**Dissertation on**

# "A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB - 65 AND PSI SCORING"

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## CERTIFICATE

This is to certify that the dissertation entitled **" A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS INHOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB - 65 AND PSI SCORING"** is a bonafide original work done by **Dr.G.PRASANNA BABU,** post graduate student, Institute of Internal medicine, Madras medical college, Chennai-3 in partial fulfilment of the requirements for the award of **M.D. GENERAL MEDICINE BRANCH – I** examination of the Tamil Nadu Dr.M.G.R Medical University under my guidance and supervision in during the academic year 2016 - 2019.

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# CONTENTS

## LIST OF ABBREVIATIONS USED

(In alphabetical order)

| | | |
|---|---|---|
| ATS | : | American Thoracic Society. |
| BTS | : | British Thoracic Society |
| CAP | : | Community Acquired Pneumonia |
| CCrRB65 | : | Confusion, Creatinine, Respiratory Rate; Blood Pressure; age >65years |
| CI | : | Confidence Interval |
| COPD | : | Chronic obstructive pulmonary disease |
| CRB65 | : | Confusion, Respiratory Rate; Blood Pressure, age >65years |
| CURB 65 | : | Confusion; Blood Urea nitrogen; Respiratory Rate; Blood Pressure; age >65years |
| CXR | : | Chest radiograph |
| ED | : | Emergency Department |
| FiO2 | : | Fraction of inspired oxygen |
| HIV | : | Human Immunodeficiency Virus |
| HTN | : | Hypertension |
| ICU | : | Intensive care unit |
| IDSA | : | Infectious Disease Society Of America |
| IgA | : | Immunoglobulin A |
| ITU | : | Intensive therapy unit |
| LRTI | : | Lower respiratory tract infection |

| | | |
|---|---|---|
| OR | : | Odds Ratio |
| PaO2 | : | Partial pressure of Oxygen |
| PIRO | : | Predisposition, Insult, Response, and Organ dysfunction |
| PORT | : | Pneumonia Patient Outcomes Research Team |
| PSI | : | Pneumonia severity Index |
| RR | : | Respiratory Rate |
| T2DM | : | Type 2 Diabetes mellitus |

# INTRODUCTION

# INTRODUCTION

Community acquired pneumonia is one of the most important public health problems worldwide[1]. The assessment of disease severity and outcome prediction are necessary for allocation of health resources and therapeutic options in management of CAP.[2,3]

CAP can be defined by both clinical and radiological findings. In the absence of available radiological facilities,[4] CAP is defined by ,

a) symptoms of LRTI (lower respiratory tract infection) for less than 1 week;

(b) At least any one of the systemic features (temperature > $37.7^0$ C, chills and rigors or malaise);

(c) At least one new focal respiratory system finding (bronchial breath sounds and/or crackles); and

(d) No other explanation for the illness

In a tertiary care hospital, where radiographs are frequently used additional requirements define CAP. New radiological findings such as shadowing in the form of lobar or patchy consolidation, loss of diaphragmatic, cardiac or mediastinal silhouette, interstitial infiltrates or bilateral perihilar opacities for which there is no other explanation (acute pulmonary edema, pulmonary tuberculosis, etc) additionally define CAP.

The use of CURB-65 AND Pneumonia severity index {PSI} have limitations. Recent studies [5] have found that the bio markers may have additional information on severity of CAP , will distinguish between bacterial and viral aetiology, and for early identification of complications. However most of the biomarkers are expensive and are not easily available in emergency situations.

Low serum albumin, within 24 hour of admissions were independently associated with poor outcomes.[6]. The mechanisms underlying the cause are diverse. Albumin serves not only nutritive functions, but also exerts anti-oxidant and buffering functions in acid-base metabolism. It also helps in maintaining osmotic pressure and transports hormones { cortisol , thyroxine} and has anti apoptotic effects.

The rate of albumin synthesis is decreased in acute phase of inflammation .The increasing concentration of pro inflammatory cytokines specially IL-6, causes inhibition of albumin synthesis in liver ,as well as increases albumin catabolism and redistribution in extra vascular compartment.[6] Cytokines produced shunt the amino acids for acute phase reactants, thereby decreasing the albumin levels.

Hence serum albumin is an indirect and easily available biomarker, which can be correlated with severity of CAP. The serum albumin levels are also compared with CURB-65 and PSI scoring in patients developing complications.

# AIMS AND OBJECTIVES

## AIM OF THE STUDY

- TO STUDY THE PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA.

- TO CORRELATE SERUM ALBUMIN LEVELS WITH THE COMPLICATIONS OF CAP.

- TO CORRELATE THE ALBUMIN LEVELS WITH CURB-65 AND PSI SCORING.

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

Pneumonia is defined as infection of the pulmonary parenchyma. Though the overall prevalence of the community acquired pneumonia is around 5.16 to 6.11 per 1000 cases per year[7] ,but still it is often misdiagnosed , mistreated and underestimated .

Maimonides described the symptoms of pneumonia as acute fever, short rapid breaths, increased pulse ,cough and sticking type of chest pain. In 1834 , Lanneac described the 3 stages of consolidation with their clinical signs: . The stage of congestion was described with " crepitous rattle", bronchial breathing in red hepatisation phase , and stage of resolution was described by return of crepitations called " rhonchus crepitus redux".

In 1882, Carl friedlander and Albert frankel, described the 2 bacterial causes of pneumonia which was caused by streptococcus pneumonia and klebsiella pneumonia. Sir William osler, the father of modern medicine described association of pneumonia with old age and described the mortality and morbidity of pneumonia.

Legionella was identified as a cause of pneumonia in an outbreak of respiratory illness in philadelphia in 1976.

Chlamydia pneumonia was found to cause both sporadic and epidemic cases. Over past few decades, there has been shift to multi drug resistant pathogens causing hospital acquired pneumonia.

Pneumonia has been attributed as 8th most common cause of death in united states [8,9] with the mortality rate of 1% in outpatient sittings and nearly 45% -60% in hospitalised sittings. The incidence of pneumonia is found to be higher in old patients increasing the burden of disease in the community. Earlier identification of risk factor, necessitating appropriate treatment and managing the high risk patients in intensive care unit is essential in decreasing the mortality of the disease.

## PATHOPHYSIOLOGY

Normally the lungs are exposed to microorganisms in the upper airway and the organisms enter the lower respiratory tract by variety of mechanisms. Microaspiration of the oropharyngeal contents occurs frequently during the sleep and in unconscious patients. Some of the pathogens are inhaled as contaminated droplets from other infected individuals.

Usually the lower airways are protected from infection by intact laryngeal , cough reflexes and pulmonary defence mechanisms. Pneumonia occurs by any condition causing breach in these defence mechanisms. [10,11] The factors that play an important role in the host defences are

- The hairs and turbinates of the nares filter the larger particles reaching the lungs.
- The branching architecture of tracheo bronchial tree clears the foreign particles and provide muco ciliary clearance. .

- The gag reflex and cough reflex prevents the aspiration of oral contents.
- The normal flora of oro-pharynx prevent the adherence of pathogenic bacteria.
- In the alveolar level, alveolar macrophages and neutrophils have a potent antibacterial and antiviral action. They also kill by their intrinsic opsonising properties .
- Immunoglobulins also play a role in controlling the infections .

Pneumonia develops when these barriers are breached by the micro organisms. When the organisms reaches the alveoli, they incite an inflammatory response by alveolar macrophages which in turn causes the symptoms and signs of pneumonia. The fever response is produced by IL -1 and TNF-alpha. IL-8 and GM-CSF , stimulate the release of neutrophils therby causing leucocytosis.

These mediators also create an alveolar-capillary leak syndrome, resulting in rales during auscultation and localised infiltrate in chest X-ray. The fluid filled alveoli leads to hypoxemia , vasoconstriction, decreased compliance and increased respiratory drive. Systemic inflammatory response syndrome is also triggered leading to respiratory alkalosis and systemic complications.

Pneumonia can also occur due to haematogenous spread or can be secondary, due to an infected pleura, mediastinal infections or

sub-diaphragmatic infections. Macro aspiration of the gastric contents, direct inoculation due to surgery or bronchoscopy are the other possible mechanisms.

**PATHOLOGY**

**AGENT:**

Certain organisms have specific ability to overcome the host defence mechanisms. For example[10.11] :

- Pneumococcus and meningococcus can split secretory IgA, by specific proteases.
- Mycobacterium tuberculosis is resistant to phagocytic action of the macrophages.
- The capsular polysaccharide of pneumococcus inhibits phagocytosis.
- .The mycoplasma and Chlamydia can damage the cilia .
- Gram negative bacteria attacks the aged epithelium and the mucosal membrane.

  thus these organisms enter the alveoli and cause infection.

The organisms implicated to cause CAP are

**Pneumococcus:**

The most commonest organism implicated in pneumonia. It is also commonly seen in Aspiration induced pneumonia, heart failure patients, and COPD patients. Para pneumonic effusions occur in 25% of the patients with pneumococcal pneumonia. Cigarette smoking is a major independent risk factor for developing severe invasive disease even in an immune-competent adult particularly in middle aged group. The Chest X-ray usually demonstrates lobar pneumonia. Mortality ranges upto 7% in hospitalised patients.

**Haemophilus influenza:**

A gram negative coccobacilli causing infections more common in patients with COPD and Cystic fibrosis .

**Legionella species:**

It constitutes about 2 -9% of the burden of pneumonia. It is naturally found in fresh water. It can contaminate hot water tanks , hot tubs and cooling towers of large air conditioners. No person to person transmission is observed. Incubation period extends between 2- 9 days. Patients with Legionnaires disease have fever(100%) , cough with sputum (45-60%) and haemoptysis(30%).

Extra pulmonary manifestations such as GIT symptoms (diarrhoea and vomiting) may be seen in half of the patients. CNS manifestations such as

confusion and impaired cognition can be seen. Relative Bradycardia is seen commonly in these cases. Electrolyte abnormalities such as hyponatremia, altered liver function are seen in most of the patients. The organisms implicated are L.pneumophila ( >90% ) , L.longbeachae, L.feelei , L.micdadei, and L.anisa.

**Mycoplasma Pneuomonia :**

Causes atypical pneuomonia with fever, cough, headache, myalgia , rhinitis and fatiguability. Most of the patients are ambulant and hence referred as “walking pneumonia ". 25% of cases may have extra pulmonary manifestations such as auto immune manifestations , central nervous system complications and dermatological manifestations. It tends to occur more commonly in prisons, schools, military bases and in hostels where persons are in closed and prolonged proximity.[12]

**Staphylococcus aureus :**

Community acquired MRSA is more common in homeless nomads, prison inmates, I.V drug abuse and homosexual populations. It is followed by an influenza like illness in an otherwise asymptomatic young adult[13,14] . In past 2 decades, there are increasing no of cases due to MRSA causing CAP and VAP. The more severe form tend to cause necrotising pneumonia and multi lobar cavitations. [13,14.15] The course of the MRSA pneumonia has high complications with >80% admitted in ICU, > 60% requiring mechanical ventilation, while 45% had chest tube placement and nearly 30% died .

**Gram negative bacilli:**

Colonisation of oral cavity by gram negative organisms in acutely ill patients, alcoholics and in diabetics have increased the incidence of gram negative organisms causing pneumonia. The mortality is higher because it is more common in debilitated patients. Klebsiella produces red currant jelly sputum and bulging fissure sign in chest X Ray. Acinetobacter is difficult to treat because of development of multiple drug resistance. Combination of beta-lactams with aminoglcosides are genrally used to prevent drug resistance.

**Chlamydia Pneumonia :**

There is a wide range of variation in the incidence of this organism, in various studies[16,17] due to difference in the diagnostic methods employed. Transmission occurs through the spread of droplets and has been implicated in outbreaks and increased incidence in overcrowded areas. There are no seasonal variations in Chlamydia as in influenza. It is described as third or fourth common cause of pneumonia in various studies and co-infection with pneumococcus is more common .

**Group A Streptococcus :**

It usually affects young adults and causes a fulminant pneumonia with earlier empyema formation. These organisms though relatively rarer, have a continuous presence. They are unrelated to influenza infection, but are rapidly fatal even in a previously healthy adult.[18]

**Anaerobes:**

They are more prone for causing aspiration pneumonia and lung abscess. The most frequently isolated genera of anaerobes are prevotella, fusobacterium, bacteroides, peptostreptococcus and porphyromonas. Poor oral hygiene, periodontitis, gingivitis and therapy with phenytoin are predisposing factors. They are more common in alcoholics, stroke patients, and in patients with IV drug addictions. Acute empyema development is also a common phenomenon in this group.

**Viruses:**

The most common viruses implicated are influenza, para influenza viruses, adenoviruses, rhino viruses, respiratory syncytial viruses, hanta viruses, corona viruses ,Epstein Barr virus , cytomegalovirus ,coxsackie viruses, herpes zoster viruses and human meta pneumo virus. The methods of damage to tissues are diverse. Some of them are directly cytopathic affecting pneumocytes, while in the rest of them inflammation from the immune response is the main mechanism implicated.

**Influenza pneumonia :**

They are implicated in causing pandemics with seasonal variations. They have a high mortality rate even in young immunocompetent adults. Transmission occurs through droplets or small sized particles from infected persons while coughing sneezing or talking. The incubation period is usually 1 to 2 days. It can cause primary pneumonia (virus alone) or secondary

pneumonia (mixed viral and bacterial) after a delay of few days. Concurrent myocarditis and pleural effusion can occur.

**Other uncommon organisms :**

Q fever caused by coxiella Burnetti is commonly a zoonotic infection acquired from infected sheep ,cattle and goats through contaminated aerosols. Tularaemia caused by francisella tularensis is a zoonosis acquired from rabbits and psittacosis from parrots. Nocardia, actinomycosis, ,listeria , melidosis and glander' s pneumonia are other rare causes of bacterial pneumonia.

**Fungal Pneuomonia :**

Fungal Pneuomonia is more common and dangerous in immune compromised individuals ,PTS on immunosuppressive therapy , diabetics ,Pts on chemotherapy and in HIV positive individuals. Histoplasmosis is commonly seen among travellers to Ohio islands. Cocciodioidosis is more common among travellers to south west United States.

**HOST FACTORS:**

**Loss of consciousness:**

Alterations in the level of consciousness, [20] which can cause both macro aspiration of stomach contents (due to stroke, seizures, anesthesia, and alcohol abuse) and micro aspiration of upper airway secretions, particularly during sleep.

**Elderly population:**

Pneumococcus is the single most common organism identified in 20-60% of the cases. Poor nutrition. ,age>65 years, the poor host immune response , poor dental hygiene, risk of aspiration ,multiple comorbid diseases , frequent hospitalization and dementia are the risk factors in elderly . H.influenzae and legionella pneumophilas were frequently isolated (5-14%). organisms[4,21]. In most cases, the microbiological patterns observed in the elderly do not differ significantly from younger ones. The systemic disease is wide spread and life threatening.

**COPD:**

COPD is a common comorbid condition in patients with CAP.[22.23] The spectrum of responsible microorganisms is not largely different than patients without COPD[24] , although the incidence of Pseudomonas aeruginosa and other Gram-negative bacilli may be increased in COPD. COPD does not appear to increase the mortality of CAP[25].

**Alcohol consumption :**

Alcohol consumption will increase the relative risk for CAP .The incidence of bacteremic CAP is higher in these patients and Pneumococcus is found most frequently. Although CAP was more severe in alcoholics, there was no difference observed in mortality.[26] Klebsiella is often found to have a strong association with alcoholics with CAP..

**Diabetes:**

Diabetes is one of the commonest reported co-morbidity in Indian data. The disease causing agents, the bacteremia rate and empyema rates did not differ in diabetics compared to the general population. [27] .However, diabetes was significantly associated with higher no of deaths and was also commonly seen in patients with bacteremic sepsis in pneumococcal pneumonia.[28] The probable mechanism was due to worsening of pre-existing heart and renal disease and not due to an altered immune response.

The other risk factors are as follows,

- Acidosis
- Toxin inhalations
- Uremia
- Malnourishment
- Cystic fibrosis
- Bronchiectasis
- Previous episodes of chronic bronchitis
- Immotile cilia syndrome
- HIV infection
- Young's syndrome (azoospermia, sinusitis, pneumonia)
- Dysphagia due to esophageal carcinoma, scleroderma and achalasia cardia
- Lung carcinoma
- Bronchial obstruction due to stenosis, tumor, or foreign body

**Drugs:**

It has been investigated in studies, that there is an increased risk of CAP among patients taking gastric acid-inhibitors such as PPIs and $H_2$ blockers.[29] Several studies demonstrated an association between antipsychotic drugs and CAP, although the causes remains unclear .[30] In one study, use of antipsychotic drugs were associated with an almost 50-60%increase in the risk of pneumonia among aged persons requiring hospitalization

In a case-control study, that evaluated inhaled drugs as possible risk factors for CAP, patients with COPD, who were receiving inhaled glucocorticoids were at increased risk for CAP and also asthmatic patients who were receiving inhaled anti-cholinergic agents (ipratropium bromide) were at increased risk for pneumonia. [30]

**PATHOLOGY OF PNEUMONIA:**

Bacterial pneumonia has two gross patterns of anatomic distribution : lobar pneumonia and lobular bronchopneumonia[31].

In lobar pneumonia, there are four stages :

The stage of congestion:

The lungs are heavy, boggy and red in this phase. This phase is characterized by blood vessel engorgement ,intra alveolar fluid accumulation with plenty of neutrophils and often the presence of numerous organisms.

The stage of red hepatization:

This phase is characterized by massive exudation with RBCs, neutrophils and inflammatory fibrin lining the alveolar spaces. On gross examination the lung now appears distinctly dusky, firm ,and airless with a liver like solid consistency, hence the term hepatization.

The stage of grey hepatization:

This phase is characterized by slow lysis of red blood cells and the presence of fibrino suppurative exudates, giving the lung, a gross appearance of grayish brown, dry surface.

The stage of resolution :

This phase is characterized by slow enzymatic digestion of the consolidated exudates within the alveolar spaces, to produce a liquid debris. They are reabsorbed, taken up by macrophages, and organised by fibroblasts.

**CLINICAL FEATURES:**

Pneumonia is characterised by the presence of fever, altered general well-being and respiratory symptoms, such as cough(90%), sputum production(66%), dyspnea (66%), pleuritic pain(50%) and haemoptysis(15%.). In older and immune compromised patients the signs and symptoms of pulmonary infection, may be muted and may be overshadowed by non specific complaints.

Occasionally, there is a "classic" history, like the patient with pneumococcal infection , presents with sudden onset of rigor followed by pleuritic chest pain, dyspnea, and cough with rusty sputum. Similarly, a patient with Legionella pneumonia may complain pre-dominantly of diarrhea, fever, headache, confusion and myalgia. For M. Pneumoniae, extra pulmonary manifestations such as myringitis, encephalitis, uveitis, iritis, and myocarditis may be present. However, only rarely does the clinical history clearly suggest a specific etiological diagnosis.

In older patients, especially those with multiple comorbidities, pneumonia may present with generalized weakness, decreased appetite, altered mental status, incontinence, or decompensation of an underlying disease. The presence of tachypnea may precede other signs of pneumonia by 1 to 2days.Tachycardia is another common initial sign, but is less frequent and non specific than tachypnea .Fever is absent in 30%to40% of older patients. Older patients with pneumonia who present with altered mental status, without fever can have a delay in receiving antibiotics by more than 4 hours of arrival therby increasing the mortality.[32]

The major clinical features of pneumonia are cough with exportation, fever, tachypnea, tachycardia, and pulmonary crackles. CAP is present-in 20% to 50% of persons who have all five factors. Specific signs of pulmonary consolidation are present in only one third of the cases that warrant

hospitalization and are frequently absent in patients who are less ill. Early in the evolution of disease, pain and cough may be absent and the physical examination may be normal other than for fever.

**LABORATORY EVALUATION:**

Once the patient is suspected to have pneumonia, laboratory studies should include blood cell counts, serum glucose levels, electrolyte measurements and arterial blood gas assays. They provide a basis for making decisions regarding the need for hospitalization. HIV testing, should be done particularly in those patients with no other risk factors of CAP. Marked leukocytosis with a left side shift is more often encountered with infections caused by *S.pneumoniae,* H. *influenzae* and gram-negative bacilli. Leucopenia may be seen with over-whelming pneumococcal or gram-negative bacterial pneumonia.

The serum levels of C-reactive protein and the erythrocyte sedimentation rate are both found to be increased to higher values with bacterial than in viral pneumonias. Thrombocytopenia and thrombocytosis are associated with a greater severity of pneumonia and higher mortality.

Procalcitonin(PCT) ,a precursor of calcitonin, is present at higher concentrations in the blood of persons with bacterial infections and [(33)] PCT assays have been used to evaluate the severity, prognosis and evolution of pneumonia. Importantly, procalcitonin is used to deescalate antibiotics or to stop antibiotics when the levels decrease to a certain cut –off point. [(34)].

**RADIOLOGY:**

A diagnosis of CAP can be suspected if at least one of the following findings is present in the chest X ray:

(i) an asymmetric increase in lung opacification with air bronchogram;

(ii) presence of silhouette sign;

(iii) an area of increased opacity, bounded by a well-defined interface against adjacent aerated lung . (such as along a fissure);

(iv) increased attenuation of the cardiac shadow ( in supine AP film);

(v) for radiographs with widespread airspace disease, more asymmetric or multifocal distribution of opacification.

