# "CORRELATION OF ARTERIAL BLOOD LACTATE TO SERUM ALBUMIN RATIO WITH SERUM ALBUMIN FOR IN-HOSPITAL MORTALITY OF PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA ADMITTED TO INTENSIVE CARE UNIT."


**BY**

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**DISSERTATION SUBMITTED TO**
**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA**
**In partial fulfilment of the requirements for the degree of**

## DOCTOR OF MEDICINE

**Under the Guidance of**

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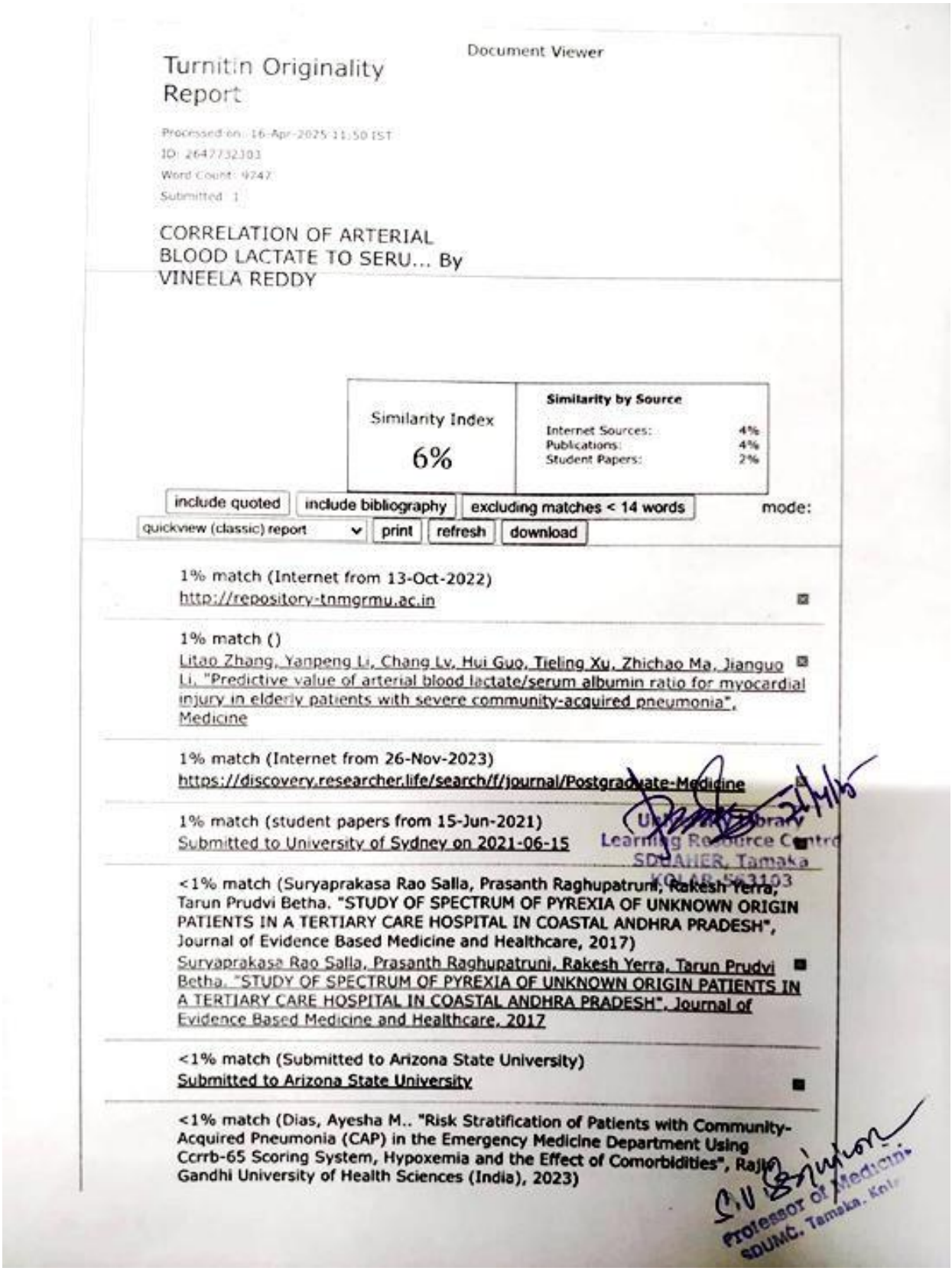

