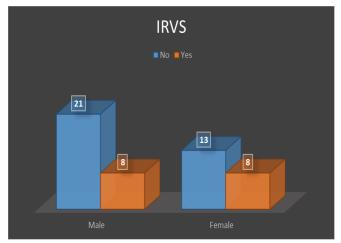| IRVS	SEX		Total	
	Male	Female		PERCENTAGE
No	21	13	34	68
Yes	8	8	16	32
Total	29	21	50	100

Figure 6 Numbers of patients who required IRVS

In the given study 32% of the patients required IRVS

Comparison of Bun mean values with Respect to the need For IRVS

Table 6 Comparison of BUN mean values with respect to the need for IRVS

IRVS	N	BUN Mean	Std. Deviation	Std. Error Mean	t value	P value
Yes	16	15.0819	3.81965	.95491	0.104	0.918
No	34	14.8662	7.85448	1.34703		

Table 7 Depicting categorization of BUN values and the need for IRVS

BUNcat	IRVS		Total
	Yes	No	
<7	0	1	1
7-20	14	28	42
>20	2	5	7
Total	16	34	50

In the given study the mean BUN value for patients who required IRVS is 15.0819 and those who did not require IRVS is 14.8662

Comparison of Mean Albumin Values with Respect to the Need for IRVS

Table 8 Comparison of mean albumin values with respect to the need for IRVS

IRVS	N	S.ALB Mean	Std. Deviation	Std. Error Mean	t value	P value
Yes	16	3.26	0.34	0.08	1.9	0.062
No	34	3.54	0.54	0.09		

In the given study the mean albumin value for patients who required IRVS is 3.26 g /dl and those who did not require IRVS is 3.54g/dl
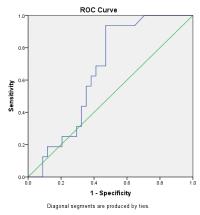
Comparison of Mean Bun/Albumin Values With Respect to the Need for IRVS

Table 9 Comparison of mean BUN/Albumin values with respect to the need for IRVS

IRVS	N	BUN/ALB Mean	Std. Deviation	Std. Error Mean	t value	P value
Yes	16	4.7394	1.63009	.40752	0.357	0.72
No	34	4.4482	3.03275	.52011		

In the given study the mean BUN/Albumin value for patients who required IRVS is 4.7394mg /dL and those who did not require IRVS is 4.4482mg/dl

ROC Curve for the BUN/ALB

AUC = 0.656

BUN / ALB value of 4.05 has highest sensitivity 62.5 and specificity 62.8%. Which can be chosen for predicting IRVS need.

Discussion

50 patients diagnosed as CAP were included in the study. 44% of the patients were in the age group

of 40-59 years .in the given study the m:f ratio is (1.38:1). Further in the given study aerum albumin levels, bun and bun/alb ratios were extensively analyzed. It was found that 40% of the patients had serum albumin levels in the range of 3.1-3.5g/dl.62% of the patients had serum albumin levels below 3.5gram/dl (lower limit of the normal range being 3.5 g/dl)

In the given study the mean BUN, serum albumin and BUN/Albumin ratio values were 14.935mg/dl, 3.446 g/dl and 4.5414 mg/dl respectively.

In this study the requirement of ICU care was indirectly taken by the need for intensive respiratory i.e. invasive ventilation and vasopressor support. 32% of the patients required IRVS.

In the IRVS group of patients (16 patients) the mean bun, albumin and BUN/albumin ratio values were 15.08mg/dl, 3.26 g/dl and 4.73mg/dl respectively

In the non IRVS group (32 patients) then mean BUN, albumin and BUN/albumin ratio values were 14.86mg/dl, 3.54g/dl and 4.44 mg/dl respectively.

Thus it is found that in the two groups bun and bun/alb ratio was higher in the IRVS group and albumin lower in the IRVS group.

Accordingly a cut off value was derived from roc curve and it was found that BUN / alb value of 4.05 has highest sensitivity 62.5 and specificity 62.8%, that can be chosen for predicting IRVS need.

Conclusion

In our study, we found that patients who required IRVS had a higher BUN and BUN/albumin values and further had a lower Albumin values.

4.05 was the cut off scored derived from our study and a value equal to or above that predicts the need for IRVS with sensitivity of 62.5% and specificity of 62.8%.

Limitations

Since the study being single centre study, shorter duration and a smaller sample size .

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