Most often a chest radiograph is also helpful in differentiating CAP from other causes of acute respiratory symptoms like pulmonary oedema, infarction, effusion or tuberculosis. Importantly, up to 50% of patients may not show complete radiographic resolution at 4 weeks and the resolution of chest radiograph findings may lag behind clinical cure during follow-up.

**Microbiological diagnosis :**

Microbiological parameters are required in patients who require hospitalisation: which includes 2 sets of blood cultures (obtained prior to antibiotics), gram stain and culture of a valid sputum sample. Urinary antigen test for detection of *Legionella pneumophila* is done in-endemic areas or during outbreaks. Similarly, stain for acid-fast bacilli and culture of sputum

for tuberculosis are done if suggested by clinical history or radiologic findings. Fungal stain and fungal serologies (if infection by an endemic mycosis is suggested by the clinical history or radiologic findings)are done only in selected cases. Sputum examination for *Pneumocystis jiroveci.* (if suggested by clinical history or radiologic findings) ,nucleic acid amplification tests for *Mycoplasma pneumoniae, Chlamydophila pneumoniae, Chlamydophila psittaci, Coxiella burnetii, Legionella* species, and respiratory viruses(in endemic areas or during outbreaks)should be specifically ordered for**.** Culture and microscopic evaluation of pleural fluid (if significant fluid is present) can also be added.

**ADDITIONAL TESTS FOR ICU PATIENTS:**

Gram stain and culture of endo tracheal aspirate or bronchoscopically obtained specimen using a protected specimen brush or BAL and other procedures done for hospitalized patients, if the initial tests are not conclusive. [1] The latest IDSA/ATS guidelines recommend obtaining a sputum sample for Gram stain and culture in hospitalized patients with the clinical indications listed below, but are optional for patients without these conditions. The Clinical Indications for More Extensive Testing in Community-Acquired Pneumonia are

- Intensive care unit admission
- Failure of the outpatient antibiotic therapy
- Radiographic cavities

- Active alcohol abuse
- Leucopenia
- Chronic severe liver disease
- Severe obstructive lung disease
- Asplenia
- Recent travel in 2 weeks
- Pleural-effusion.

**Antigen testing:**

Commercially available kits for detecting antigens, such as capsular polysaccharide antigen of pneumococcus and legionella pneumophila serotype 1 are easily available. [35,36,37]

The advantages are results will be available in less than one hour and results are unaffected by antibiotics. Moreover the degree of positivity of pneumococcal antigens correlate with the severity. But the problem with Legionella, is only one serotype , L.pneumophila type 1 which is the most common one is only available.

The viruses such as influenza can also be detected rapidly by this method. Nucleic acid amplification techniques for organisms not detected by traditional cultural methods such as Chlamydia, bordetella, and certain viruses are considered as gold standard in diagnosis..

**BAL TESTING**:

Bronchoalveolar lavage has more sensitivity and equal specificity than sputum culture for M.tuberculosis and fungal elements, but poor specificity for bacterias due to oral contamination. [38]

**Differential diagnosis:**

Other conditions mimicking pneumonia are[39]:

- Pulmonary infarction
- ARDS
- Pulmonary edema
- Pulmonary haemorrhage
- Atelectasis
- Lung tumours
- Radiation pneumonitis
- Drug reactions involving lungs
- Pulmonary vasculitis
- Pulmonary eosinophilia
- Organising pneumonias.

They should be considered when there is early disappearance of radiological signs or when the radiological signs are prolonged .

**Approach to pneumonia :**

Once the diagnosis is confirmed it is necessary to evaluate the treatment options**:**. whether patient needs admission, or they can be treated as an outpatient. In case of admission ,the need for ICU admission should be evaluvated.

Clinical examination play a vital role in decision making. However the clinical decision alone has been documented to show either unnecessary admissions or missed patients requiring admissions. The application of the scoring systems in admission and accessing the prognosis has given uniformity and has improved the outcome of the patients ,as they could be appropriately triaged. The initial decision making has a pivotal role in the outcome of the patient as delayed admissions and delayed shifting the patients to ICU has drastically changed the mortality and morbidity of the patients. The scoring systems and bio markers can solve this problem, as they positively correlate with disease severity .The commonly used scoring systems are as follows:

**PSI SCORING :**

The PSI rule is being validated from the Pneumonia Patient Outcomes Research Team (PORT) prospective cohort study which identified patients with CAP and their mortality risks. The PSI further classified adults with CAP into five classes , in accordance with their mortality risk from all causes within 30 days . At the time of patient presentation, variables based upon the

history, physical examination, and a few laboratory and radiographic findings were recorded. PSI is applied in two steps; Step 1 of the rule identifies patients in the lowest risk based upon the absence of 11 demographic, co morbid conditions and examination findings.

The PSI scoring stratifies the remaining patients into risk classes II, III, IV, or V based upon the total amount of points assigned to each risk factor.

| **Demographics** | **Points** |
|---|---|
| Age | Men (age in years) |
| | Women ( age in years-10) |
| Nursing home residents | +10 |
| **Comorbidities** | |
| Neoplastic diseases | +30 |
| Liver diseases | +20 |
| Heart failure | +10 |
| Stroke | +10 |
| Renal failure | +10 |
| **Physical examination** | **Points** |
| Altered mental status | +20 |
| Respiratory rate≥30/minute | +20 |
| Systolic blood pressure <90 mmHg | +20 |
| Temprature below35$^0$c or above 39.9$^0$c | +15 |
| Pulse rate above 124 | +10 |

| Lab investigations | **Points** |
|---|---|
| Arterial pH <7.35 | +30 |
| BUN >29mg per dl | +20 |
| Sodium<130mg per dl | +20 |
| Glucose ≥ 250mg per dl | +10 |
| Hematocrit <30 % | +10 |

| | |
|---|---|
| Partial pressure of arterial oxygen <60 per cent | +10 |
| Pleural effusion on X ray | +10 |

The total points are calculated and based on scores divided into 5 classes.

Class 1 - below 51 and class 2 with score between 51 -70 carry 0.4% and 0.7% mortality respectively. Hence these Patients can be managed as outpatients.

Class 3 with scoring between 71-90 carry 2.8% mortality and hence brief course of hospitalisation is required.

Class 4 with scores from 91-130 and class 5 above 130 carry mortality rates of 8.5 % and 31.1% respectively. Hence all of them needs hospitalisation. The class 5 patients have mortality of 33% and hence require ICU admissions.[40]

**Limitations :**

The PSI rule may oversimplify the interpretation of some predictor variables as the exact value is not considered. As an example, using PSI scoring systolic blood pressures below 90 mmHg are considered abnormal. However, a systolic blood pressure of 40 mmHg, probably has a markedly different implication than that of 80 mmHg ,though the same points are assigned to both.

A more practical limitation to its routine use in the ED is its perceived complexity by most clinicians. Calculating a score based upon 19 variables, in a two-step method and classifying them based on the risk factors to finally deciding an appropriate site for therapy can be too time- consuming especially in a busy ED.

The prediction rule is intended to supplement, rather than substitute the clinician's judgment. Individual factors other than the predictors included in the rule may be important, when making an admission decision for patients with CAP.

A study by Labarere J, et al. 2007 included patients evaluation in emergency departments with CAP. ,Among those patients with low risk (PSI classes I to III, no arterial oxygen desaturation, or psychosocial contraindications to outpatient therapy) compared the outcomes of 944 patients who were treated on an outpatient basis with 549 who were hospitalized[41]. Mortality at 30 days was higher for inpatients (2.6 versus 1.0 percent), suggesting physician judgment was an appropriate adjunct to the risk stratification score. After matching for potential confounding factors, there was no difference in the overall mortality, but the outpatient treatment was associated with an earlier return to usual activities and to work.

The presence of certain co morbidities may necessitate a more intensive therapy than recommended by the PSI rule. Finally, the rule is applicable to adult patients with CAP, and specifically excludes children, pregnant women,

immuno compromised patients with pneumonia, or those with nosocomial or aspiration pneumonia.

**CURB 65 scoring:**

The British thoracic society recommends a simple score with one point for each findings at presentation: [41.42]

(1) Confusion;

(2) BUN more than 19 mg/dl or more than 7 mmol/L

(3) Respiratory rate of 30/min or more

(4) Low systolic(<90mmHg) or diastolic (<60mmHg) blood pressure; and

(5) Age 65years or above.

Out patient treatment is recommended for 0or 1 point. Brief in patient or supervised outpatient care is recommended for 2 points, and hospitalisation is recommended for 3 or greater.

CURB -65(74.6%) is more specific than PSI (52.2%) in predicting ICU admissions . But PSI has more sensitivity than CURB 65 in predicting ICU admissions.[43]

**CRB65**

A simplified version (CRB-65), was devised which did not require any laboratory testing and is appropriate for decision-making even at the primary health care centre. But here the hospitalization is recommended if one or more

points are present. The CRB65 score has been specifically studied in over 6000 patients both in community hospitals and tertiary care hospitals. All studies reported findings similar to the derivation study and, in some studies, the CRB65 score was reported to be of similar discriminatory value to the CURB65 score.

**ATA/IDSA CRITERIA :**

The 2007 International Disease society of America(IDSA/ATS) guidelines for the management of CAP identified two major criteria for direct admission to an intensive care unit (ICU) .[44]

(1) Septic shock requiring vasopressor support and

(2) Requirement for mechanical ventilation

The presence of either criterion requires ICU care.

Criteria to Consider Admission to an Intensive Care Unit for Patients with Community-Acquired Pneumonia without Shock or Respiratory Failure

- Respiratory rate> 30breaths/min
- Pao2/F102ratio<250 (or) arterial saturation<90% on room air
- Multi lobar / bilateral radiographic involvement or pleural effusion
- Confusion or disorientation
- Uremia (BUN level>20mg/dl)
- Leucopenia(WBCcount<4000cells/dl)(or)extreme leukocytosis (>20,000cells/dl)

- Thrombocytopenia (platelet count<100,000cells/dl)
- Hypothermia(core temperature<36°C)
- Hypotension requiring aggressive fluid resuscitation

Presence of at least 1 major or three minor is required for hospitalisation.

**Comparison between CURB 65 and PSI：**

CURB-65 is a severity of illness score, whereas PSI is a prognostic model. Pneumonia Severity Index (PSI), CURB-65, and CURB were compared in predicting 30- day mortality in a prospective study of 3181 adults with CAP[45]. Overall, the PSI classified 68 percent of the patients as low risk, the CURB 51 percent AND the CURB-65 61percent[46]. The PSI was better than CURB-65 scores in predicting no of days of hospital stay and 28 day mortality. However, there are no randomized trials of hospital admission strategies that directly compare the 2 scoring systems.[47,48]

In addition, no prospective criteria have been validated for the decision making process for an ICU admission.[48] PSI also underperforms in the elderly population, probably secondary to the inappropriate weight given to the age variable in the scoring system. As elderly patients often have atypical presentations and worser outcomes this may account for a high number of inappropriately triaged cases.

**PIRO SCORING :**

PIRO(Predisposition, Insult, Response, and Organ dysfunction) was developed to predict mortality among patients with severe CAP admitted to the ICU and was compared with the APACHE-II score and the ICU admission criteria recommended by the IDSA/ATS. [49] The PIRO score was calculated in 529 patients within 24 hours of ICU admission, by giving one point when each of the following variables was present, with a maximum achievable score of 8: co morbidities

- Chronic obstructive pulmonary disease,
- Immuno compromised and age >70 years,
- Multi-lobar opacities on chest radiograph,
- Shock,
- Severe hypoxemia,
- Acute renal failure,
- Bacteremia, and
- Acute respiratory distress syndrome.

The mean PIRO score was significantly higher in non-survivors than survivors (4.6 versus 2.3). The 28 days Mortality with the PIRO scores are as follows.

- Low (0 to 2 points) — 3.6percent
- Moderate (3 points) — 13percent
- High (4 points) — 43percent
- Very high (5 to 8 points) — 76percent.

The PIRO score performed better than APACHE-II score and ATS/IDSA .

**Treatment of CAP**

The standard therapy for inpatient empirical antibiotic coverage of CAP is usually one of these two regimens: Either the combination of a second-or third-generation cephalosporin combined with a macrolide or one of the fluoroquinolone with efficacy against respiratory pathogens (levofloxacin, moxifloxacin, or gatifloxacin).

The North American guidelines recommend that any empirical regimen for CAP should be active against" atypical" pathogens such a M.pneumoniae, C. pneumoniae and L.pneumophila. Retrospective analyses of patients hospitalized with CAP indicate that regimens that cover "atypical" pathogens and those that follow recommendations made by the ATS and the IDSA are associated with improved clinical outcomes. In contrast, some Northern European guidelines suggest atypical coverage is not needed in the patients who don't have clinical features suggestive of atypical pathogens.

It is-important to recognize that, all CAP treatment guidelines, are based on broad epidemiological considerations, that may vary by location. Variation from these regimen should be based on specific epidemiological or clinical characteristics that strongly suggest one of the less common CAP pathogens such as mixed aerobic-anaerobic flora due to aspiration or presence of gram-negative Enterobacteriaceae or P.aeruginosa inpatients with specified risk factors.

When tuberculosis is a possibility, fluoroquinolone should be used cautiously in CAP, because as little as 10 days of fluoroquinolone

administration is sufficient to cause fluoroquinolone –resistant M..tuberculosis.

The greatest factor to consider in the choice of regimens is a history of recent use of any of the anti microbial agents. Widespread fluoroquinolone use, especially in sub-therapeutic doses, and use of ciprofloxacin has been associated with fluoroquinolone resistance in upto 13°/o of S. pneumoniae isolates in Hong Kong. Fluoroquinolone resistance and subsequent treatment failures are reported in pneumococcal CAP, but this is less common with use of the fluroquinolone that have improved activity against respiratory pathogens. In contrast, the frequency of macrolide resistance in S.pneumoniae is increasing, and a macrolide should not be used for monotherapy of S. pneumoniae infection unless in vitro testing confirms that the patient's strain is susceptible to macrolide.

Empirical antibiotic treatment of severe CAP(SCAP) remains controversial ,predominantly due to a lack of treatment studies specifically focused on CAP. The spectrum of etiologies clearly are found greater varied than in CAP, but so called ,penicillin -sensitive pneumococci are still the most likely causative organism. Whether CAP justifies more aggressive diagnostic testing or broader spectrum empirical treatment in all cases has not been established through broader studies.

Retrospective studies suggest that, combination therapy specifically for severe pneumococcal pneumonia and for SCAP in general, are associated with

lower mortality. . In a large cohort of older patients with CAP needing hospitalization, antibiotic treatment including azithromycin was associated with lower 90-day risk mortality compared with other antibiotics.

**Biomarkers in pneumonia** :

Nevertheless, pneumonia is a multi systemic disease ,having cardiovascular implications. Immunity and immune regulation , coagulation cascade are all altered. It is more a catabolic state with decreased protein synthesis. So the biomarkers can be used as an excellent predictor of disease activity . The common biomarkers used are [7,50,51]

- CRP
- Serum albumin
- Pro calcitonin
- IL-6
- Proadrenomedullin
- Red cell distribution width
- D-dimer
- BNP
- Kalistatin
- Vistatin
- Copeptin
- Vitamin D

- IL 6, high CURB 65 and pleural effusion in chest X Ray are early predictors.
- CRP and pro calcitonin are late predictors, increased in severe disease. CRP and IL -6 are more accurate predictors in prognosis and mortality[51].
- CRP<100 mg/dl generally has lesser mortality than in patients with CRP>100 mg/dl.
- Kalistatin is a serine protease inhibitor. They have a pivotal role in transport, inflammation and in regulation of blood pressure.
- Platelet counts less than one lakh and more than four lakhs have poorer prognosis..
- SUPAR-soluble urokinase type Plasminogen Activator Receptor has a positive correlation with immune system activation and regulation.
- Vistatin - This is a pre B -cell colony enhancing factor. This molecule in studies have been found to be strongly correlated with prognostic scores CURB -65 and PSI scoring.
- Vitamin D levels in pneumonia: The role of vitamin D in immuno modulation is well established. Vitamin D deficiency is observed in systemic inflammatory states such as pneumonia. Increased cortisol levels with decrease in vitamin D levels can be used along with CURB 65 and PSI scoring for prognosis.

Though multiple biomarkers have been described , the utility in clinical practice is highly questionable. Most of them are not readily available in all

hospitals except in certain tertiary centres .Even in a higher tertiary centres , they need to be available round the clock , so that they can be useful in appropriate setting and triaging the cases. But these markers aren't available round the clock. More ever their cost is also very high ,which prevents them being used frequently for monitoring the disease activity. Hence the need for a biomarker that is easily available ,that is also cost effective and which can be repeatedly used for monitoring the disease arises.

**Serum albumin in community acquired pneumonia.:**

It has been evaluated that serum albumin measured within 24 hours of admission, is an excellent marker for prognosis and identifying high risk cases.[5,6] The combination of serum albumin with PSI /CURB 65 has enormously increased the sensitivity and specificity in identifying the complications.[6,53,54] . The prospective cohort study involving 3463patients in 2014 demonstrated the effect of hypoalbuminemia (The levels of albumin <3 gm/dl ) in mortality and complications of CAP .

Albumin is a protein synthesised in the liver. The name albumin is derived from white precipitate formed while boiling the egg .It is derived from Latin word, albus which denotes white colour. The half life of albumin is about 20 days. The daily synthesis of albumin by liver is approximately 12 grams . They are distributed in vascular compartment and in CSF and in interstitial fluid. The functions of albumin are diverse

- ❖ It maintains colloidal osmotic pressure of plasma by exerting effective osmotic pressure.
- ❖ Transport all the substances that can't dissolve in plasma.
- ❖ It provides nutrition to cells as all tissues can take albumin by pinocytosis and break the amino acids
- ❖ Albumin has histidine residues that contributes to buffering action in plasma.

Albumin is a negative phase reactant, that decreases during an inflammatory response. The other negative phase reactants are transthyretin ( pre albumin), Retinol binding protein and transferrin.. The mechanisms underlying hypoalbuminemia in hospitalised patients are diverse[6,7]. The bacteria and other organisms can induce an inflammatory response releasing IL-6 therby inhibiting the synthesis of the albumin by the hepatocytes .The chemokines also contributes, by increasing the vascular permeability which causes the release of albumin in extra vascular space leading to hypoalbuminemia.

Additionally stress ,surgical causes ,poor nutrition and post radiation are the other contributing factors for decreased albumin. Multiple studies were done to find the correlation between the nutritional status and the albumin levels on day of admission in pneumonia and sepsis.[53,54] However there was no correlation observed between the nutritional status and

hypoalbuminemia These studies fail to support the use of albumin supplementation in pneumonia patients with decreased albumin.

But on contrary , the albumin has some protective effects in systemic diseases. They tend to regulate acid base mechanisms, they offer protection against oxidative damage. They also have an anti apoptotic effect, and they transport cortisol and thyroxine which may be useful in inflammatory states. But the studies on large ground failed to demonstrate the usefulness in administering albumin infusions during the inflammatory phase. No differences in mortality and outcome parameters were observed between group receiving normal saline and group receiving albumin. Thus to conclude serum albumin levels within 24 hours was a good marker in predicting the complications.[11,12,16] Addition of albumin to scoring systems has greatly enhanced the sensitivity and specificity in predicting complications.[7,12,16]

Hence serum albumin estimation is now included in newer scoring systems. The recent scoring systems which include the albumin levels are :

**EXPANDED CURB 65:**

It includes CURB 65 scoring and includes three other extra parameters with it. They are

- LDH >230 micrograms/litre
- Serum albumin <3.5 gm/dl
- Platelet count < 1 lakh.

As discussed above the serum albumin levels decrease in CAP. The cytokines shift the amino acids to synthesise the acute phase reactant proteins and hence serum albumin levels were good predictor of the severity. The enzymatic level of LDH are increased in any tissue injury as they are abundant in cytoplasm, so the levels of LDH roughly reflects the extent of lung tissue damage.

The low platelet count also is a poor prognostic factor. Low platelet count can be attributed to sepsis, disseminated intra vascular coagulation, and associated liver disease all of which are poor prognostic features.

In recent studies,[55] expanded CURB 65 had most sensitivity in mortality prediction and had the highest negative predictive value. They are particularly useful in cirrhotic patients who have high mortality.

# MATERIALS AND METHODS

# MATERIALS AND METHODS

The present study titled" **A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB-65 AND PSI SCORING"** was carried out in the Institute of Internal Medicine, Rajiv Gandhi Government General Hospital and Madras medical college ,Chennai.

1. **Study design :** Cross sectional prospective study.

2. **Period of study:** January 2018 to October 2018

3. **Materials :**

- Questionnaire, Age, Blood pressure, respiratory rate, temperature, pulse rate
- Haematological: Haematocrit, Total leucocyte count.
- Renal Parameters : Blood urea ( BUN calculated), Serum creatinine.
- Serum albumin levels on day 0,3 ( if applicable) & 7 (if applicable)
- Blood sugars.
- Chest X-Ray.
- Sputum-gram stain, AFB, culture and sensitivity.
- HIV STATUS
- ARTERIAL BLOOD GAS ANALYSIS
- Investigations in selected cases: USG ABDOMEN

**STUDY GROUP** :

The study group included 100 persons with symptoms and signs of community acquired pneumonia as described by the inclusion criteria admitted in wards of institute of Internal Medicine,RGGGH.

**INCLUSION CRITERIA :**

1. Age > 18 years of both sex
2. Patients with community acquired pneumonia, with atleast 2 clinical signs and symptoms related to pneumonia {fever, cough, chestpain, dyspnoea, and crackles on auscultation}
3. New infiltrates on chest x-ray.