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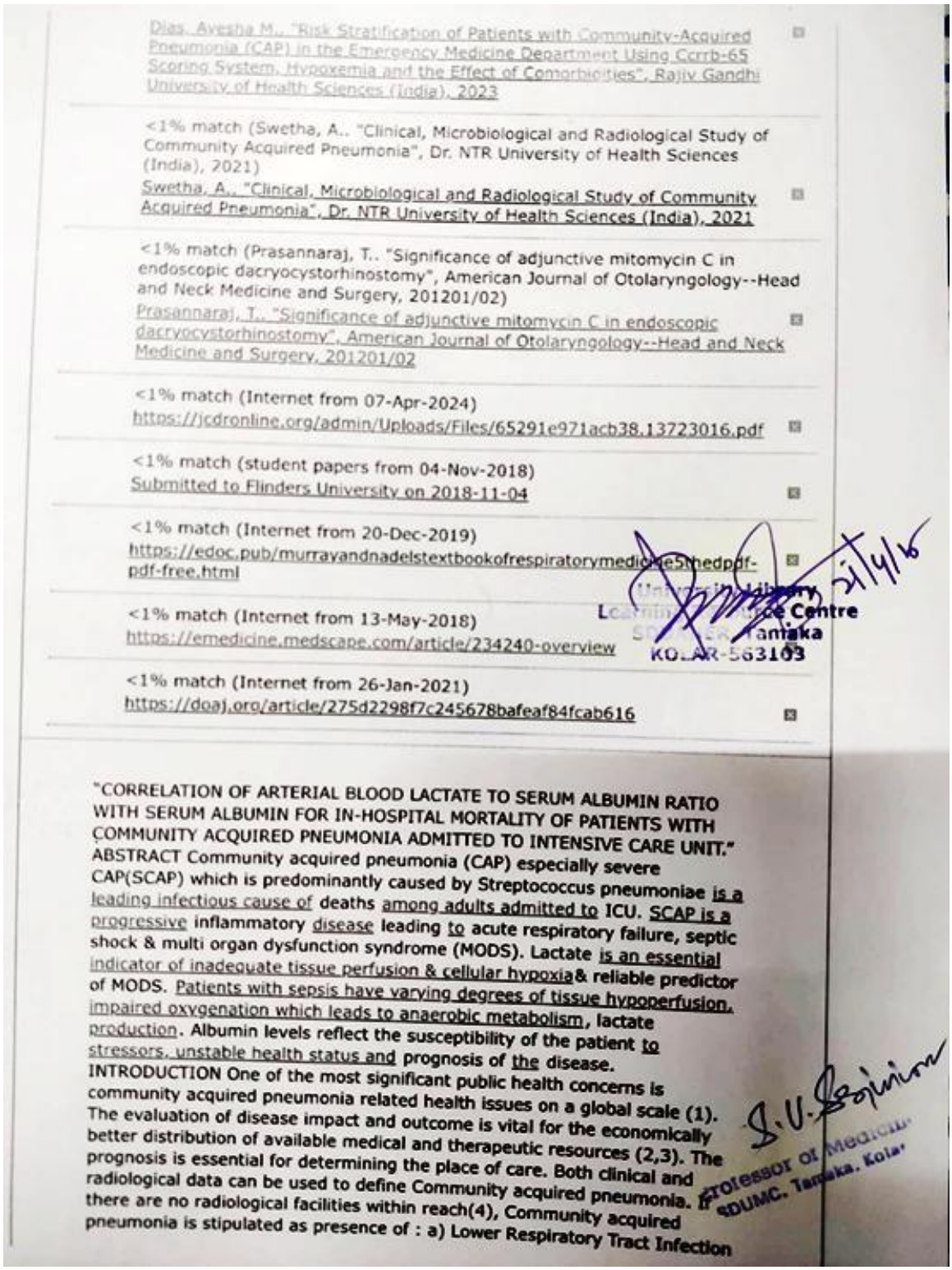

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**ABSTRACT** Community acquired pneumonia (CAP) especially severe CAP(SCAP) which is predominantly caused by Streptococcus pneumoniae is a leading infectious cause of deaths among adults admitted to ICU. SCAP is a progressive inflammatory disease leading to acute respiratory failure, septic shock & multi organ dysfunction syndrome (MODS). Lactate is an essential indicator of inadequate tissue perfusion & cellular hypoxia& reliable predictor of MODS. Patients with sepsis have varying degrees of tissue hypoperfusion, impaired oxygenation which leads to anaerobic metabolism, lactate production. Albumin levels reflect the susceptibility of the patient to stressors, unstable health status and prognosis of the disease.

**INTRODUCTION** One of the most significant public health concerns is community acquired pneumonia related health issues on a global scale (1). The evaluation of disease impact and outcome is vital for the economically better distribution of available medical and therapeutic resources (2,3). The prognosis is essential for determining the place of care. Both clinical and radiological data can be used to define Community acquired pneumonia. If there are no radiological facilities within reach(4), Community acquired pneumonia is stipulated as presence of : a) Lower Respiratory Tract Infection

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## PRIOR PERMISSION TO START OF STUDY

The Institutional Ethics Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has examined and unanimously approved the synopsis entitled **"Predictive Value Of Arterial Blood Lactate To Serum Albumin Ratio For In-Hospital Mortality Of Patients With Community Acquired Pneumonia Admitted To Intensive Care Unit And It's Comparison With Serum Albumin"** being investigated by **Dr.Reddy Hari Priya Vani Vineela & Dr.Srinivasa S V** in the Department of General Medicine at Sri Devaraj Urs Medical College, Tamaka, Kolar. **Permission is granted by the Ethics Committee to start the study.**

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*My sincere appreciation to my respected guide* ***Dr. SRINIVASA.S.V.*** *for his unwavering guidance.*

*His valuable suggestions, and kind encouragement throughout this study were immeasurable. His constant support, wise guidance, and prudent admonitions have empowered me to cultivate a profound comprehension of the subject.*

*I extend my heartfelt gratitude to* ***Dr. VIDYASAGAR C R*** *,The Head of the Department of General Medicine. His steadfast guidance, keen scientific insight, practicality, a knack for solving the impossible, and ability to break complex ideas into simple terms taught me to think beyond the box. I wish to imprint his teachings throughout my career.*

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*My acknowledgement would be incomplete without mentioning my dearest and beloved family, especially my parents,* ***R. SRINIVASA RAO*** *and* ***R. LALITHA RANI*** *and beloved Sister* ***Dr. R. SRAVANI*** *for all the support and belief they had in me.*

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*Lastly, I would like to extend my gratitude to the nursing staff and hospital workers for their assistance in conducting the study. My humble acknowledgement to the patients and their cooperation during this research.*

Place: Kolar **DR. REDDY. HARI PRIYA VANI VINEELA**

# LIST OF ABBREVIATIONS

| | |
|---|---|
| CAP | COMMUNITY ACQUIRED PNEUMONIA |
| SCAP | SEVERE COMMUNITY ACQUIRED PNEUMONIA |
| MODS | MULTI ORGAN DYSFUNCTION SYNDROME |
| LAR | LACTATE ALBUMIN RATIO |
| ICU | INTENSIVE CARE UNIT |
| LRTI | LOWER RESOIRATORY TRACT INFECTIONS |
| TB | TUBERCULOSIS |
| IL-6 | INTERLEUKIN-6 |
| O2 | OXYGEN |
| CO2 | CARBON DIOXIDE |
| $HCO3^-$ | BICARBONATE |
| H+ | HYDROGEN |
| TNF-ALPHA | TUMOUR NECROTIC FACTOR-ALPHA |
| LFT | LIVER FUNCTION TESTS |
| SPO2 | SATURATION |
| IL-8 | INTERLEUKIN-8 |
| GM-CSF | GRANULOCYTE MONOCYTE-COLONY STIMULATING FACTOR |
| Ig-A | IMMUNOGLOBULIN-A |
| M.TUBERCULOSIS | MYCOBACTERIUM TUBERCULOSIS |
| COPD | CHRONIC OBSTRUCTIVE PULMONARY DISEASE |