## EXCLUSION CRITERIA :

- Patients of age<18 years
- Patients with chronic liver /kidney disease
- Burns.
- Malabsorbption syndromes & Malnutrition status.
- HIV infection
- Organ transplant recipients
- On immunosupressants and steroids
- Pregnancy& Lactation
- Symptoms after 48 hrs of hospitalisation

All patients in the study group were selected without any bias for sex, age duration, or severity . Patients with COPD and diabetes were also included in this study. After admission of cases based on PORT /PSI (Pneumonia Outcome Research Trial ) /CURB-65 scores ,a detailed history and clinical examination will be done along with chest X-ray to establish the diagnosis.

Routine haematological investigations along with serum albumin levels on day 0,3 & 7/discharge will be carried out. The lab values of serum albumin will be analysed with the clinical profile and outcome in these study groups. The data will be compiled & appropriate statistical test will be applied.

**METHOD EMPLOYED**;

Serum albumin is measured by bromocresol green dye binding technique using a spectrophotometer.

**CURB -65 CALCULATION**

C-Confusion ( new confusion to time , place and person ).

U- Blood urea nitrogen more than 19 mg/dl

R- Respiratory rate of 30 and more

B-Low systolic(<90mmHg) or diastolic(<60mmHg) blood pressure;

Age 65 years or more.

**BUN CALCULATION:**

BUN(mg/dl) =urea (mg/dl) ÷ 2.1428 and 1 point is given if the value is above 19 mg/dl

1 point is given for each variable and total score is calculated.

**PSI SCORING:**

| Demographics: | | Points: |
|---|---|---|
| Age | Men | (age in years) |
| | Women | ( age in years-10) |
| Nursing home residents | | +10 |

**Comorbidities:**

| | |
|---|---|
| Neoplastic diseases | +30 |
| Liver disease | +20 |
| Heart failure | +10 |
| Stroke | +10 |
| Renal failure | +10 |

**Physical examination :**

| | |
|---|---|
| Altered mental status | +20 |
| Respiratory rate≥30/minute | +20 |
| Systolic blood pressure <90 mmHg | +20 |
| Temprature below$35^0$ c or above $39.9^0$c | +15 |
| Pulse rate above 124 | +10 |

**Lab Investigation**

| | |
|---|---|
| Arterial pH <7.35 | +30 |
| BUN > 29 mg per dl | +20 |
| Sodium<130mg per dl | +20 |
| Glucose ≥ 250mg per dl | +10 |
| Haematocrit<30 % | +10 |
| Partial pressure of arterial oxygen <60 per cent | +10 |
| Pleural effusion | +10 |

The age in years is added for males.10 points are subtracted from age for females . The comorbid diseases are considered while history taking and accessing the baseline liver function tests , renal function tests, heart diseases,stroke and cancer.

The ABG is taken and arterial pH is measured. BUN value is calculated from blood urea as mentioned above. Serum sodium levels are measured.. Serum blood glucose estimation will be done. Haematocrit from blood counts, Pao2 is taken from ABG and pleural effusion is detected either by clinical methods or through chest radiography,and the scores are calculated accordingly. The following parameters are measured and compared with the albumin levels on day 0 , day3 and day 7.

- No of days to reach clinical stability (no of days in which all vitals of the patient are stabilised which includes heart rate, blood pressure, temperature and respiratory rate.) [14]
- Total no of days of hospital stay
- No of patients requiring mechanical ventilation.
- No of patients requiring vasopressors
- No of patients developing empyema

**Statistical Analysis Plan:**

Data analysed using statistical package - SPSS Software

pearson correlation coefficient and p value have to be calculated and statistical significance has to be established.

$p < 0.05$ - Significant

$p > 0.05$ - Not Significant

$p < 0.0001$ - Highly Significant

**Consent**

All participants / attenders gave written informed consent.

**Ethical Committee Approval**

Institutional Ethics Committee of Madras Medical College approved the study.

# OBSERVATION AND RESULTS

# RESULTS AND ANALYSIS

The present study titled **"A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB-65 AND PSI SCORING"** was undertaken in the Institute of Medicine ,Rajiv Gandhi Government General Hospital and Madras Medical College, Chennai over a period of 10 months from January 2018 to october 2018.

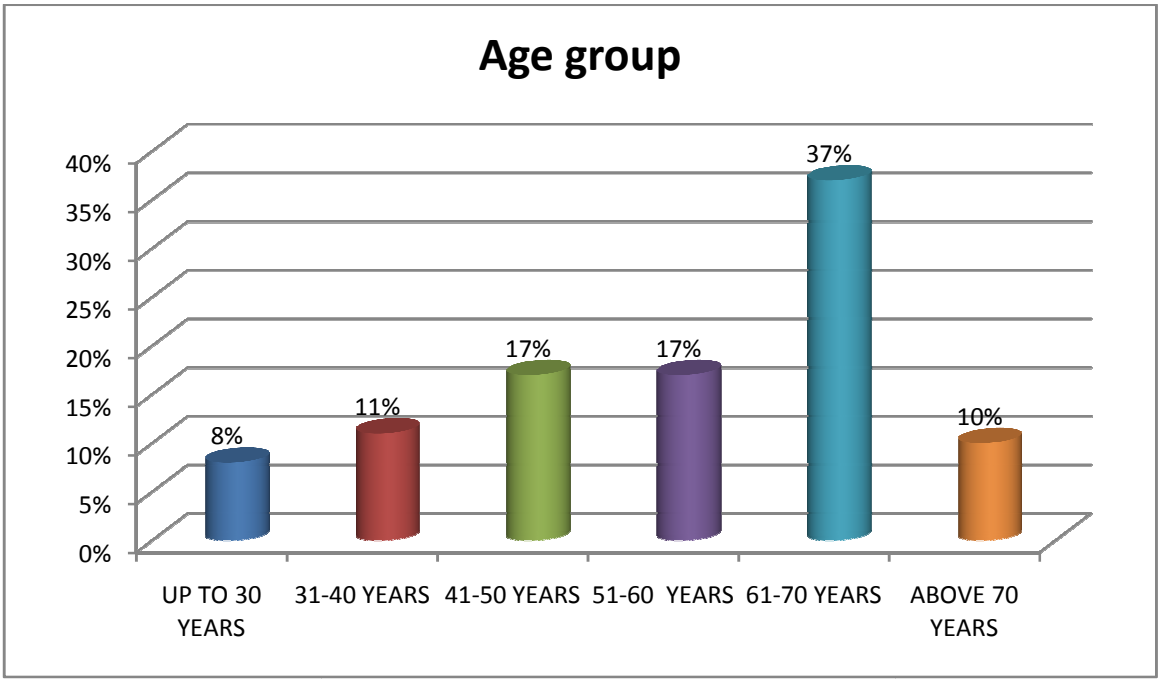
The study sample included 100 patients with pneumonia in the wards and following were the observations

TOTAL CASES-100

## AGE DISTRIBUTION : TABLE 1

| AGE GROUP | FREQUENCY | PERCENT |
|---|---|---|
| UP TO 30 YEARS | 8 | 8.0 |
| 31-40 YEARS | 11 | 11.0 |
| 41-50 YEARS | 17 | 17.0 |
| 51-60 YEARS | 17 | 17.0 |
| 61-70 YEARS | 37 | 37.0 |
| ABOVE 70 YEARS | 10 | 10.0 |
| Total | 100 | 100.0 |

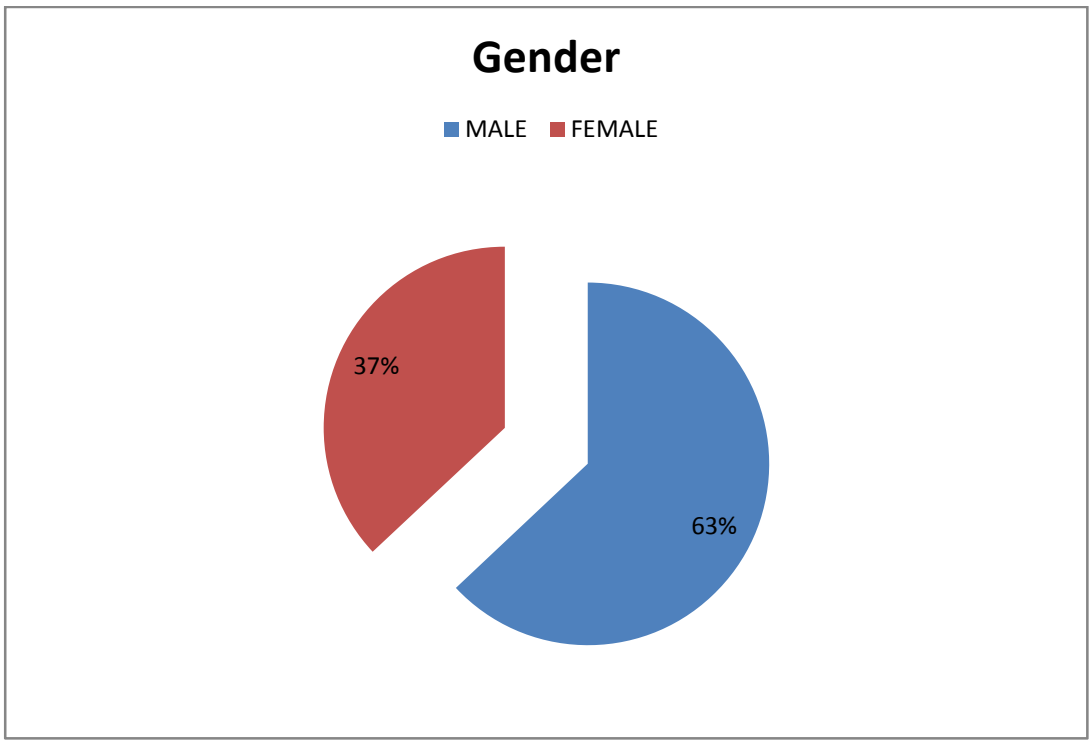
In our study, we found that most cases in our study were between age of 50-70(54%) and particularly more crowding was seen from 60 -70 years of age(37%).



## SEX DISTRIBUTION :

| GENDER | FREQUENCY | PERCENT |
|---|---|---|
| MALE | 63 | 63.0 |
| FEMALE | 37 | 37.0 |
| Total | 100 | 100.0 |

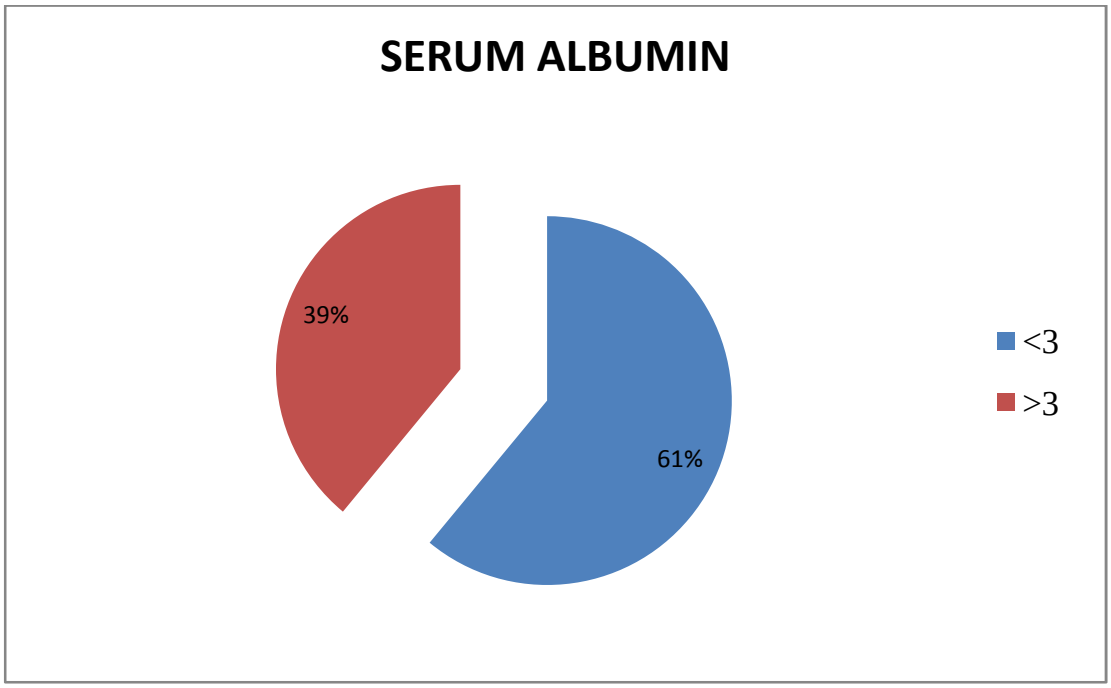
Our study had a male predominance with 63% males and this could be attributed to smoking and COPD as a common assosciation in many cases.



**SERUM ALBUMIN LEVELS:**

| SERUM ALBUMIN | FREQUENCY | PERCENT |
|---|---|---|
| <3 | 61 | 61.0 |
| >3 | 39 | 39.0 |
| Total | 100 | 100.0 |

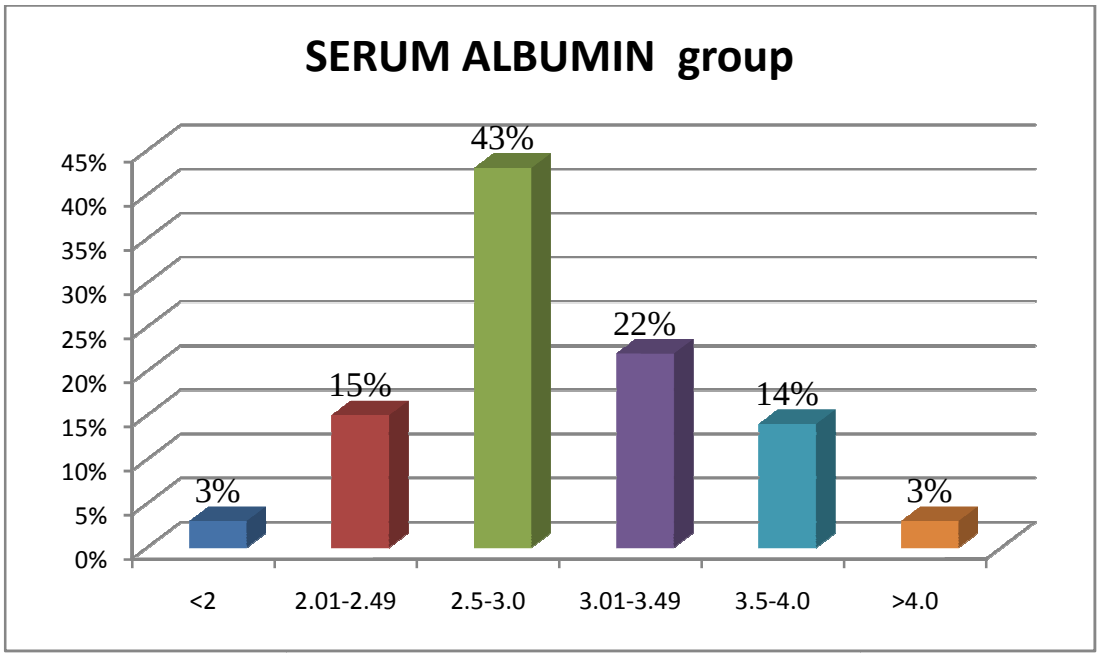
Most of the PTS had hypoalbuminemia(serum albumin less than 3 mg/dl in this study. 61% had serum albumin less than 3 gm/dl on admission.



**CLASSIFYING THE PATIENTS INTO 6 GROUPS BASED ON SERUM ALBUMIN LEVELS**

| SERUM ALBUMIN | FREQUENCY | PERCENT |
|---|---|---|
| <2 | 3 | 3.0 |
| 2.01-2.49 | 15 | 15.0 |
| 2.5-3.0 | 43 | 43.0 |
| 3.01-3.49 | 22 | 22.0 |
| 3.5-4.0 | 14 | 14.0 |
| >4.0 | 3 | 3.0 |
| Total | 100 | 100.0 |

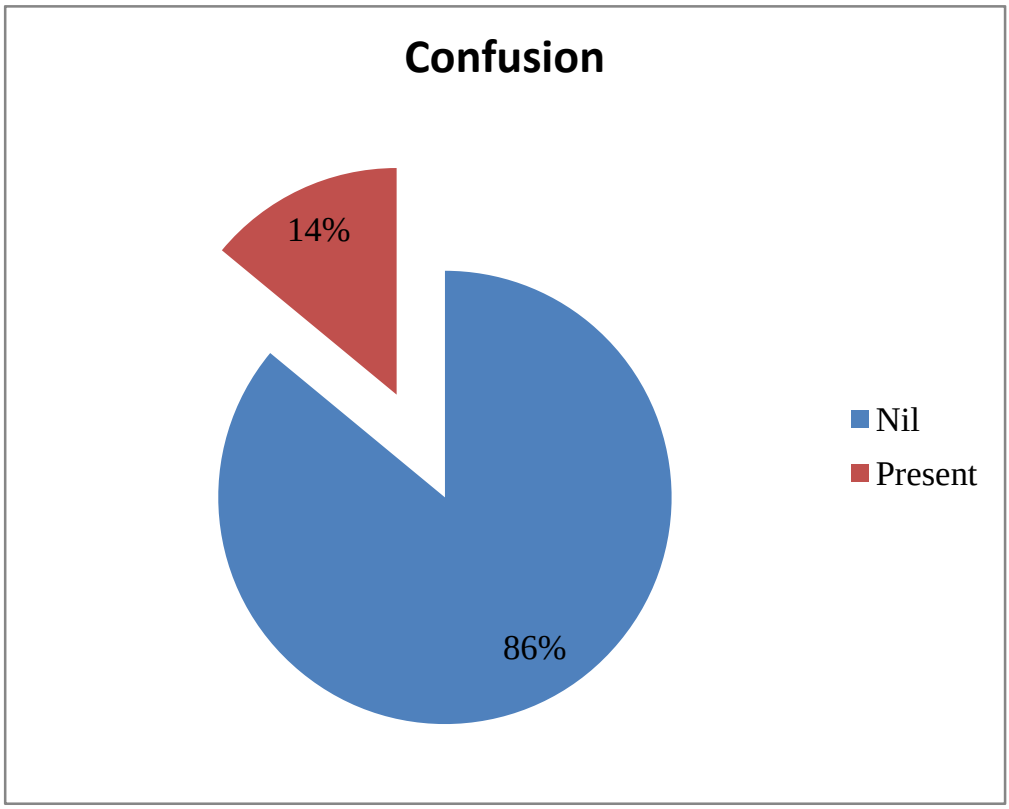
Most of them had serum albumin levels between 2.5-3.5 (65%). only very few were below 2 and above 4.



**CONFUSION :**

| CONFUSION | FREQUENCY | PERCENT |
|---|---|---|
| Present | 14.0 | 14.0 |
| Nil | 86.0 | 86.0 |
| Total | 100 | 100.0 |

In our study, 14% of the patients had confusion (new disorientation to time, place and person) while presentation. Most of them were above the age of 60.No sex predilection was found.