| | |
|---|---|
| GI | GASTROINTESTINAL TRACT |
| CNS | CENTRAL NERVOUS SYSTEM |
| IV | INTRA VENOUS |
| MRSA | METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS |
| VAP | VENTILATOR ASSOCIATED PNEUMONIA |
| EBV | EBSTEIN BARR VIRUS |
| PL-HIV | PATIENT LIVING WITH HIV |
| CBC | COMPLETE BLOOD COUNT |
| RBS | RANDOM BLOOD SUGAR |
| HIV | HUMAN IMMUNODEFICIENCY VIRUS |
| H.INFLUENZA | HAEMOPHILUS INFLUENZA |
| ESR | ERYTHROCYTE SEDIMENTATION RATE |
| CRP | C-REACTIVE PROTEIN |
| AFB | ACID FAST BACILLI |
| NAA | NUCLEIC ACID AMPLICATION |
| BAL | BRONCHO-ALVEOLAR LAVAGE |
| IDSA | INFECTIOUS DISEASES SOCIETY OF AMERICA |
| ATS | AMERICAN THORACIC SOCIETY |
| CLD | CHRONIC LIVER DISEASE |
| WBC | WHITE BLOOD CELLS |
| PSI | PNEUMONIA SEVERITY INDEX |
| LDH | LACTATE DEHYDROGENASE |
| RR | RESPIRATORY RATE |
| PaO2 | PARTIAL PRESSURE OF OXYGEN |

| | |
|---|---|
| FiO2 | FRACTION OF INSPIRED OXYGEN |
| BUN | BLOOD UREA NITROGEN |
| PR | PULSE RATE |
| BP | BLOOD PRESSURE |
| HR | HEART RATE |
| RDW | RED CELL DISTRIBUTION WIDTH |
| PCT | PROCALCITONIN |
| SUPAR | SOLUBLE UROKINASE PLASMINOGEN ACTIVATOR RECEPTOR |
| ROC | RECEIVER OPERATING CURVE |

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# ABSTRACT

**Introduction:**

Community acquired pneumonia (CAP) especially severe CAP(SCAP) which is predominantly caused by Streptococcus pneumoniae is a leading infectious cause of deaths among adults admitted to ICU. SCAP is a progressive inflammatory disease leading to acute respiratory failure, septic shock & multi organ dysfunction syndrome (MODS). Lactate is an essential indicator of inadequate tissue perfusion & cellular hypoxia & reliable predictor of MODS. Patients with sepsis have varying degrees of tissue hypoperfusion, impaired oxygenation which leads to anaerobic metabolism, lactate production. Albumin levels reflect the susceptibility of the patient to stressors, unstable health status and prognosis of the disease.

**Materials and Methods:**

The present „cross sectional study" was conducted on 35 patients suffering from community acquired pneumonia in „Sri Devraj URS academy of higher education and research" for a period of 24 months from November 2023 to April 2025. Prior to the initiation of the study, Ethical and Research Committee clearance was obtained from Institutional Ethical Committee.

**Results and observations:**

The study involved 35 subjects aged 18-70 years. This suggests that elderly individuals were more affected or more likely to be included in the study. The study also suggests mortality rate of 57%. This death rate suggests Lactate Albumin Ratio (LAR) can be used as prognostic marker for community acquired pneumonia patients admitted to ICU.

**Conclusion:**

According to this study there is 100% mortality in patients with elevated Lactate albumin ratio.