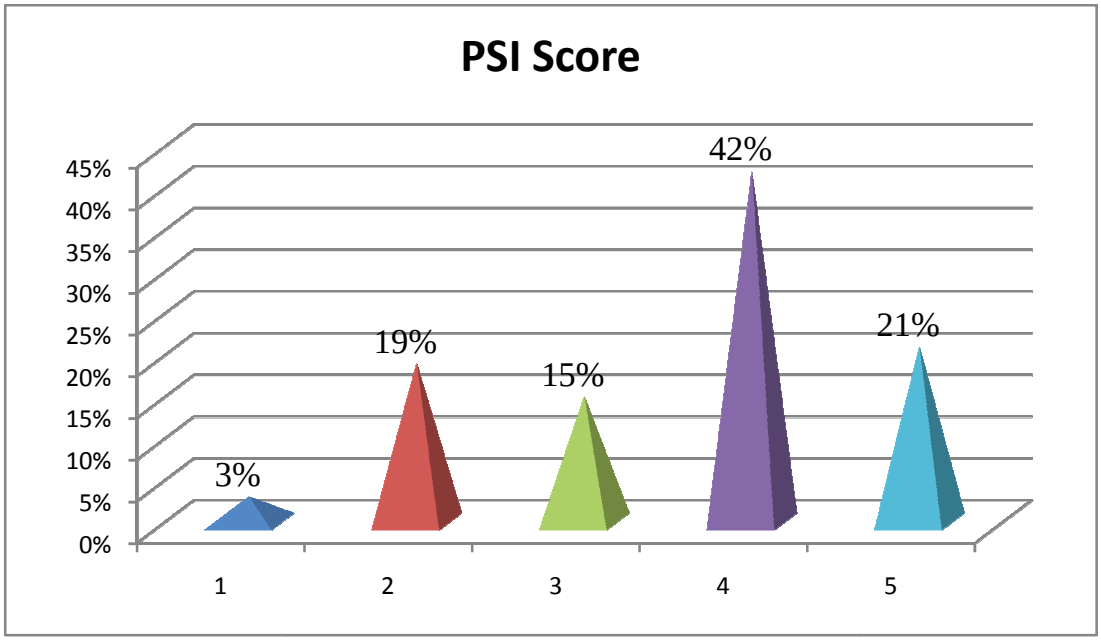


**PSI SCORING :**

The results of PSI Scoring for 100 patients are as follows:

| PSI SCORE | FREQUENCY | PERCENT |
|---|---|---|
| 1.00 | 3 | 3.0 |
| 2.00 | 19 | 19.0 |
| 3.00 | 15 | 15.0 |
| 4.00 | 42 | 42.0 |
| 5.00 | 21 | 21.0 |
| Total | 100 | 100.0 |

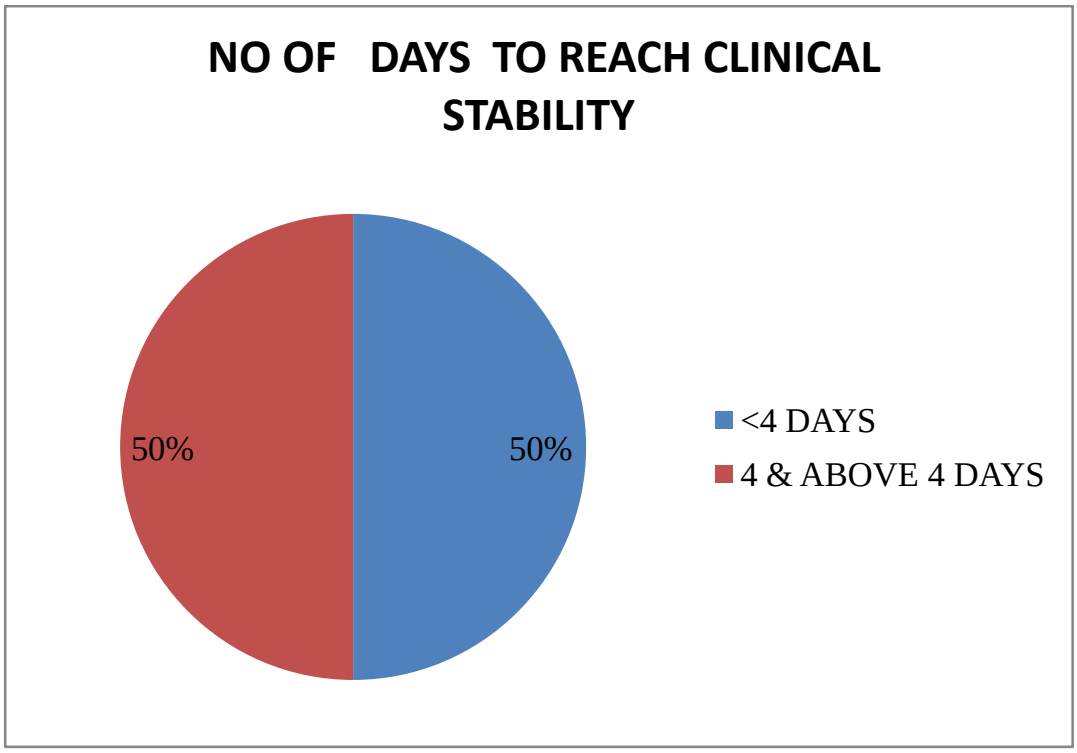
Most of the hospitalised patients were above PSI score of 4 and 5.(63 % ).Class 4 was the commonest contributing about 42% in our study.



## CLINICAL STABILITY SCORE:

| CLINICAL STABILITY SCORE | FREQUENCY | PERCENT |
|---|---|---|
| 4 or more than 4 DAYS | 50 | 50.0% |
| < 4 DAYS | 50 | 50.0% |
| Total | 100 | 100.0% |

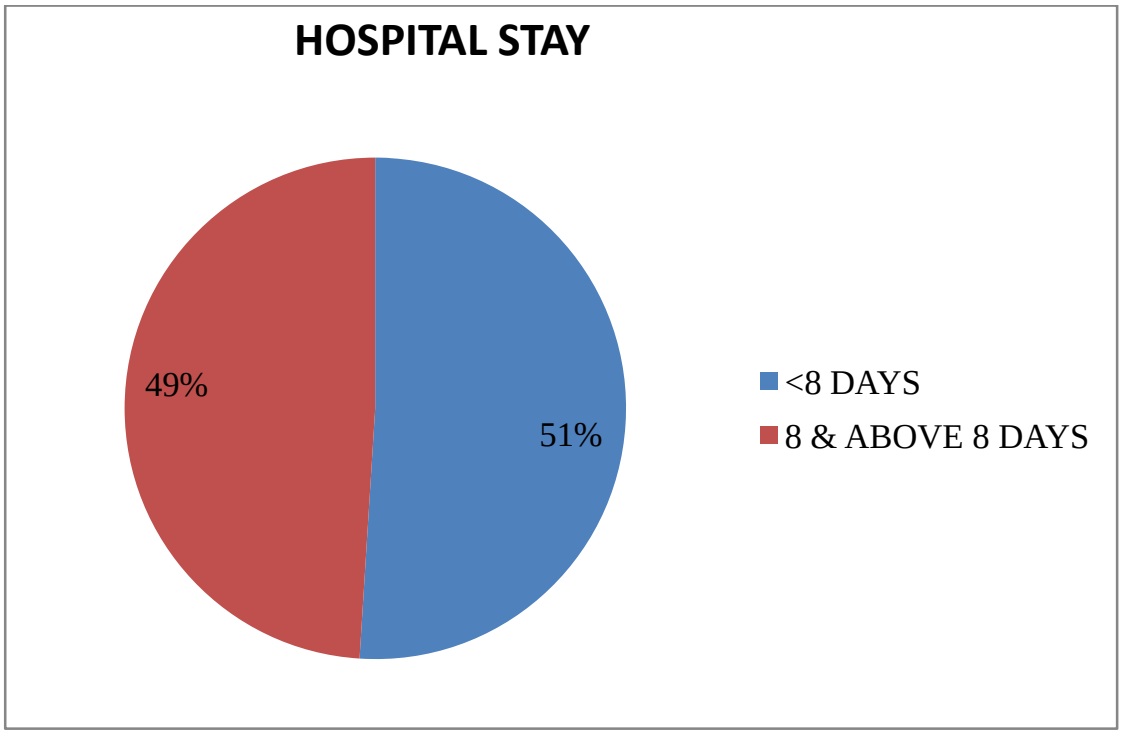
Half of them reached clinical stability in less than 4 days in our study.



**NO OF DAYS OF HOSPITAL STAY :**

| NO OF DAYS OF HOSPITAL STAY | FREQUENCY | PERCENT |
|---|---|---|
| 8 DAYS or above | 49.0 | 49.00% |
| Below 8 days | 51 | 51.0% |
| Total | 100 | 100.0% |

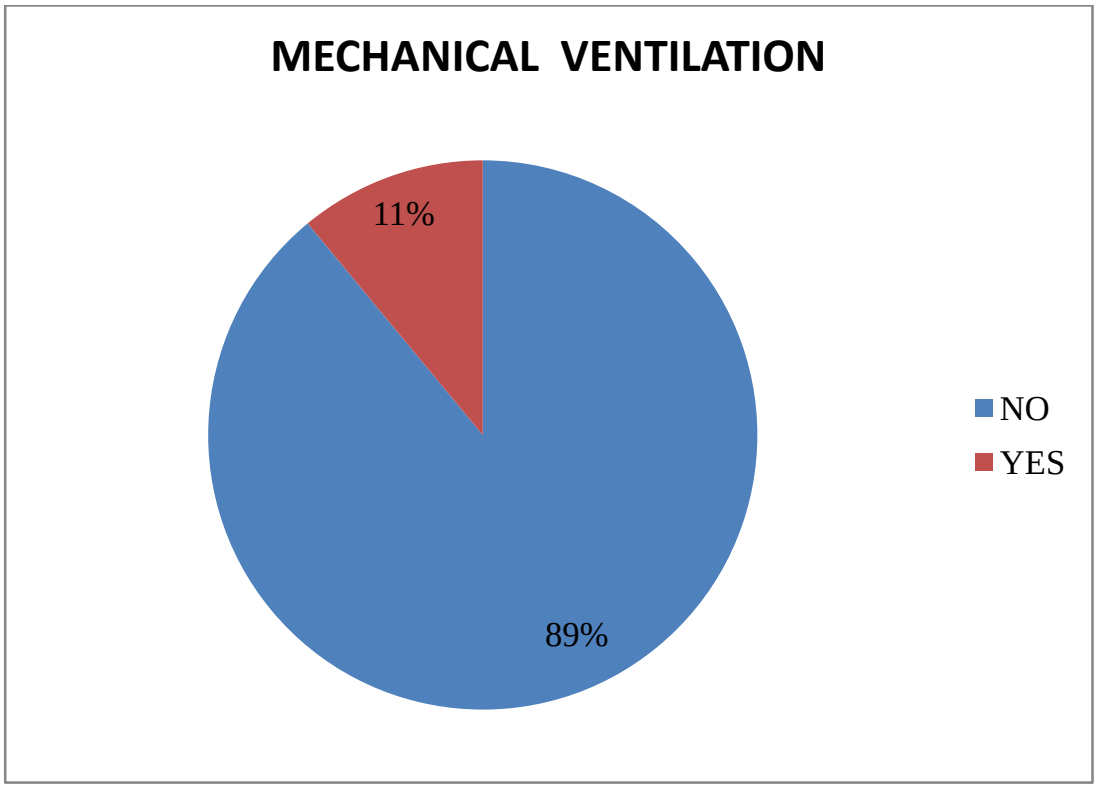
More or less there were equal persons in both groups.



## NEED FOR MECHANICAL VENTILATION :

11 out of 100 persons in our study needed mechanical ventilation.

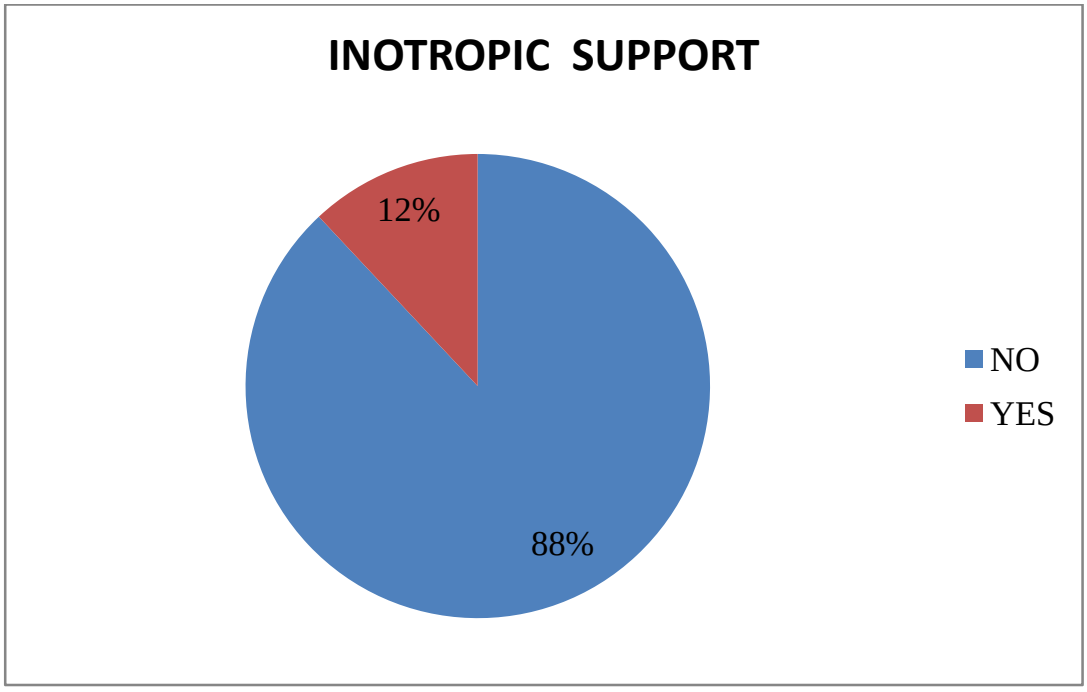
| MECHANICAL VENTILATION | FREQUENCY | PERCENT |
|---|---|---|
| Yes | 11 | 11.0% |
| No | 89 | 89.0% |
| Total | 100 | 100.0% |



## NEED FOR INOTROPIC SUPPORT:

12 persons in our study needed inotropic support

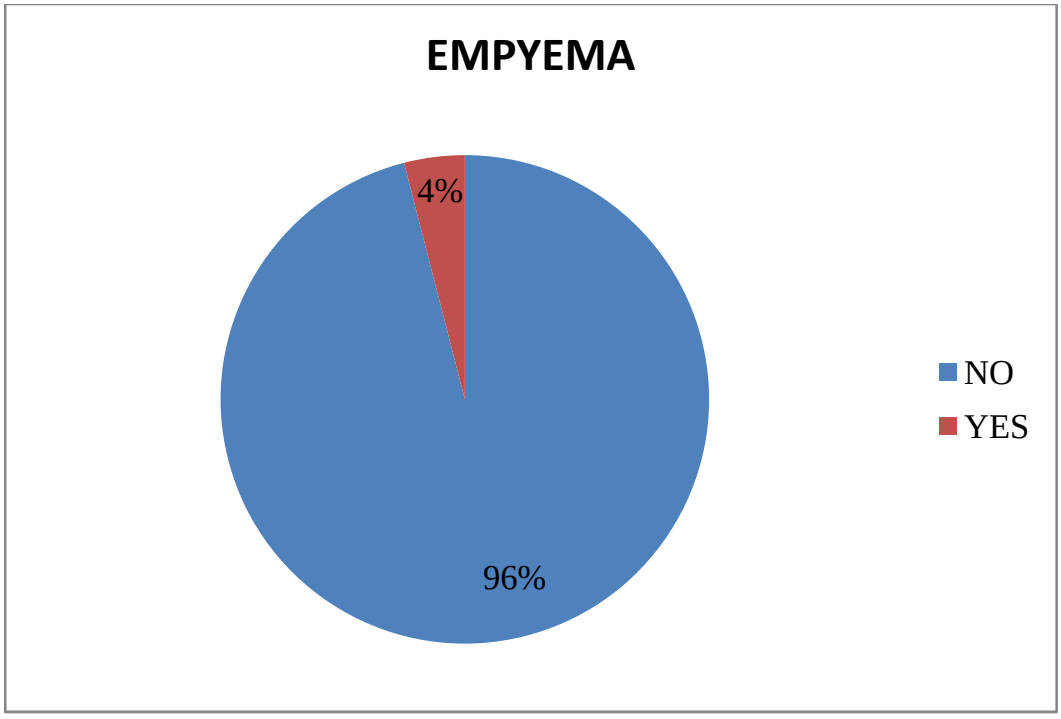
| INOTROPIC SUPPORT | FREQUENCY | PERCENT |
|---|---|---|
| YES | 12 | 12..0% |
| No | 88 | 88.0% |
| Total | 100 | 100.0% |



**EMPYEMA :**

Only four patients out of 100 patients, developed empyema .in our study.

| EMPYEMA | FREQUENCY | PERCENT |
|---|---|---|
| YES | 04 | 4.0% |
| NO | 96 | 96.0% |
| Total | 100 | 100.0% |

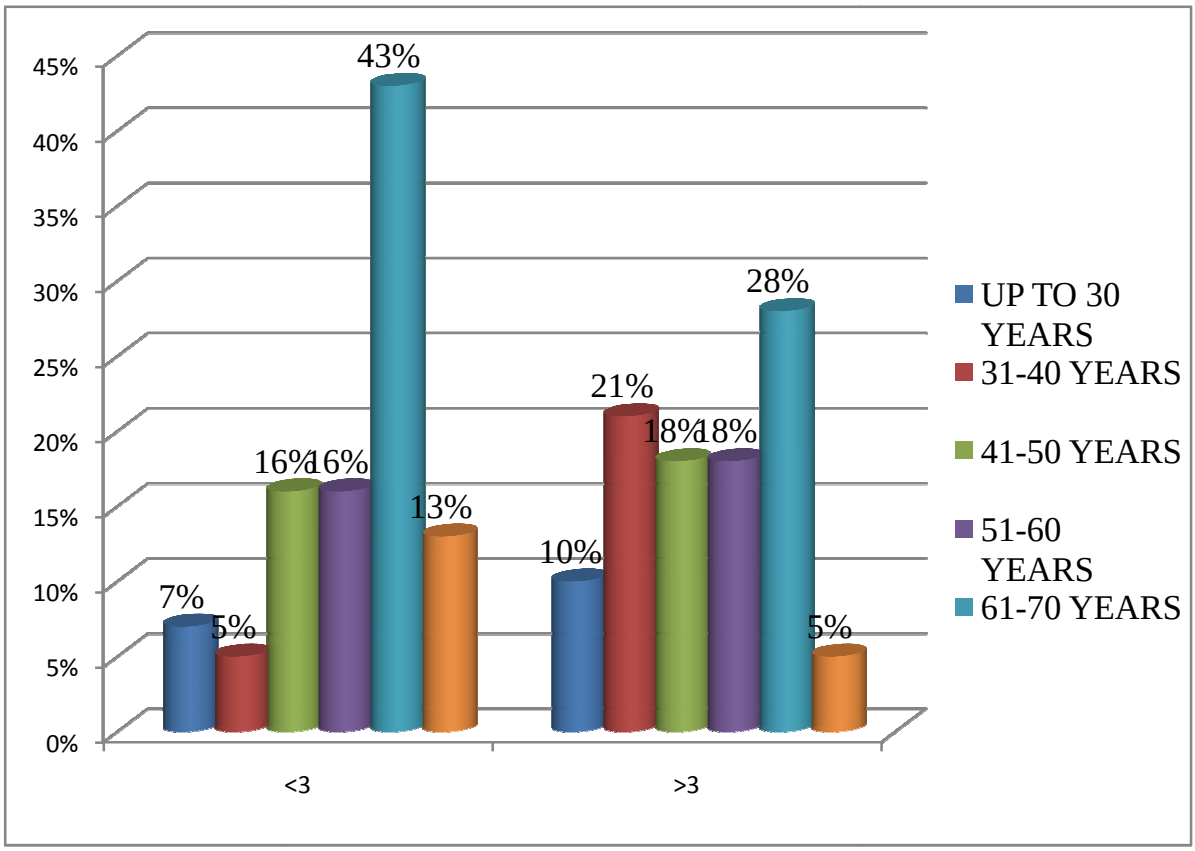


**SERUM ALBUMIN LEVELS DISTRIBUTION ACCORDING**

**TO THE AGE:**

| AGE GROUP | | | SERUM ALBUMIN levels | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| | UP TO 30 YEARS | Count | 4 | 4 | 8 |
| | | % | 6.6% | 10.3% | 8.0% |
| | 31-40 YEARS | Count | 3 | 8 | 11 |
| | | % | 4.9% | 20.5% | 11.0% |
| | 41-50 YEARS | Count | 10 | 7 | 17 |
| | | % | 16.4% | 17.9% | 17.0% |
| | 51-60 YEARS | Count | 10 | 7 | 17 |
| | | % | 16.4% | 17.9% | 17.0% |
| | 61-70 YEARS | Count | 26 | 11 | 37 |
| | | % | 42.6% | 28.2% | 37.0% |
| | ABOVE 70 YEARS | Count | 8 | 2 | 10 |
| | | % | 13.1% | 5.1% | 10.0% |
| **Total** | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=8.588 P=0.127



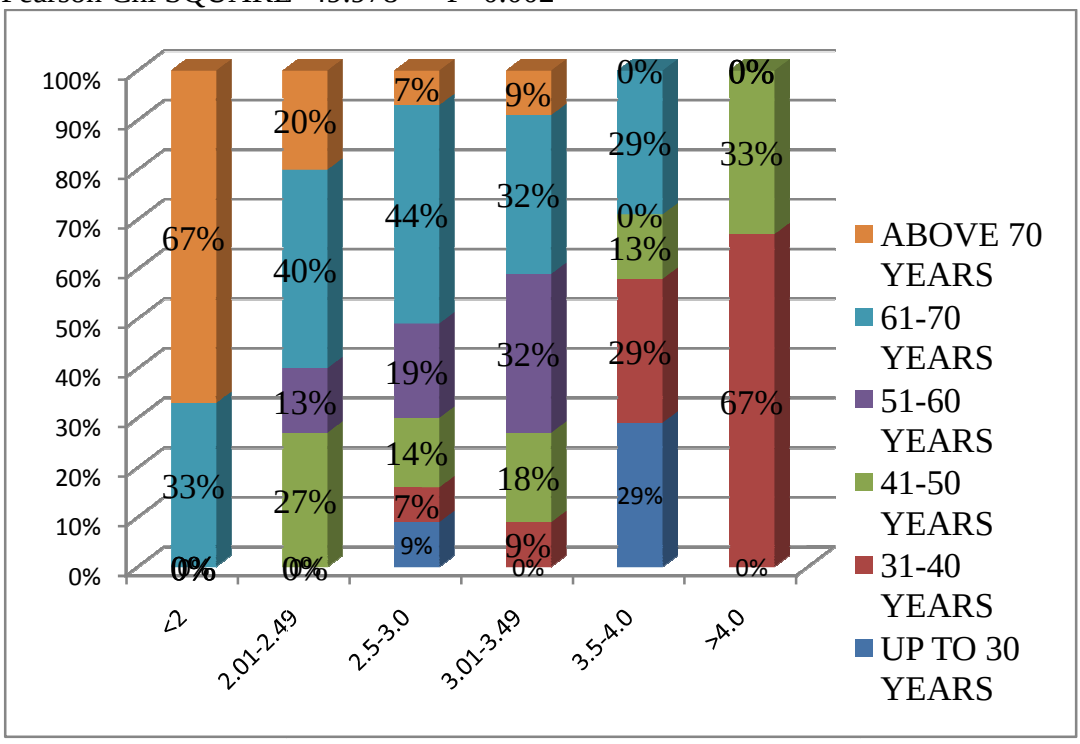

All the age groups had decreased albumin levels but the age group between 61 -70 had more hypoalbuminemic patients when compared to others. However, no stastitical assosciation was found between age and serum albumin levels

**SERUM ALBUMIN DISTRIBUTION ACCORDING**

**TO THE AGE:**

| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
|---|---|---|---|---|---|---|---|---|---|
| AGE GROUP | UP TO 30 YEARS | Count | 0 | 0 | 4 | 0 | 4 | 0 | 8 |
| | | % | 0.0% | 0.0% | 9.3% | 0.0% | 28.6% | 0.0% | 8.0% |
| | 31-40 YEARS | Count | 0 | 0 | 3 | 2 | 4 | 2 | 11 |
| | | % | 0.0% | 0.0% | 7.0% | 9.1% | 28.6% | 66.7% | 11.0% |
| | 41-50 YEARS | Count | 0 | 4 | 6 | 4 | 2 | 1 | 17 |
| | | % | 0.0% | 26.7% | 14.0% | 18.2% | 14.3% | 33.3% | 17.0% |
| | 51-60 YEARS | Count | 0 | 2 | 8 | 7 | 0 | 0 | 17 |
| | | % | 0.0% | 13.3% | 18.6% | 31.8% | 0.0% | 0.0% | 17.0% |
| | 61-70 YEARS | Count | 1 | 6 | 19 | 7 | 4 | 0 | 37 |
| | | % | 33.3% | 40.0% | 44.2% | 31.8% | 28.6% | 0.0% | 37.0% |
| | ABOVE 70 YEARS | Count | 2 | 3 | 3 | 2 | 0 | 0 | 10 |
| | | % | 66.7% | 20.0% | 7.0% | 9.1% | 0.0% | 0.0% | 10.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

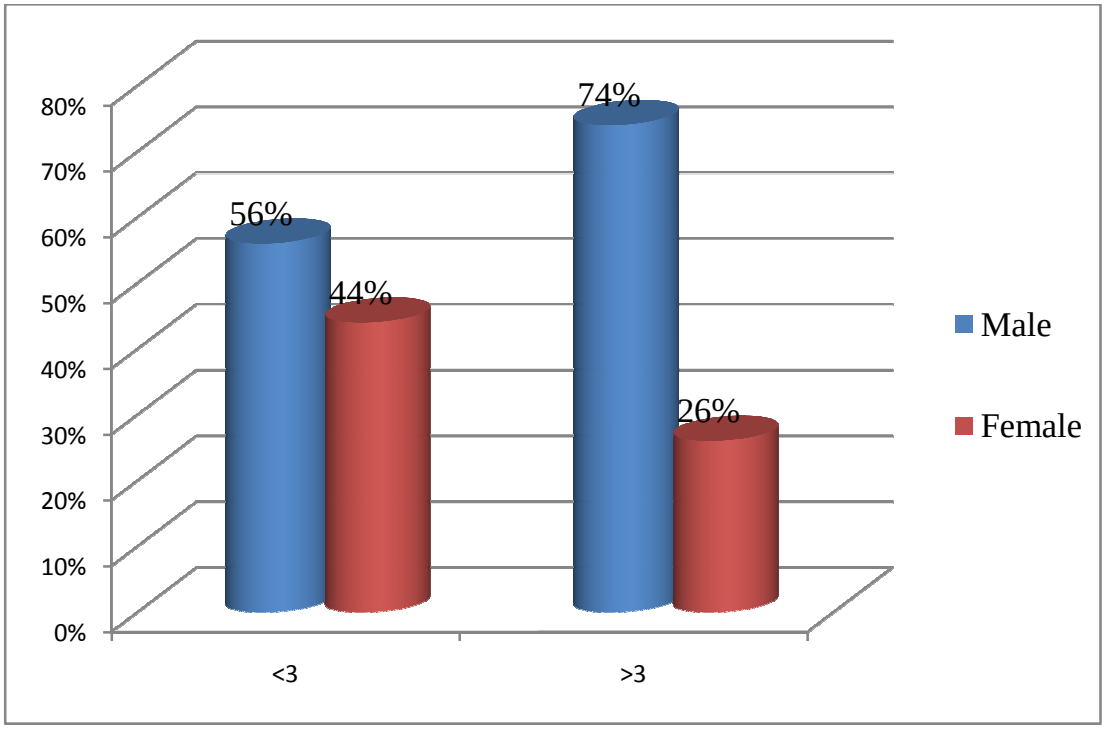
Pearson Chi SQUARE=49.978** P=0.002



**SERUM ALBUMIN LEVELS IN MALES AND FEMALES:**

| | | | SERUMALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| Gender | MALE | Count | 34 | 29 | 63 |
| | | % | 55.7% | 74.4% | 63.0% |
| | FEMALE | Count | 27 | 10 | 37 |
| | | % | 44.3% | 25.6% | 37.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

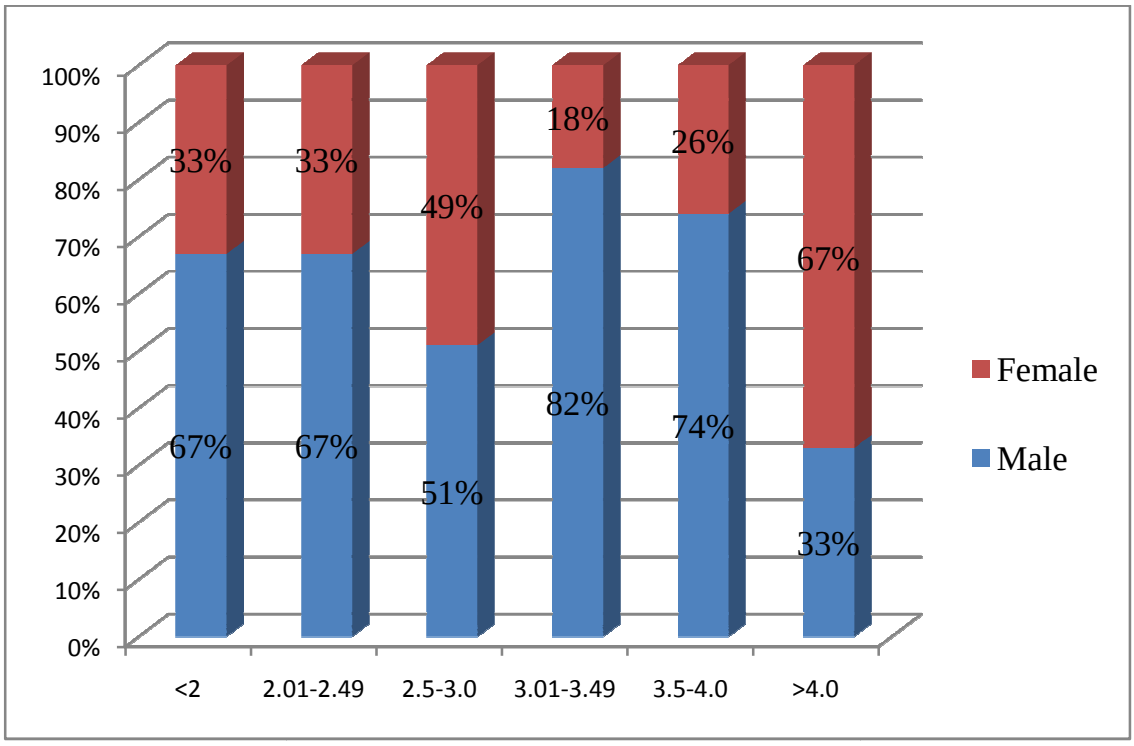
Pearson Chi-Square=3.539 P=0.060



**SEX DISTRIBUTION AMONG 6 GROUPS BASED ON ALBUMIN. LEVELS :**

| | | | SERUMALBUMIN6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Gender | MALE | Count | 2 | 10 | 22 | 18 | 10 | 1 | 63 |
| | | % | 66.7% | 66.7% | 51.2% | 81.8% | 71.4% | 33.3% | 63.0% |
| | FEMALE | Count | 1 | 5 | 21 | 4 | 4 | 2 | 37 |
| | | % | 33.3% | 33.3% | 48.8% | 18.2% | 28.6% | 66.7% | 37.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Parson Chi-Square=7.590 P=0.180




There was no statistical difference between males and females with their corresponding serum albumin levels….

**CONFUSION COMPARED WITH THEIR SERUM ALBUMIN**

**LEVELS ON DAY OF ADMISSION**

| | | | SERUM ALBUMIN 3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| Confusion | Nil | Count | **50** | **36** | **86** |
| | | % | 82.0% | 92.3% | 86.0% |
| | Present | Count | 11 | 3 | 14 |
| | | % | 18.0% | 7.7% | 14.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=2.113 P=0.146

No statistical . difference found between two groups in confusion..

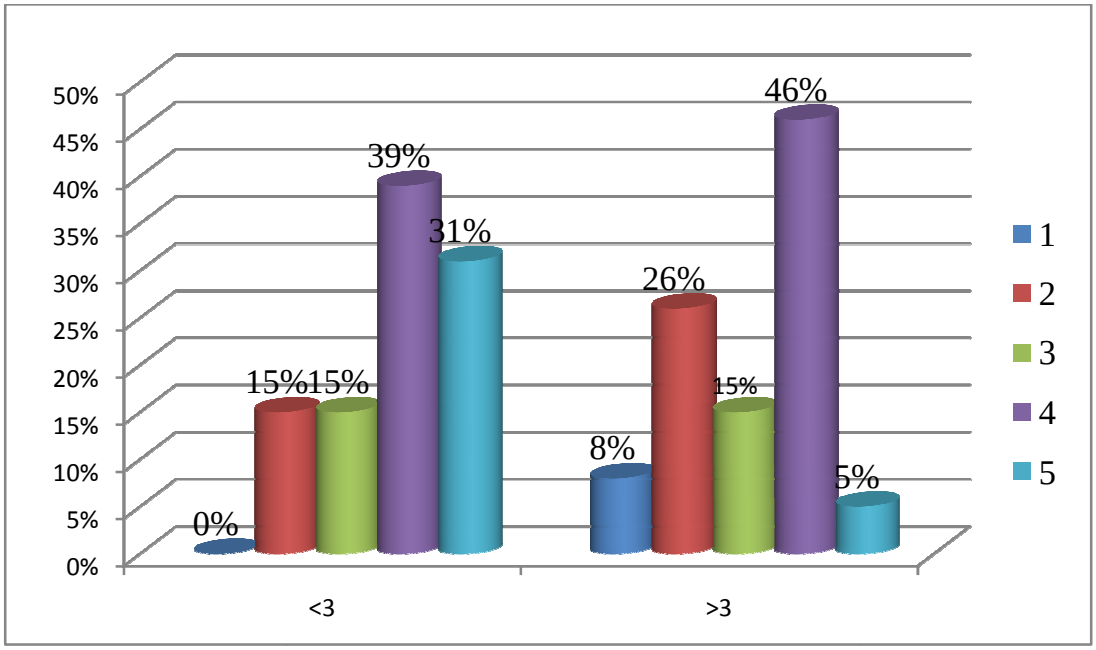
**CONFUSION COMPARED WITH THEIR SERUM ALBUMIN**

**LEVELS ON DAY 6**

| | | | SERUMALBUMIN6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Confusion | Nil | Count | 2 | 14 | 34 | 19 | 14 | 3 | 86 |
| | | % | 66.7% | 93.3% | 79.1% | 86.4% | 100.0% | 100.0% | 86.0% |
| | Present | Count | 1 | 1 | 9 | 3 | 0 | 0 | 14 |
| | | % | 33.3% | 6.7% | 20.9% | 13.6% | 0.0% | 0.0% | 14.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=6.086 P=0.298

**COMPARISON OF SERUM ALBUMIN ON ADMISSION WITH PSI SCORING OF THE CORRESPONDING PATIENT**




| | | | SERUM ALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | **<3** | **>3** | |
| PSISCORE1 | 1.00 | Count | 0 | 3 | 3 |
| | | % | 0.0% | 7.7% | 3.0% |
| | 2.00 | Count | 9 | 10 | 19 |
| | | % | 14.8% | 25.6% | 19.0% |
| | 3.00 | Count | 9 | 6 | 15 |
| | | % | 14.8% | 15.4% | 15.0% |
| | 4.00 | Count | 24 | 18 | 42 |
| | | % | 39.3% | 46.2% | 42.0% |
| | 5.00 | Count | 19 | 2 | 21 |
| | | % | 31.1% | 5.1% | 21.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=14.115*  P=0.007

The. PSI SCORING is compared with the serum albumin levels .

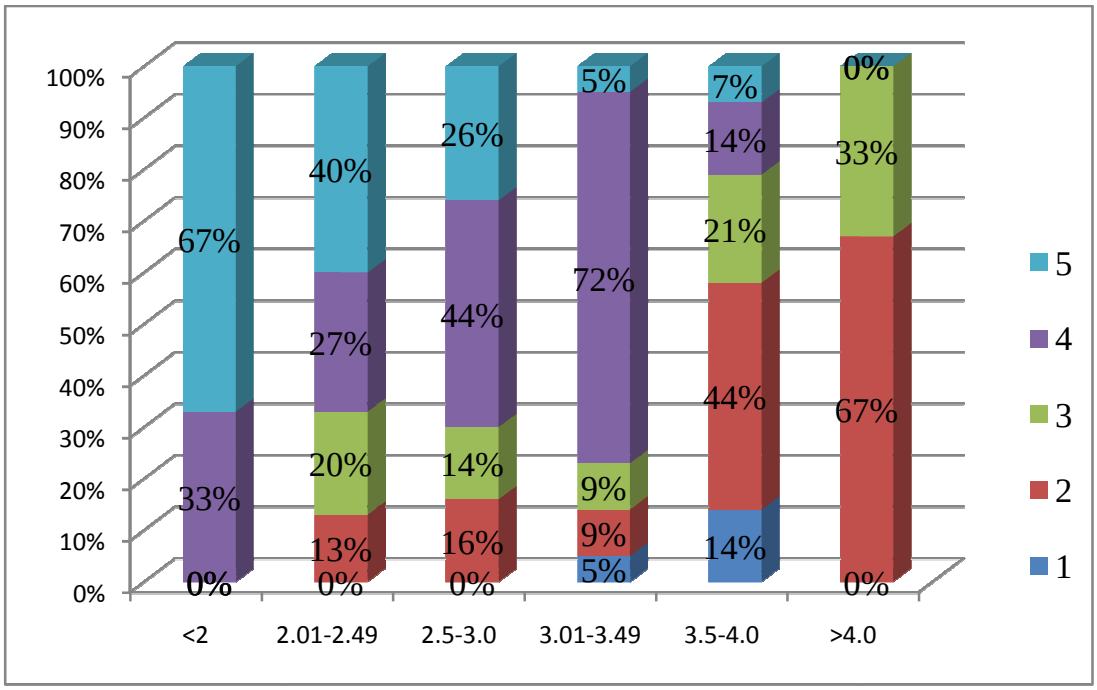
- All patients with PSI class1 had albumin levels more than 3
- In patients with PSI class 2 , 50% had hypoalbuminemia on admission .nearly 50% had albumin >3gm.
- In patients with PSI class 3, 60% had hypoalbuminemia on admission
- In patients who belonged to class 4, approximately 57% had hypoalbuminemia
- In patients who belonged to class 5, 90% had hypoalbuminemia However more cases which fell under class 4 PSI had serum albumin levels less than 3.

**PSI SCORE WITH SERUM ALBUMIN ON DAY 6 :**

| | | | SERUMALBUMIN6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| PSISCORE1 | 1.00 | Count | 0 | 0 | 0 | 1 | 2 | 0 | 3 |
| | | % | 0.0% | 0.0% | 0.0% | 4.5% | 14.3% | 0.0% | 3.0% |
| | 2.00 | Count | 0 | 2 | 7 | 2 | 6 | 2 | 19 |
| | | % | 0.0% | 13.3% | 16.3% | 9.1% | 42.9% | 66.7% | 19.0% |
| | 3.00 | Count | 0 | 3 | 6 | 2 | 3 | 1 | 15 |
| | | % | 0.0% | 20.0% | 14.0% | 9.1% | 21.4% | 33.3% | 15.0% |
| | 4.00 | Count | 1 | 4 | 19 | 16 | 2 | 0 | 42 |
| | | % | 33.3% | 26.7% | 44.2% | 72.7% | 14.3% | 0.0% | 42.0% |
| | 5.00 | Count | 2 | 6 | 11 | 1 | 1 | 0 | 21 |
| | | % | 66.7% | 40.0% | 25.6% | 4.5% | 7.1% | 0.0% | 21.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0% | 100.0% |

Pearson Chi-Square=40.692** P=0.004

**PSI SCORE WITH SERUM ALBUMIN ON DAY 6 :**

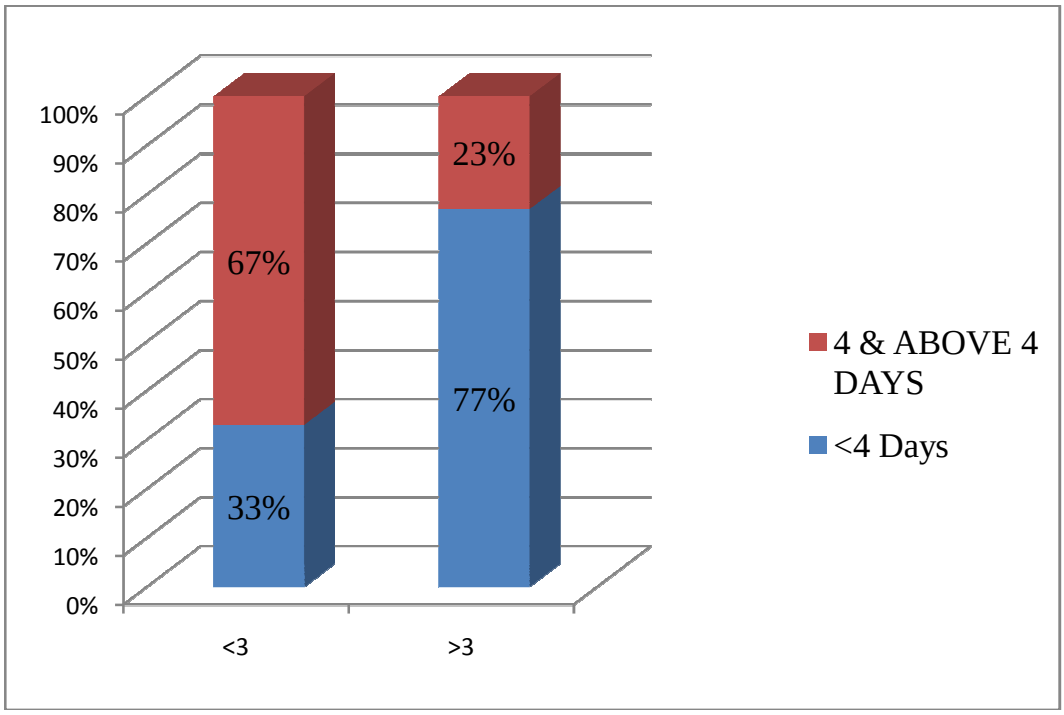



**TIME TO REACH CLINICAL STABILITY:**

| | | | SERUM ALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| CLINICAL STABILITY SCORE | <4 DAYS | Count | 20 | 30 | 50 |
| | | % | 32.8% | 76.9% | 50.0% |
| | 4 & ABOVE 4 DAYS | Count | 41 | 9 | 50 |
| | | % | 67.2% | 23.1% | 50.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=18.537** P<0.001

**TIME TO REACH CLINICAL STABILITY:**

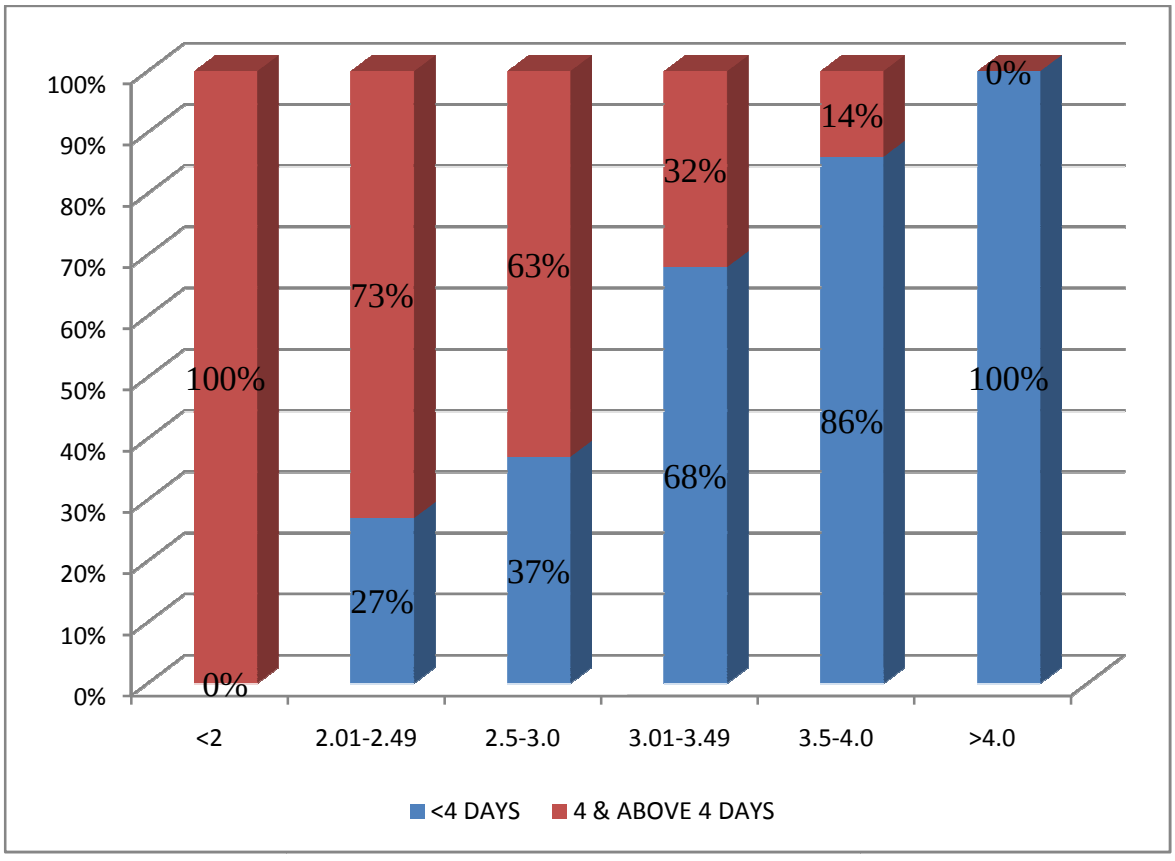



Time to reach clinical stability was comparatively higher in admitted patients with hypoalbuminemia than in patients without hypoalbuminemia..