**Key words:**

**"**Community acquired pneumonia, lactate, Lactate albumin ratio."

# INTRODUCTION

# INTRODUCTION

One of the most significant public health concerns is community acquired pneumonia related health issues on a global scale [(1)]. The evaluation of disease impact and outcome is vital for the economically better distribution of available medical and therapeutic resources [(2,3)]. The prognosis is essential for determining the place of care. Both clinical and radiological data can be used to define Community acquired pneumonia. If there are no radiological facilities within reach[(4)], Community acquired pneumonia is stipulated as presence of :

a) Lower Respiratory Tract Infection (LRTI) symptoms for a duration of less than 7days.

b) At least 1 symptom like temperature >= 37.7C, malaise, chills, rigors

c) At least 1 new respiratory examination finding- bronchial breath sounds/ crepitations & all alternative causes should be ruled out.

In hospital which provides tertiary care, wherein chest x-ray is commonly taken, CAP is defined by additional criteria. New imaging findings like loss of diaphragmatic/ cardiac/ mediastinal silhouette, shadow in the form of consolidation which might be lobar or patchy in distribution, interstitial infiltrates/ bilateral perihilar opacities that cannot be explained by anything else like acute pulmonary oedema, pulmonary TB etc adds on to the criteria.

Recent research has discovered that the biomarkers will provide further information on severity of CAP, and will be able to differentiate bacterial & viral cause & will allow for early detection of complications. Most biomarkers are costly & difficult to obtain on emergency basis. Within 24 hours of admittance, low serum albumin levels were independently linked to poor outcomes[(6)].Numerous mechanisms underlie the cause. Albumin performs antioxidant and buffering actions in acid-base metabolism in addition to its nutritional role. Additionally, it

transports the hormones cortisol and thyroxine, maintains oncotic pressure, and inhibits apoptosis. In the acute phase of inflammation, there is a decline in albumin synthesis rate. Inhibitory effect on albumin production in the liver, increased catabolism of albumin, and redistribution of albumin in the extravascular compartment[6] are all caused by the rising levels of pro-inflammatory cytokines, particularly IL-6.The cytokines production diverts amino acids towards synthesis of acute phase reactants, thus lowering albumin levels. Serum albumin is a simple, inexpensive, readily available and indirect biomarker that can be used to determine severity of Community acquired pneumonia (CAP). When patients are developing complications, the serum albumin levels are also evaluated in relation to lactate level.

Increased lactate production which is due to impaired tissue oxygenation, either from reduced O2 delivery / mitochondrial O2 utilization defect. Normally an individual will produce 15-20 millimol/kg lactic acid/day. Majority of it is derived from glucose metabolism (glycolytic pathway). Hence balance is maintained by utilization of equal amounts of lactic acid.

Lactic acidosis is said to occur when lactic acid production > excretion. Lactate levels >=2 millimol/L indicates “Hyperlactatemia”. It is defined as serum lactate concentration >=4 mmol/L which is the commonest cause of metabolic acidosis in hospitalized patients. It is oxidized to CO2 & water (70 to 80%) & used to produce glucose (15 to 20%). Small amounts of lactic acid is converted to alanine. Utilization of lactate primarily occurs in liver, kidneys, heart, other tissues. Large amount of lactate is produced from glucose by non-hepatic tissues & from glycogen by muscle. Delivery of lactate to liver, where it is converted back to glucose, is called as Cori Cycle/ Lactic Acid Cycle.

When lactate accumulates in body, $H^+$ ions are completely buffered by extracellular $HCO3^-$. When lactic acid is utilized, either by oxidation to CO2 &water or by conversion to glucose/ alanine, $H^+$ is consumed & $HCO3^-$ is generated. So, in a patient who has elevated lactate, utilization of the lactic acid will restore $HCO3^-$ concentration.

# AIMS & OBJECTIVES

# AIM AND OBJECTIVES

**AIM:-**

To determine prognostic significance of lactate and albumin levels in patients with Community Acquired Pneumonia (CAP) who are admitted to Intensive Care Unit (ICU).