## TIME TO REACH CLINICAL STABILITY COMPARED BETWEEN 6 GROUPS

| | | | SERUMALBUMIN6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Clinical stability score | <4 days | Count | 0 | 4 | 16 | 15 | 12 | 3 | 50 |
| | | % | 0.0% | 26.7% | 37.2% | 68.2% | 85.7% | 100.0% | 50.0% |
| | 4 & above 4 days | Count | 3 | 11 | 27 | 7 | 2 | 0 | 50 |
| | | % | 100.0% | 73.3% | 62.8% | 31.8% | 14.3% | 0.0% | 50.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

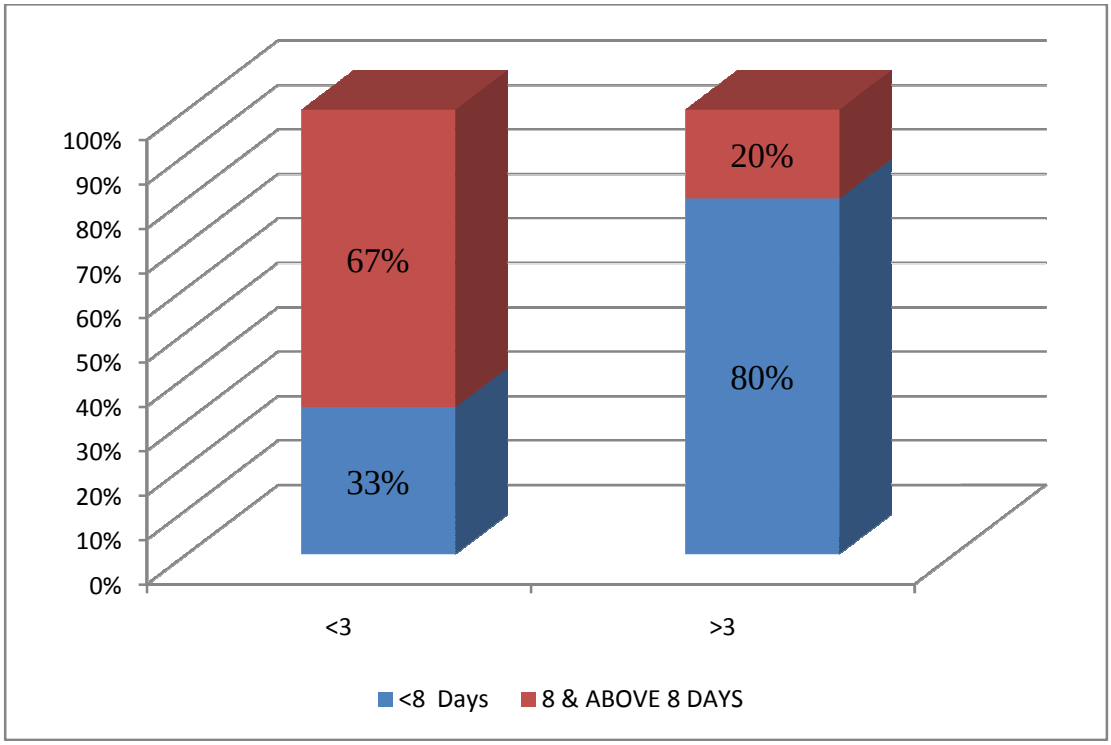
Pearson Chi-Square=22.133** P<0.001 P= 0.0005



**NO OF DAYS OF HOSPITAL STAY :**

| | | | SERUMALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| HOSPITAL STAY SCORE | <8 DAYS | Count | 20 | 31 | 51 |
| | | % | 32.8% | 79.5% | 51.0% |
| | 8 & ABOVE 8 DAYS | Count | 41 | 8 | 49 |
| | | % | 67.2% | 20.5% | 49.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0 % |

Pearson Chi-Square=20.762** P<0.001

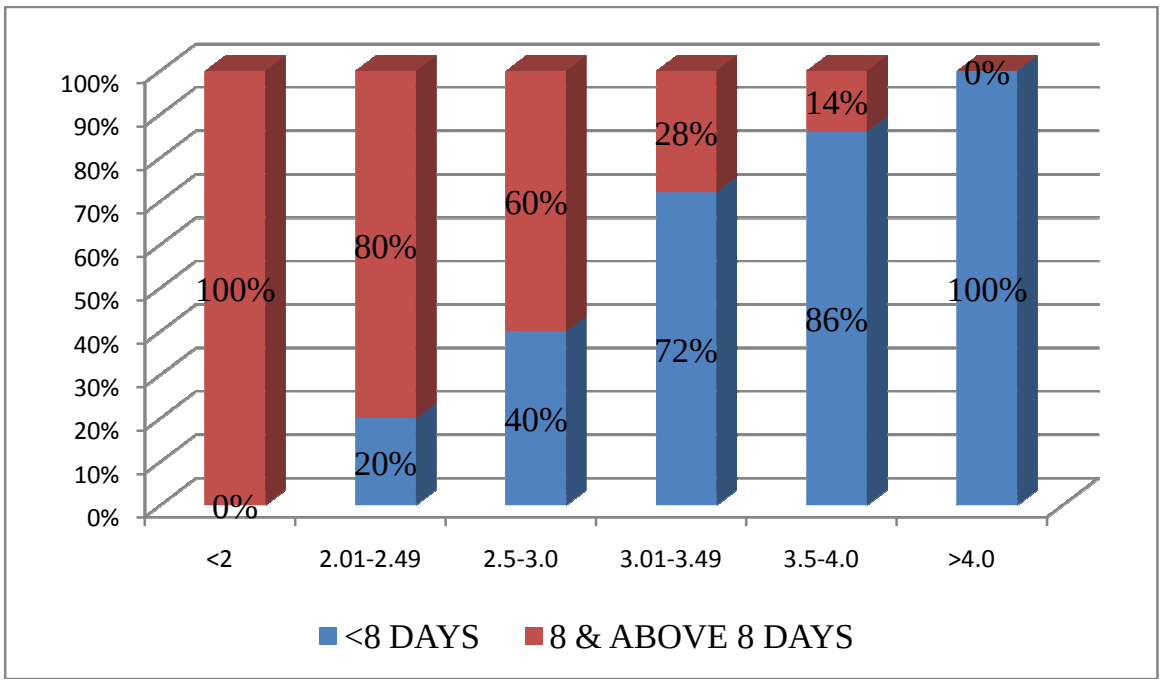



The no of days of hospital stay was significantly higher in patients with hypoalbuminemia than in patients without hypoalbuminemia.

**NO OF DAYS OF HOSPITAL STAY : COMPARED SERUM ALBUMIN LEVELS DAY 6**

| | | | SERUM ALBUMIN 6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Hospital Stay Score | <8 days | Count | 0 | 3 | 17 | 16 | 12 | 3 | 51 |
| | | % | 0.0% | 20.0 % | 39.5 % | 72.7 % | 85.7 % | 100.0 % | 51.0 % |
| | 8 & above 8 days | Count | 3 | 12 | 26 | 6 | 2 | 0 | 49 |
| | | % | 100.0 % | 80.0 % | 60.5 % | 27.3 % | 14.3 % | 0.0% | 49.0 % |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % |

Pearson Chi-Square=24.942** P<0.001



**PATIENTS REQUIRING MECHANICAL VENTILATION :**

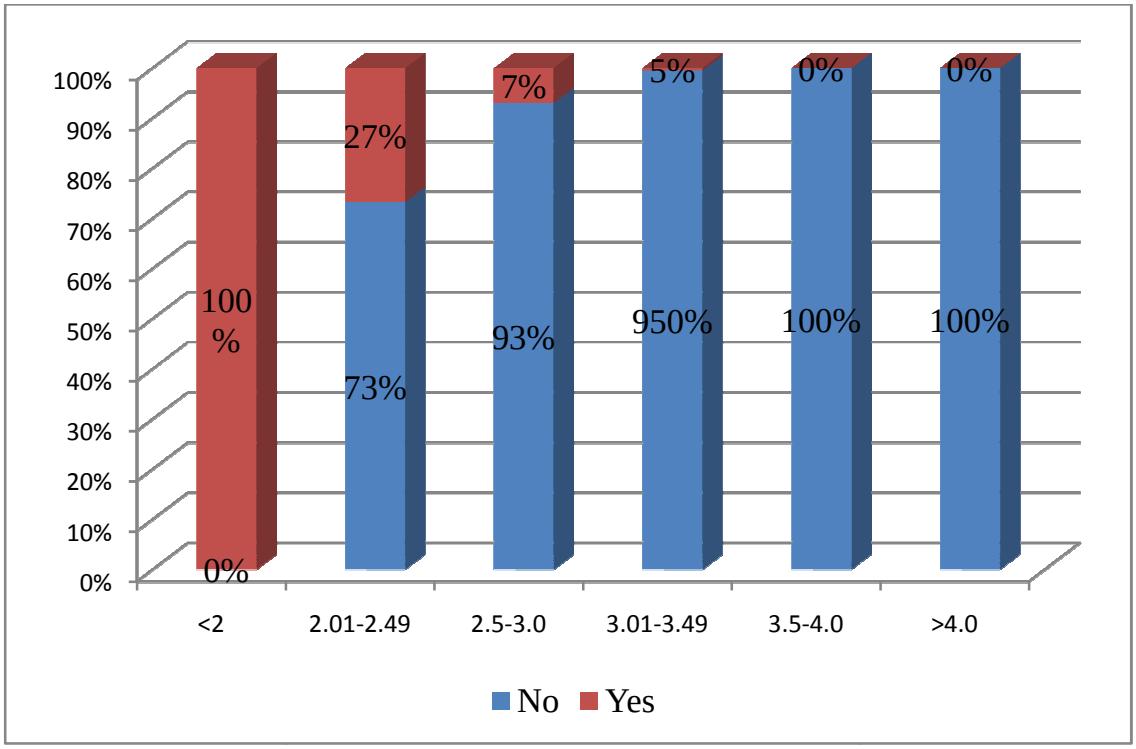
| | | | SERUMALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| MECHANICAL VENTILATION | NO | Count | 51 | 38 | 89 |
| | | % | 83.6% | 97.4% | 89 % |
| | YES | Count | 10 | 1 | 11 |
| | | % | 16.4% | 2.6% | 11.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=4.6474* P=0.0311

There is a significant relation between serum albumin levels and the need for mechanical ventilation.

| | | SERUM ALBUMIN 6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Mechanical Ventilation | No Count | 0 | 11 | 40 | 21 | 14 | 3 | 89 |
| | No % | 0% | 73.33% | 93% | 95.5% | 100.0% | 100.0% | 89.0% |
| | Yes Count | 3 | 4 | 3 | 1 | 0 | 0 | 11 |
| | Yes % | 100% | 26.66% | 7% | 4.5% | 0.0% | 0.0% | 11.0% |
| Total | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

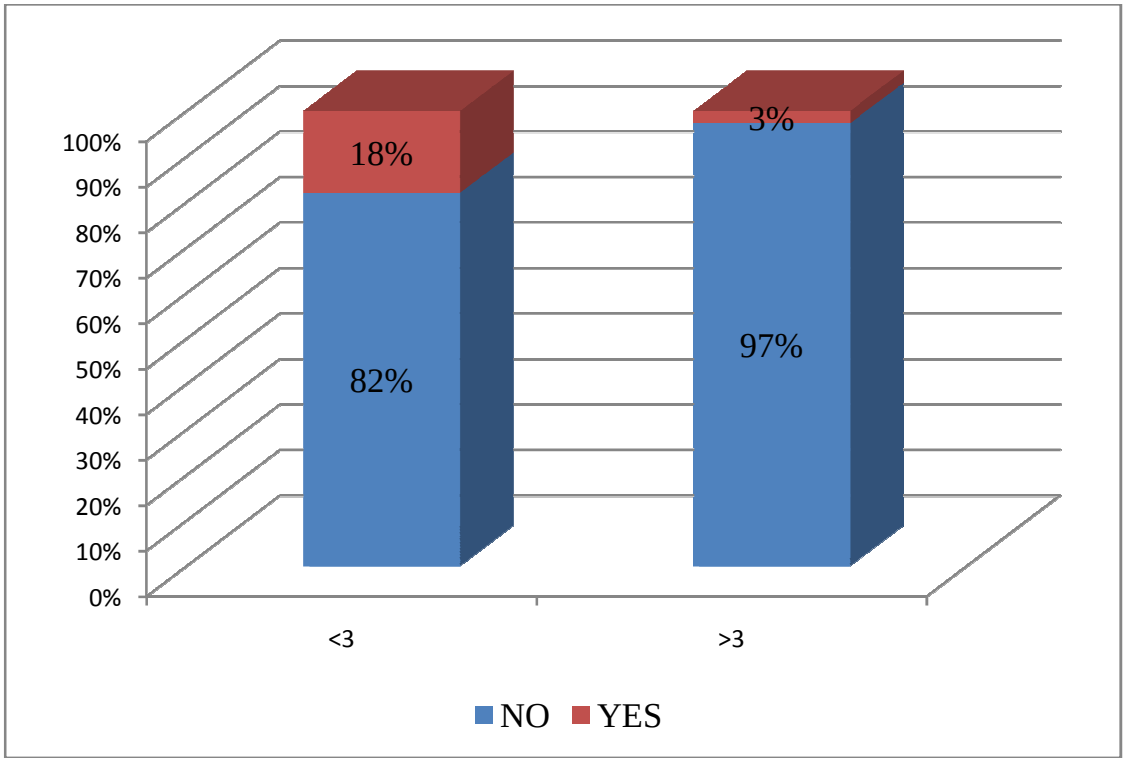
Pearson Chi-Square=31.782** P value less than 0.001




**PATIENTS REQUIRING VASOPRESSORS :**

| | | | SERUM ALBUMIN 3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| IONOTROPIC SUPPORT | NO | Count | 50 | 38 | 88 |
| | | % | 82% | 97.37% | 88.0% |
| | YES | Count | 11 | 1 | 12 |
| | | % | 18% | 2.631% | 12.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |

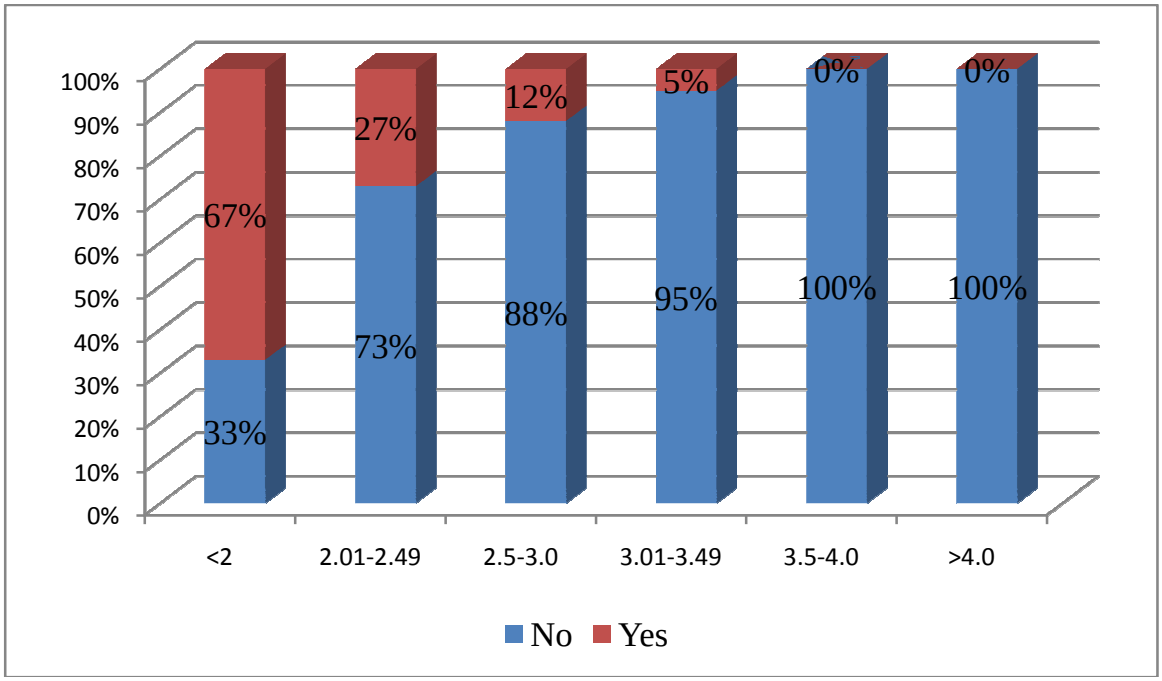
Pearson Chi-Square=5.391 ** P=0.02024 P<0.05




**VASOPRESSORS NEEDED IN 6 DIVIDED GROUPS :**

| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
|---|---|---|---|---|---|---|---|---|---|
| Ionotropic Support | NO | Count | 1 | 11 | 38 | 21 | 14 | 3 | 88 |
| | | % | 33.3% | 73.34 % | 88.4% | 95.5% | 100.0% | 100.0% | 88.0% |
| | YES | Count | 2 | 4 | 5 | 1 | 0 | 0 | 12 |
| | | % | 66.7% | 26.66% | 11.6% | 4.76% | 0.0% | 0 | 12% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

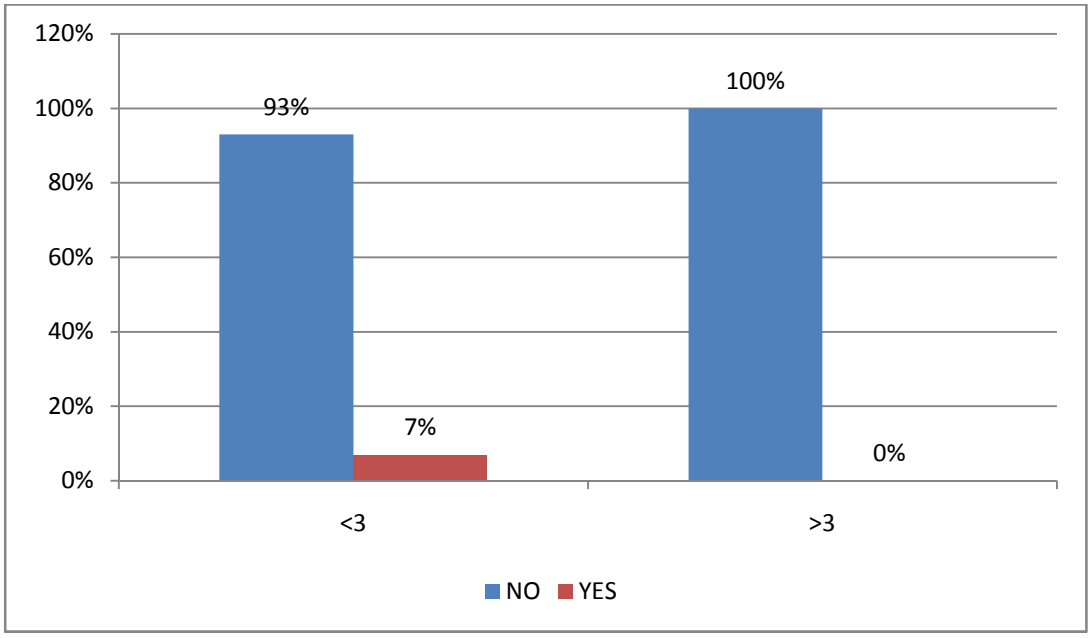
Pearson Chi-Square=15.027* P=0.0102




The need for vasopressors are strictly higher in groups in whom serum albumin levels are less than 3.There is a significant assosciation between decreased serum albumin on admission and need for inotropic /vasopressor support.

## DEVELOPMENT OF EMPYEMA :

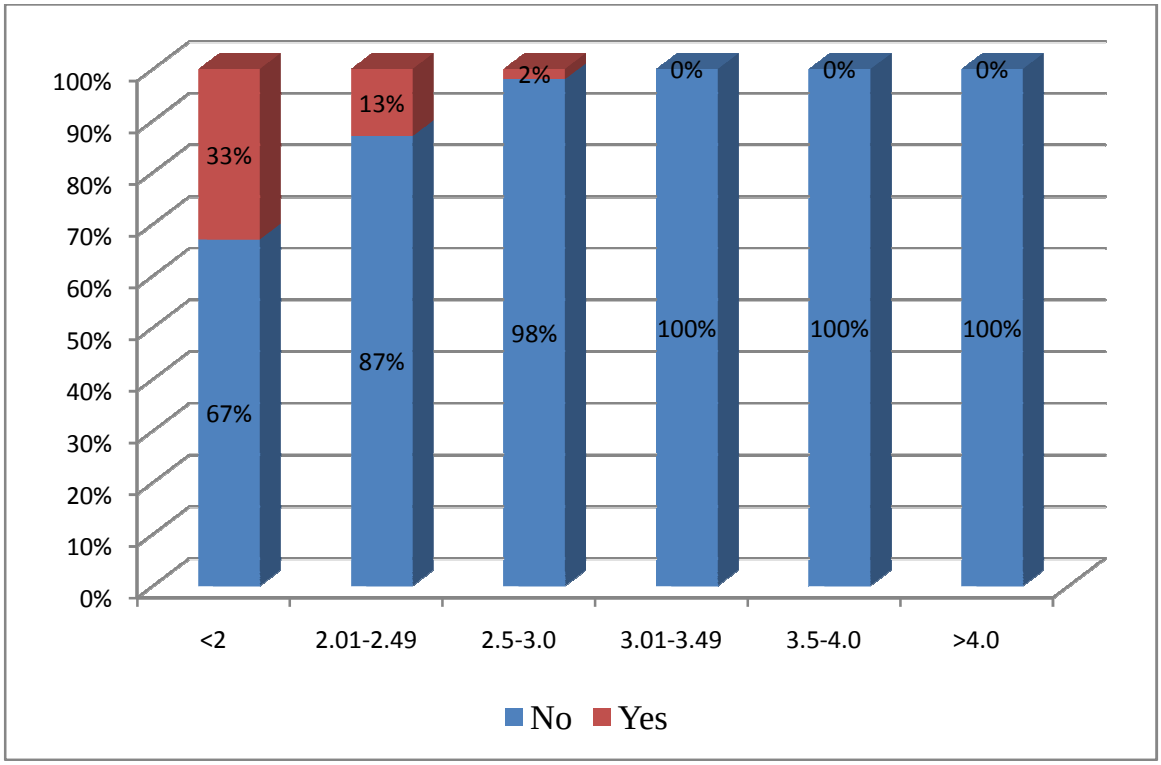
| | | | SERUMALBUMIN3 | | Total |
|---|---|---|---|---|---|
| | | | <3 | >3 | |
| Empyema | NO | Count | 57 | 39 | 96 |
| | | % | 93.4% | 100% | 96.0% |
| | YES | Count | 4 | 0 | 4 |
| | | % | 6.6% | 0% | 4.0% |
| Total | | Count | 61 | 39 | 100 |
| | | % | 100.0% | 100.0% | 100.0% |



## DEVELOPMENT OF EMPYEMA :

| | | | SERUM ALBUMIN 6 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | 2.01-2.49 | 2.5-3.0 | 3.01-3.49 | 3.5-4.0 | >4.0 | |
| Empyema | NO | Count | 2 | 13 | 42 | 22 | 14 | 3 | 96 |
| | | % | 66.7% | 86.7% | 97.7% | 100.0% | 100.0% | 100.0% | 96.0% |
| | YES | Count | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| | | % | 33.3% | 13.3% | 2.3% | 0.0% | 0.0% | 0.0% | 4.0% |
| Total | | Count | 3 | 15 | 43 | 22 | 14 | 3 | 100 |
| | | % | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

Pearson Chi-Square=12.064* P=0.034




The development of empyema was higher in patients with serum albumin less than 2.5.

## 30 DAY MORTALITY :

Total persons who died were 3. All three had serum albumin levels less than 2.5 on admission. So 30 day mortality correlated significantly with serum albumin levels on admission.

| Serum albumin levels | <2 | 2-2.49 | 2.5-2.99 | 3.5-3.99 | >4 |
|---|---|---|---|---|---|
| Death cases | 1 | 2 | - | - | - |

## PSI SCORES COMPARED WITH NUMBER OF DAYS OF HOSPITAL STAY

| **PSI CLASS** | **NO OF DAYS OF HOSPITAL STAY8 or >8 days** | **Hospital stay <8 days** | **Total** |
|---|---|---|---|
| **1-3** | 8 | 29 | 37 |
| **4 and 5** | 44 | 19 | 63 |
| **Total.** | 52 | 48 | 100 |

Pearson chi-square =21.7143 p value <0.00001

Hence PSI scores 4 and 5 were significantly associated with prolonged hospital stay.

## PSI SCORES COMPARED WITH MECHANICAL VENTILATION:

| PSI CLASS | No of patients requiring mechanical ventilation | Not requiring mechanical ventilation | Total |
|---|---|---|---|
| **1-3** | 0 | 37 | 37 |
| **4 and 5** | 11 | 52 | 63 |
| **Total** | 11 | 89 | 100 |

PSI scoring correlated significantly with no of patients requiring mechanical ventilation. Out of 11 patients ,5 of them belonged to class 4 and 6 of them belonged to class 5.

## PSI SCORES COMPARED WITH SEPTIC SHOCK :

| PSI CLASS | No of patients went for septic shock needed inotropic suport | Not went for septic shock | Total |
|---|---|---|---|
| **1-3** | 1 | 36 | 37 |
| **4 and 5** | 11 | 52 | 63 |
| **Total** | 12 | 88 | 100 |

Pearson chi-square =4.8074; p value=0.0283

PSI SCORING correlated significantly with no of patients in septic shock requiring inotropes.

## PSI SCORES COMPARED WITH EMPYEMA :

| PSI CLASS | NO OF PATIENT WITH EMPYEMA | Not went for EMPYEMA | Total |
|---|---|---|---|
| **1-3** | 3 | 34 | 37 |
| **4 and 5** | 1 | 62 | 63 |
| **Total** | 4 | 96 | 100 |

Empyema prediction didn’t correlate with PSI SCORING

## COMPARISON OF CURB 65 WITH COMPLICATIONS :

CURB 65 Scoring : 0- 27 patients

1-30 patients

2-25 patients

3 and above-18 patients.

Most of the patients fell in scoring of 0,1,2.only 18 of them had high scores.

## CURB 65 SCORES COMPARED WITH MECHANICAL VENTILATION:

| CURB 65 score | No of patients requiring mechanical ventilation | Not requiring mechanical ventilation | Total |
|---|---|---|---|
| **0,1 and 2** | 5 | 77 | 82 |
| **3 and above** | 6 | 12 | 18 |
| **Total** | 11 | 89 | 100 |

Pearson value = 11.1836. P value = 0.000825

CURB 65 high scores were significantly associated with the need for mechanical ventilation.

**CURB 65 SCORES COMPARED WITH SEPTIC SHOCK :**

| CURB 65 Scoring | No of patients went for septic shock needed inotropic support | Not went for septic shock | Total |
|---|---|---|---|
| **0,1 and2** | 9 | 73 | 82 |
| **3 and above** | 3 | 15 | 18 |
| **Total** | 12 | 88 | 100 |

Pearson chi-square =0.4527; p value=0.0501017

CURB 65 didn't correlate significantly with no of patients in septic shock requiring inotropes**.**

**CURB 65 SCORES COMPARED WITH EMPYEMA :**

| CURB 65 | NO OF PATIENT WITH EMPYEMA | Not went for EMPYEMA | Total |
|---|---|---|---|
| **0,1 and 2** | 3 | 79 | 82 |
| **3 and above** | 1 | 17 | 18 |
| **Total** | 4 | 96 | 100 |

100 Pearson chi-square =0.7909933; p value=0.138

Empyema prediction didn't correlate with CURB 65 Scores

# DISCUSSION

# DISCUSSION

The present study was undertaken to determine the level of serum albumin levels in pneumonia and to compare the relationship of serum albumin levels with conventional complications of pneumonia like prolonged hospital stay, mechanical ventilation, septic shock and empyema.

In present study, pneumonia as commonly seen in 6$^{th}$ decade of life (37%) followed by 5th decade of life (17%), and 4th decade (17%). It predominantly involved male patients (63%). This was less common among young patients.. Pneumonias was less frequently seen in young patients. Below 30, only 8 patients were seen in our study..

The various studies conducted, the mean age of patients with CAP were reported to be over 60 years. Studies conducted by Capelasteguiet al. and Lim et al. noted the mean age of their study population to be 64.1 and 61.8 years, respectively. Furthermore in another prospective observational study conducted exclusively among those aged over 65 years with CAP (mean SD age 81.1 (+/-)7.9 years), Mynith K et al reported that the sensitivity and specificity of CURB in predicting death was as high as 81 and 52%, respectively . The specificity figure of this elderly cohort was much lower than in other studies of younger patients. Due to this low specificity, the CURB-65 criteria in their current form was not ideal for assessing older CAP patients

Smoking, diabetes mellitus, COPD and alcohol were considered as important risk factors for pneumonia. Various studies have demonstrated the

increased risk of developing CAP among nursing home residents. Elder or debilitated patients with pneumonia often present with nonspecific complaints and not the classic symptoms, this could account for a delayed presentation and hence worser outcome. Pneumonia commonly presents in the elderly as acute confusion or a deterioration of baseline function. Thus they are likely to have advanced illness at the time of presentation in the absence of previous symptoms suggestive of pneumonia. Indeed, the determination of the score in the PSI developed by Fine *et al* is heavily influenced by age. In contrast to other parameters, age is easy to determine and has been consistently found to be very strongly associated with prognosis in most studies of severity assessment in adults with CAP.

In our study, 14 patients presented with confusion. All 14 of them were above 60 years. The lowest age of patient presenting with confusion was 64. As demonstrated in other studies, there was no sex predilection in patients presenting with confusion. Comparing serum albumin levels with confusion as outcome, 11 of them had serum albumin less than 3 at presentation and 3 patients had serum albumin levels more than 3 at presentation. However, this difference between two groups was not statistically significant.

Among the patients, who had confusion at initial presentation, two patients needed mechanical ventilation , one patient had septic shock at presentation and also developed Empyema. Both these patients had hypoalbuminemia in presentation. They had serum albumin levels of 2.6 and 1.8 at presentation. Hence patients presenting with confusion with low serum

albumin levels has more risk of developing complications and need to be managed in intensive care unit.

Regarding the sex of the patient ,our study showed a male predominance. 63 of them were males and 37 of them were females. According to the demographic data, from each of the three prospective studies used in the derivation study of CURB65 done by Lim et al (3, 49)in 2003, the number of males was found to be higher than females. The study conducted in Netherlands had the highest number of male patients accounting for 54% of their overall study population. Overall, the Lim et al study had a total of 550 patients, 51% of whom were male.

The slightly higher male preponderance rate in the study could find an explanation in the higher number of COPD patients and smokers . Among our group of patients 13 were admitted with a co morbid condition of COPD.

Regarding serum albumin levels most of them had serum albumin levels less than 3 at presentation. A very few cases had serum albumin levels less than 2 (3 cases) and above 4(3 cases). Most of them had serum albumin levels between 2.5 and 3.5 (65 cases ) at admission. The serum albumin levels on admission were compared with the complications.

The time to reach the clinical stability ( time for normalization of all the 4 vitals Heart rate, blood pressure , respiratory rate and temperature were measured. Normal pulse rate was kept below hundred, the blood pressure was kept as 100/70, The normal respiratory rate was kept below 24, Temperatures

below $99^0$F on two occasions 12 hours apart and no fever spikes then. 51 patients reached clinical stability in 4 days or above. The rest of them reached clinical stability in less than 4 days.

Time to reach clinical stability was comparatively higher in admitted patients with hypoalbuminemia than in patients without hypoalbuminemia. Comparing the days to reach clinical stability with serum albumin levels, those patients with serum albumin levels less than 2 all (100% ) took 4 or more days to reach clinical stability. Among patients with albumin levels between 2-2.49 and 2.5-2.9, 73.3% and 62.7 % took prolonged time to reach clinical stability.( 4 or more than 4 days ). On other hand ,among those patients with serum albumin levels between 3-3.4 and 3.5 -4 , 31.8% and 21.4% took prolonged time to reach clinical stability. Thus serum albumin levels on admission, had a significant correlation with time to reach clinical stability.

No of days of hospital stay: This was similar to time to reach clinical stability, with minor variations. Hence serum albumin levels on admission significantly correlated with the no of days of hospital stay. Our study demonstrated that those who had hypoalbuminemia on admission had prolonged hospital stay and prolonged time to reach clinical stability.

Regarding mechanical ventilation, in our study 11 patients required mechanical ventilation, out of which 10 had hypoalbuminemia (albumin levels less than 3). Among 6 groups those PTS with serum albumin levels less than 2, 100.0% required mechanical ventilation. Similarly in patient group with serum albumin levels from 2-2.4 , 26.66% required mechanical ventilation.

The group between2.5-2.99 had 7% of the patients requiring mechanical ventilation.. None of the patients who had serum albumin more than 3.5 required mechanical ventilation. Most of the patients were above 65 years in this group.

Regarding the patients who had septic shock with Bp less than 90/60, 91.7% patients had serum albumin levels less than 3 ,(11 patients out of the total 12.), 8.3% patients had serum albumin levels more than 3. Among patients in six groups , 66.6% of the patients with serum albumin levels below 2 had septic shock. Similarly, 26.66% of the patients with serum albumin levels between 2-2.5 had septic shock. It was nearly 11% and 4.7 %, and in patients with albumin levels of 2.5-2.9, 3-3.4 respectively. None of them had albumin levels more than 3.5 on admission. So both need for mechanical ventilation and septic shock requiring vasopressors was significantly associated with serum albumin levels on admission.

Similarly, regarding empyema all of the 4 patients who developed empyema had hypoalbuminemia on admission.

Regarding 30 day mortality, 3 patients out of the total 100 died .All three had hypoalbuminemia on admission. Their serum albumin levels were 2.4, 2.1 and 1.7 at admission. So 30 day mortality correlated significantly with serum albumin levels on admission.

Regarding the prediction scores , the PSI scoring most of the hospitalised patients came under class 4 ( 43% ) and class 5 (20%). The no of patients who

fell under class 2,3 were 18% and 16% respectively. Only 3 patients came under class 1. Age of the patient was the major determinant in PSI scoring..

Comparing PSI SCORING with serum albumin levels on admission, there was a significant correlation between high PSI scores and low serum albumin levels on admission. Particularly 90% of the patients on class PSI 5 had hypoalbuminemia at presentation. In class 3 and 4, 60% and 57% had hypoalbuminemia respectively on presentation.

Comparing the PSI SCORING and their complications, those who belonged to class 4 and class 5 had significantly higher rate of complications than in those patients with PSI class 1 ,2 and 3 except for empyema. The no of days of hospital stay ,the need for mechanical ventilation, the patients in septic shock all were higher in PSI Class 5 and PSI class 4.Hence PSI scoring correlated well with outcome, ICU admissions, predicting complications.

Regarding mortality of the patients, all three people who died fell under class 5,and hence the scoring correlated significantly with mortality. Regarding CURB 65 scoring, most of them had low scores of 0,1 and 2. Only 18 patients had score of 3 and more. It didn't include comorbid illness, acidosis, pleural effusions and hyponatremia which are all the complications noted in pneumonia.

Moreover, out of 11 patients who needed mechanical ventilation 5 of them had low CURB 65 scoring on admission. Out of the patients, who had prolonged hospital stay ,only 18 of them had high scores. others all had low

CURB 65 scoring. Hence CURB 65 scoring failed to predict the patients with prolonged hospital stay.

Among the patients ,who had septic shock at presentation, only 3 of them had CURB 65 score of 3 and above. The rest 9 of them had low CURB 65 levels, thus correlating poorly with the prognosis. Regarding the development of empyema, 3 out of 4 had low scores on presentation. Thus CURB 65 scoring system was not efficient in predicting the outcomes and mortality.

**Pit falls of CURB 65:**

- No points assigned for comorbid illness and nursing home residents.
- Confusion and high blood urea nitrogen in elderly can be due to variety of reasons and hence highly non specific, and may not identify patients who require ICU admissions.
- Moreover, severity is highly influenced by the age of the patient.

# CONCLUSION

## CONCLUSION:

- The serum albumin levels on day of admission was, an excellent predictor of complications such as need for mechanical ventilation, need for ICU admissions, empyema and death..It also predicted those who required prolonged hospital stay and prolonged time to reach clinical stability.

- The PSI SCORING is better predictor for the complications. But the calculation of the score was more difficult, complex, and time consuming. There are chances of miscalculation and misinterpretation of the findings.

- The CURB 65 scoring didn't predict the complications when used alone. The high weightage to the age, considering the non specific findings confusion and blood urea nitrogen made it unreliable when compared to PSI and other biomarkers.

- Addition of serum albumin with PSI or CURB 65 scoring has tremendously increased the sensitivity and specificity of assessment of the prognosis of the patient.

- However it was found that serum albumin supplementation during critical illness, didn't prove any benefit to patient . So the question of albumin infusion would improve clinical outcomes still warrants further investigation.

# LIMITATIONS

## LIMITATIONS

- Sample size was small due to financial and time constraint.

- The study was conducted only in patients admitted at a single tertiary care centre.

- This was conducted only in hospitalised patients with CAP ,and hence cannot make assertions for usefulness in individuals who are candidates for outpatient care.

- Long term follow up was not performed in these patients, and time duration at which serum albumin normalises could not be asscertained..

- A few dynamic changes in serum value due to fluid administration were not studied.

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# ANNEXURE

## PROFORMA

NAME :

OCCUPATION :

AGE/SEX :

IP No. :

**COMPLAINTS :**

CHEST PAIN :

FEVER :

COUGH :

BREATHLESSNESS :

**COMORBID ILLNESS :**

Diabetic :

Coronary Artery Disease :

Kidney disease :

Liver disease :

Neoplasm :

Bronchial Asthma :

Immunosupressants :

pregnancy lactation :

HIV positive :

**VITAL SIGNS:**

TEMPERATURE :

RESPIRATORY RATE :

PULSE RATE :

BLOODPRESSURE :

**INVESTIGATIONS:**

Hb :

PLATELETS :

SERUM ALBUMIN ON DAY0 :

SERUM ALBUMIN ON DAY 3:

SERUM ALBUMIN ON DAY 7 :

CHEST X RAY ON ADMISSION

**CURB -65 SCORE**

AGE :

CONFUSION :

BLOOD UREA :

RESPIRATORY RATE :

BLOOD PRESSURE :

TOTAL SCORE :

**PNEUMONIA SEVERITY INDEX**

AGE :

SEX :

NURSING HOME RESIDENT :

NEOPLASTIC DISEASE :

STROKE HISTORY :

LIVER DISEASE :

CHF HISTORY :

Renal disease :

SYSTOLIC BP <90 :

ALTERED MENTAL STATUS :

RESP RATE>29 /mt :

TEMP<35/>39.9$^0$C :

PULSE>124 /minute :

pH<7.35 :

BUN>29 mg per dl :

SODIUM<130 mg per dl :

GLUCOSE>249 mg per dl :

HEMATOCRIT<30% :

PaO2<60mmHg :

PLEURAL EFFUSION :

TOTAL and GRADE :

## INFORMATION SHEET

We are conducting a study on **"A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB-65 AND PSI SCORING"** among patients attending Rajiv Gandhi Government General Hospital, Chennai and for that your specimen may be valuable to us The purpose of this study is to determine the prognostic value of serum albumin in community acquired pneumonia . Also to correlate them with CURB 65 and Pneumonia severity index. We are selecting certain cases and if you are found eligible, we may elicit a short history and also do relevant clinical examination . We may use your blood samples to do certain tests. Chest X Ray will be taken which in any way do not affect your final report or management.

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled. The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management.

Signature of Investigator Signature of the participant

Date :

Place :

## PATIENT CONSENT FORM

Study Detail : **A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB-65 AND PSI SCORING A**

| | | |
|---|---|---|
| Study Centre | : | Rajiv Gandhi Government General Hospital, Chennai. |
| Patient's Name | : | |
| Patient's Age | : | |
| Identification Number | : | |

Patient may check (☑) these boxes

| | |
|---|---|
| I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. | |
| I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. | |
| I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. | |
| I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. | |
| I hereby consent to participate in this study. | |

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests.

Signature/thumb impression Signature of Investigator

Patient's Name and Address **Dr.G.PRASANNA BABU.**

# ஆராய்ச்சி தகவல் தாள்

**ஆராய்ச்சி தலைப்பு**

**சமூகத்தில் பெறப்பட்ட நுரையீரல் தொற்று (நிமோனியா) காரணமாக மருத்துவமனையில் அனுமதிக்கப்படும் நோயாளிகளின் குருதி ஆல்புமின் அளவுகளைக் கொண்டு நோயின் தீவிரத்தை முன் கணித்து அவற்றை CURB-65, PSI Score ஆகியவற்றுடன் ஒப்பிட்டு பார்க்கும் ஆய்வு.**

ஆய்வாளர் பெயர் : மரு.கோ.பிரசன்ன பாபு

ஆய்வு நிலையம் : பொது மருத்துவப் பிரிவு
சென்னை மருத்துவக் கல்லூரி, சென்னை-3.

இந்த ஆய்வில் தங்களை பங்கேற்க அழைக்கிறோம். இந்த தகவல் அறிக்கையில் கூறப்பட்டிருக்கும் தகவல்கள் தாங்கள் இந்த ஆராய்ச்சியில் பங்கேற்கலாமா வேண்டாமா என்பதை முடிவு செய்ய உதவியாக இருக்கும். இந்த படிவத்தில் உள்ள தகவல்கள் பற்றி உள்ள சந்தேகங்களை நீங்கள் தயங்காமல் கேட்கலாம்.

இந்த ஆராய்ச்சியின் மூலம் சமூகத்தில் பெறப்பட்ட நுரையீரல் தொற்று (நிமோனியா) காரணமாக மருத்துவமனையில் அனுமதிக்கப்படும் நோயாளிகளின் குருதி ஆல்புமின் அளவுகளைக் கொண்டு நோயின் தீவிரத்தை முன் கணிக்கப்பட்டு அவை CURB-65, PSI Score ஆகியவற்றுடன் ஒப்பிடப்படும். அதற்கு தங்கள் ஒத்துழைப்பு தேவை.

நீங்கள் இந்த ஆராய்ச்சியில் பங்கேற்க நாங்கள் விரும்புகிறோம். முடிவுகளை அல்லது கருத்துக்களை வெளியிடும்போதோ அல்லது ஆராய்ச்சியின்போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிடமாட்டோம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில்தான் இருக்கிறது. மேலும் நீங்கள் எந்த நேரமும் இந்த ஆராய்ச்சியில் இருந்து பின் வாங்கலாம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த சிறப்பு பரிசோதனையின் முடிவுகளை ஆராய்ச்சியின்போது அல்லது ஆராய்ச்சியின் முடிவில் தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

**ஆராய்ச்சியாளர் கையொப்பம்**

தேதி:

**பங்கேற்பாளர் கையொப்பம்**
**இடது கட்டைவிரல் ரேகை**

தேதி :

**INSTITUTIONAL ETHICS COMMITTEE**
**MADRAS MEDICAL COLLEGE, CHENNAI 600 003**

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

**CERTIFICATE OF APPROVAL**

To

Dr.G.Prasanna Babu
PG in MD General Medicine
Institute of Internal Medicine
Madras Medical College
Chennai 600 003

Dear Dr.G.Prasanna Babu,

The Institutional Ethics Committee has considered your request and approved your study titled **"THE PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB 65 AND PSI SCORING " - NO.10052017**

The following members of Ethics Committee were present in the meeting hold on **02.05.2017** conducted at Madras Medical College, Chennai 3

| | |
|---|---|
| 1.Prof.Dr.C.Rajendran, MD., | :Chairperson |
| 2.Prof.R.Narayana Babu, MD.,DCH.,Dean, MMC,Ch-3 | :Deputy Chairperson |
| 3.Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3 | :Member Secretary |
| 4.Prof.S.Suresh,MS.,Prof.of Surgery,MMC, Ch-3 | : Member |
| 5.Prof.S.Mayilvahanan,MD,Director,Inst. of Int.Med,MMC, Ch-3 | : Member |
| 6.Tmt.J.Rajalakshmi, JAO,MMC, Ch-3 | : Lay Person |
| 7.Thiru S.Govindasamy, BA.,BL,High Court,Chennai | : Lawyer |
| 8.Tmt.Arnold Saulina, MA.,MSW., | :Social Scientist |

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

# PLAGIARISM REPORT

URKUND

## Urkund Analysis Result

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|---|---|
| Analysed Document: | prasanna babu thesis.docx (D42575500) |
| Submitted: | 10/15/2018 3:28:00 PM |
| Submitted By: | babu71188@yahoo.com |
| Significance: | 5 % |

### Sources included in the report:

PROCALCITONIN AS A MARKER OF SEPSIS IN HOSPITALISED ELDERLY.docx (D31359346)
http://jultika.oulu.fi/Record/isbn978-952-62-0531-1
https://openarchive.ki.se/xmlui/handle/10616/41284
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https://www.news-medical.net/news/20130121/Albumin-may-prove-a-predictor-for-pneumonia-outcomes.aspx

### Instances where selected sources appear:

9

# CERTIFICATE – II

This is to certify that this dissertation work titled **"A STUDY OF PROGNOSTIC VALUE OF SERUM ALBUMIN LEVELS IN HOSPITALIZED PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA AND CORRELATION WITH CURB-65 AND PSI SCORING"** of the candidate **Dr**.**G.PRASANNA BABU** with registration Number **201611017** for the award of **M.D.** in the branch of **GENERAL MEDICINE**. I personally verified the urkund.com website for plagiarism Check. I found that the uploaded thesis file contained all pages from introduction to conclusion pages and the result showed **5 percentage** of plagiarism in the dissertation.

Guide & Supervisor sign with Seal

# MASTER CHART

| S.No | Age | Gender | Serum albumin on day 0 | Day 3 | Day 7 | Confusion | BUN | Respiratory Rate | BP | CURB -65 | PSI SCORE | NO OF DAYS TO REACH CLINICAL STABILITY | NO OF DAYS OF HOSPITALS STAY | NEED FOR MECHANICAL VENTILATION | NEED FOR INOTROPIC SUPPORT | EMPYEMA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 62 | M | 2.9 | 2.7 | 2.8 | Nil | 43 | 36 | 140/80 | 2 | 107(4) | 4 | 8 | No | No | No |
| 2 | 56 | M | 2.4 | 2.6 | 2.7 | Nil | 33 | 34 | 90/60 | 3 | 100(4) | 8 | 12 | No | Yes | No |
| 3 | 67 | M | 3 | 3.2 | - | Nil | 26 | 22 | 100/60 | 2 | 97(4) | 2 | 6 | No | No | No |
| 4 | 64 | F | 2.6 | 2.7 | 3.1 | Present | 36 | 30 | 150/90 | 4 | 138(4) | 9 | 13 | Yes | No | No |
| 5 | 31 | M | 3.8 | 3.7 | 3.7 | Nil | 39 | 34 | 130/90 | 2 | 91(4) | 2 | 6 | No | No | No |
| 6 | 70 | M | 2.8 | 2.6 | 2.9 | Nil | 43 | 32 | 100/70 | 3 | 100(4) | 5 | 9 | No | No | No |
| 7 | 60 | F | 3.3 | - | - | Nil | 22 | 32 | 130/90 | 2 | 89(3) | 2 | 3 | No | No | No |
| 8 | 47 | M | 2.7 | 2.9 | - | Nil | 17 | 32 | 120/80 | 1 | 67(2) | 3 | 4 | No | No | No |
| 9 | 74 | M | 3.4 | - | - | Present | 34 | 28 | 110/70 | 3 | 114(4) | 2 | 4 | No | No | No |
| 10 | 65 | F | 2.9 | - | - | Nil | 18 | 36 | 130/80 | 2 | 85(3) | 2 | 3 | No | No | No |
| 11 | 36 | M | 4.3 | - | - | Nil | 17 | 22 | 110/80 | 0 | 66(2) | 1 | 2 | No | No | No |
| 12 | 62 | M | 2.8 | 2.9 | 3.1 | Nil | 38 | 34 | 120/90 | 2 | 132(5) | 5 | 9 | No | No | No |
| 13 | 44 | F | 2.3 | 2.6 | - | Nil | 16 | 26 | 130/90 | 0 | 64(2) | 2 | 4 | No | No | No |
| 14 | 28 | M | 2.9 | - | - | Nil | 17 | 22 | 120/90 | 0 | 68(2) | 2 | 3 | No | No | No |
| 15 | 60 | M | 3.2 | - | - | Nil | 22 | 26 | 100/80 | 1 | 110(4) | 1 | 3 | No | No | No |
| 16 | 71 | M | 2.9 | 2.8 | 2.9 | Present | 18 | 34 | 110/70 | 3 | 141(5) | 5 | 8 | No | No | No |
| 17 | 63 | F | 3.8 | - | - | Nil | 12 | 36 | 110/80 | 1 | 73(3) | 2 | 3 | No | No | No |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 66 | M | 3.4 | 3.5 | - | Nil | 22 | 26 | 120/90 | 2 | 126(4) | 2 | 4 | No | No | No |
| 19 | 48 | F | 2.4 | 2.6 | - | Nil | 16 | 28 | 80/50 | 0 | 58(2) | 3 | 5 | No | Yes | No |
| 20 | 60 | F | 2.8 | 2.7 | 2.6 | Nil | 34 | 24 | 60/40 | 2 | 160(5) | 5 | 9 | No | Yes | No |
| 21 | 25 | F | 2.9 | 3.2 | - | Nil | 16 | 36 | 120/90 | 1 | 55(2) | 3 | 5 | No | No | No |
| 22 | 65 | M | 3.2 | - | - | Present | 32 | 32 | 110/70 | 3 | 145(4) | 6 | 9 | Yes | No | No |
| 23 | 46 | M | 2.9 | - | - | Nil | 15 | 22 | 130/80 | 0 | 61(2) | 2 | 3 | No | No | No |
| 24 | 36 | M | 3.7 | - | - | Nil | 14 | 28 | 120/90 | 0 | 51(2) | 1 | 3 | No | No | No |
| 25 | 62 | M | 3.4 | 3.6 | - | Nil | 32 | 36 | 110/80 | 2 | 112(4) | 2 | 4 | No | No | No |
| 26 | 68 | M | 1.9 | 1.8 | 1.8 | Nil | 17 | 34 | 130/90 | 2 | 118(4) | 14 | 16 | Yes | No | No |
| 27 | 60 | F | 2.8 | 3 | - | Nil | 16 | 38 | 120/90 | 1 | 80(3) | 5 | 7 | No | No | No |
| 28 | 70 | M | 2.3 | 2.2 | 2.5 | Present | 34 | 24 | 110/70 | 3 | 130(4) | 8 | 10 | Yes | No | No |
| 29 | 41 | M | 3.8 | - | - | Nil | 16 | 22 | 110/90 | 0 | 61(2) | 2 | 3 | No | No | No |
| 30 | 38 | M | 3.7 | 3.8 | - | Nil | 15 | 32 | 100/70 | 1 | 68(2) | 3 | 5 | No | No | No |
| 31 | 70 | F | 2.7 | 3 | - | Present | 36 | 28 | 110/70 | 3 | 125(4) | 3 | 5 | No | No | No |
| 32 | 42 | M | 2.8 | - | - | Nil | 16 | 26 | 120/90 | 0 | 52(2) | 2 | 3 | No | No | No |
| 33 | 38 | M | 3.4 | - | - | Nil | 12 | 28 | 110/70 | 0 | 48(1) | 1 | 2 | No | No | No |
| 34 | 70 | F | 2.9 | 2.8 | 3.1 | Nil | 18 | 26 | 80/50 | 2 | 150(5) | 6 | 9 | No | Yes | No |
| 35 | 63 | F | 2.4 | 2.3 | 2.8 | Nil | 12 | 32 | 110/70 | 1 | 88(3) | 10 | 14 | No | No | Yes |
| 36 | 37 | M | 3.9 | 4 | - | Nil | 16 | 28 | 120/80 | 0 | 57(2) | 2 | 4 | No | No | No |
| 37 | 43 | M | 3.2 | - | - | Nil | 12 | 32 | 110/70 | 1 | 88(3) | 2 | 3 | No | No | No |
| 38 | 73 | M | 2.4 | 2.1 | 2 | Nil | 18 | 36 | 110/70 | 2 | 123(5) | - | Died on day 10 | Yes | No | No |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 54 | M | 2.9 | 3 | 2.9 | Nil | 22 | 28 | 110/70 | 2 | 94(4) | 5 | 9 | No | No | No |
| 40 | 27 | F | 3.7 | 4.1 | - | Nil | 14 | 22 | 100/70 | 0 | 42(1) | 3 | 5 | No | No | No |
| 41 | 65 | M | 2.3 | 2.6 | 2.8 | Nil | 18 | 32 | 120/80 | 2 | 125(5) | 7 | 10 | Yes | No | No |
| 42 | 46 | F | 2.7 | 2.4 | 2.8 | Nil | 16 | 36 | 110/70 | 1 | 116(4) | 5 | 8 | Yes | No | No |
| 43 | 56 | M | 2.8 | - | - | Nil | 22 | 24 | 110/70 | 1 | 106(4) | 2 | 3 | No | No | No |
| 44 | 37 | M | 3.4 | 3.5 | - | Nil | 12 | 26 | 130/90 | 0 | 77(2) | 3 | 6 | No | No | No |
| 45 | 65 | F | 3.5 | 3.1 | - | Nil | 16 | 22 | 100/60 | 1 | 85(3) | 3 | 6 | No | No | No |
| 46 | 66 | M | 3.5 | 3.1 | 2.9 | Nil | 37 | 22 | 120/80 | 2 | 136(5) | 5 | 9 | No | No | No |
| 47 | 68 | F | 2.9 | 3 | - | Present | 17 | 32 | 110/70 | 3 | 118(4) | 3 | 6 | No | No | No |
| 48 | 48 | M | 3.1 | 3 | 3.1 | Nil | 32 | 26 | 70/50 | 2 | 118(4) | 5 | 9 | No | Yes | No |
| 49 | 37 | F | 2.7 | 2.8 | 2.9 | Nil | 32 | 26 | 80/50 | 2 | 88(3) | 6 | 8 | No | Yes | No |
| 50 | 63 | M | 2.9 | 3.1 | - | Nil | 28 | 19 | 110/70 | 1 | 93(4) | 3 | 5 | No | No | No |
| 51 | 49 | M | 2.3 | 2.1 | 2.4 | Nil | 18 | 26 | 120/80 | 0 | 74(3) | 7 | 9 | No | No | No |
| 52 | 70 | F | 2.6 | 2.7 | 2.9 | Present | 36 | 22 | 100/70 | 3 | 130(4) | 6 | 9 | No | No | No |
| 53 | 58 | F | 2.7 | 2.9 | 3 | Nil | 16 | 32 | 120/80 | 1 | 98(4) | 5 | 8 | No | No | No |
| 54 | 31 | M | 2.9 | 3.1 | - | Nl | 16 | 26 | 120/80 | 0 | 61(2). | 2 | 4 | No | No | No |
| 55 | 72 | F | 1.8 | 2 | 1.6 | Present | 36 | 25 | 80/50 | 5 | 144(5) | 8 | 10 | Yes | Yes | Yes |
| 56 | 54 | M | 3 | 2.9 | 3.2 | Nil | 21 | 22 | 130/90 | 1 | 94(4) | 5 | 8 | No | No | No |
| 57 | 65 | F | 2.3 | 2.6 | 3 | Nil | 22 | 26 | 110/80 | 2 | 95(4) | 6 | 9 | No | No | No |
| 58 | 21 | M | 3.9 | - | - | Nil | 17 | 24 | 120/80 | 0 | 41(1) | 2 | 3 | No | No | No |
| 59 | 66 | F | 2.8 | 2.9 | - | Present | 38 | 26 | 100/70 | 3 | 146(5) | 3 | 5 | No | No | No |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 42 | M | 3.2 | 3 | 3.5 | Nil | 13 | 28 | 100/70 | 0 | 92(4) | 5 | 8 | No | No | No |
| 61 | 37 | F | 4.2 | 4.5 | 4.8 | Nil | 17 | 18 | 110/70 | 0 | 57(2) | 1 | 3 | No | No | No |
| 62 | 70 | M | 2.8 | 2.9 | 3.2 | Nil | 36 | 32 | 130/80 | 3 | 140(5) | 5 | 8 | Yes | No | No |
| 63 | 73 | M | 2.2 | 1.9 | 1.9 | Nil | 19 | 36 | 110/70 | 2 | 143(5) | - | Died on day 8 | Yes | No | No |
| 64 | 64 | F | 3.7 | 3.6 | 3.5 | Nil | 12 | 30 | 130/90 | 1 | 104(4) | 6 | 8 | No | No | No |
| 65 | 66 | M | 2.8 | 3 | - | Present | 12 | 32 | 120/80 | 2 | 126(4) | 2 | 4 | No | No | No |
| 66 | 70 | F | 2.9 | 2.8 | 3.4 | Nil | 18 | 26 | 110/70 | 1 | 110(4) | 5 | 9 | No | No | No |
| 67 | 49 | M | 3.4 | 3.6 | - | Nil | 13 | 24 | 110/70 | 0 | 99(4) | 2 | 4 | No | No | No |
| 68 | 70 | F | 2.7 | 2.5 | 2.8 | Nil | 15 | 26 | 80/50 | 2 | 130(5) | 6 | 9 | No | Yes | No |
| 69 | 55 | M | 3.2 | 3.5 | - | Nil | 16 | 32 | 110/70 | 1 | 115(4) | 3 | 5 | No | No | No |
| 70 | 62 | M | 2.1 | 2.4 | - | Nil | 15 | 36 | 100/60 | 1 | 122(4) | 3 | 5 | No | No | No |
| 71 | 48 | F | 2.9 | 3.1 | 3.6 | Nil | 14 | 22 | 110/70 | 0 | 88(2) | 5 | 8 | No | No | No |
| 72 | 68 | F | 3.4 | 3.2 | 3.5 | Nil | 14 | 26 | 110/70 | 1 | 128(4) | 5 | 8 | No | No | No |
| 73 | 80 | M | 2.8 | 2.9 | 3.1 | Present | 38 | 24 | 100/80 | 3 | 140(5) | 5 | 8 | No | No | No |
| 74 | 49 | M | 2.3 | 2.6 | 2.7 | Nil | 21 | 22 | 110/70 | 1 | 89(3) | 8 | 10 | No | No | Yes |
| 75 | 56 | F | 3 | 3.4 | - | Nil | 15 | 26 | 100/60 | 0 | 96(4) | 3 | 5 | No | No | No |
| 76 | 70 | M | 2.6 | 2.9 | - | Nil | 19 | 34 | 120/80 | 2 | 130(5) | 5 | 9 | Yes | No | No |
| 77 | 29 | M | 3.9 | - | - | Nil | 15 | 24 | 110/70 | 0 | 69(2) | 2 | 3 | No | No | No |
| 78 | 60 | M | 2.8 | 2.9 | 3.1 | Nil | 16 | 42 | 100/60 | 1 | 100(5) | 4 | 9 | No | No | No |
| 79 | 42 | F | 4 | - | - | Nil | 25 | 16 | 110/70 | 1 | 82(3) | 1 | 2 | No | No | No |
| 80 | 72 | M | 3.1 | 3.4 | - | Present | 42 | 22 | 120/80 | 3 | 152(5) | 6 | 7 | No | No | No |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 33 | M | 2.6 | 2.5 | 2.4 | Nil | 12 | 32 | 120/80 | 1 | 83(3) | 7 | 13 | No | No | Yes |
| 82 | 56 | F | 2.7 | 2.9 | - | Nil | 16 | 30 | 110/70 | 1 | 106(4) | 3 | 5 | No | No | No |
| 83 | 45 | M | 2.8 | 2.9 | 3 | Nil | 22 | 26 | 110/70 | 1 | 85(3) | 5 | 8 | No | No | No |
| 84 | 24 | M | 3.7 | - | - | Nil | 14 | 28 | 110/70 | 0 | 54(2) | 2 | 3 | No | No | No |
| 85 | 60 | F | 2.4 | 2.6 | - | Nil | 36 | 26 | 100/70 | 1 | 110(5) | 3 | 8 | No | No | No |
| 86 | 62 | M | 2.9 | 2.8 | 3 | Nil | 39 | 26 | 80/60 | 2 | 142(5) | 5 | 8 | No | Yes | No |
| 87 | 72 | M | 2.3 | 2.1 | 2.2 | Nil | 16 | 24 | 70/50 | 2 | 142(5) | 8 | 10 | No | Yes | No |
| 88 | 64 | M | 3.4 | 3.6 | - | Nil | 12 | 22 | 110/70 | 0 | 94(2) | 2 | 5 | No | No | No |
| 89 | 30 | F | 2.7 | 2.9 | - | Nil | 12 | 28 | 110/70 | 1 | 105(4) | 3 | 6 | No | No | No |
| 90 | 66 | F | 2.8 | 3.1 | 3.1 | Nil | 16 | 26 | 140/80 | 1 | 106(4) | 5 | 8 | No | No | No |
| 91 | 60 | F | 3.2 | 3 | 3.4 | Nil | 12 | 22 | 110/70 | 0 | 100(4) | 5 | 9 | No | No | No |
| 92 | 80 | M | 1.7 | 2.1 | 1.6 | Nil | 29 | 38 | 80/50 | 4 | 170(5) | - | Died on day 8 | Yes | Yes | No |
| 93 | 66 | F | 2.6 | 2.8 | 2.8 | Present | 48 | 24 | 110/70 | 3 | 136(5) | 5 | 9 | No | No | No |
| 94 | 28 | M | 2.8 | 2.9 | 3.2 | Nil | 12 | 32 | 110/80 | 1 | 78(3) | 5 | 8 | No | No | No |
| 95 | 58 | M | 3.4 | - | - | Nil | 12 | 26 | 120/80 | 0 | 98(4) | 2 | 3 | No | No | No |
| 96 | 74 | M | 2.8 | 2.8 | 3.1 | Nil | 28 | 22 | 110/70 | 2 | 114(4) | 5 | 8 | No | No | No |
| 97 | 70 | M | 2.3 | 2.2 | 2.8 | Nil | 18 | 24 | 70/40 | 2 | 140(5) | 8 | 10 | No | Yes | No |
| 98 | 64 | M | 3.3 | - | - | Nil | 14 | 26 | 120/80 | 0 | 94(4) | 1 | 2 | No | No | No |
| 99 | 56 | F | 2.9 | 3.4 | - | Nil | 17 | 22 | 130/90 | 0 | 96(4) | 2 | 4 | No | No | No |
| 100 | 48 | M | 3.8 | 3.7 | - | Nil | 21 | 22 | 110/70 | 1 | 88(3) | 2 | 6 | No | No | No |