**OBJECTIVES:-**

To measure predictive value of Arterial Blood Lactate to Serum Albumin Ratio (LAR) for in-hospital mortality of patients with community acquired pneumonia(CAP) admitted in intensive care unit (ICU)and to compare it with serum albumin.

# REVIEW OF LITERATURE

# REVIEW OF LITERATURE

**"**Infection of pulmonary parenchyma is called Pneumonia. Even prevalence of community acquired pneumonia (CAP) is generally between 5 to 6/1000 cases in 1 year[(7)]. It is frequently misdiagnosed, poorly managed, underestimated. Acute fever, cough, chest pain, rapid shallow breathing, tachycardia are the symptoms of pneumonia. Lanneac outlined 3 stages of consolidation and their associated clinical findings in 1834, which includes:

1. crackles in congestion phase

2. bronchial breathing during the red hepatization phase

3. return of crepitations known as "rhonchus crepitus redux" in resolution phase. Streptococcus pneumoniae and Klebsiella pneumonia were the two bacterial causes of pneumonia that Carl Friedlander & Albert Frankel reported in 1882. Sir.Williamm Osler, who is the father of modern medicine, discussed relation between pneumonia and advanced age as well as its mortality and morbidity. In a respiratory disease outbreak in Philadelphia in 1976, Legionella was isolated to be the etiology of pneumonia. Both sporadic and pandemic occurrences of chlamydia pneumonia were discovered. Hospital acquired pneumonia is now more frequently caused by MDR bacteria than in previous decades. According to statistics, CAP is the 8th commonest cause of death, in USA [(8,9)], with outpatient mortality of 1% and 40-60% in hospitalized settings. It is discovered that the incidence of pneumonia is higher among elderly individuals, increasing the illness burden in the community. Early detection of risk factors is a prerequisite for effective therapy and Intensive care unit management of high-risk patients is crucial to reduce the mortality.

PATHO–PHYSIOLOGY OF COMMUNITY ACQUIRED PNEUMONIA: Oropharyngeal micro-aspiration occurs often in patients with altered sensorium and during sleep. There are some infections that are transmitted via droplet mode from infected individuals. Usually, lower airways serve as barriers against infection, by the presence of pulmonary defence mechanisms, laryngeal reflexes, cough reflex. Pneumonia arises due to breach in any of the above mentioned defence mechanisms[10,11].The elements that are crucial for host defence mechanisms are :

- The nasal hairs and turbinates filter the bigger particles and prevent them from entering the lungs.
- The tracheobronchial tree ensures the mucociliary removal of foreign particles.
- The cough reflex and gag reflex prevent oropharyngeal content aspiration.
- Commensals of oropharynx prevents the adhesion of pathogens.
- Neutrophils and macrophages at the alveolar level have a strong anti-viral, anti-bacterial properties and property of opsonization.
- Immunoglobulins are also important for preventing infections

When the microorganisms cross these barriers, pneumonia occurs. Pneumonia symptoms and signs develop when an organism enters the alveoli & triggers inflammatory response in alveolar macrophages. TNF-alpha and Interleukin-1 are responsible for fever.6 cardinal symptoms of pneumonia: fever, pleuritic type of chest pain, cough with expectoration of greenish sputum, dyspnoea, haemoptysis. Altered sensorium/ confusion may be the only symptom in elderly patients. In Legionella pneumonia extra-pulmonary symptoms like diarrhoea, altered sensorium, hyponatremia, deranged LFT are seen. On examination tachypnoea, tachycardia, hypotension, low

SpO2, use of accessory muscles of respiration, reduced chest movements on the affected side, dull note on percussion, bronchial breath sounds/bronchophony/egophony/crackles on auscultation. Leucocytosis is due to stimulation by IL-8 and GM-CSF. Localized infiltrate can be seen on a chest X-ray as a result of the inflammatory mediators causing alveolar-capillary leak syndrome. Hypoxemia, vasoconstriction, reduced compliance, and increased respiratory rate are caused by fluid-filled alveoli. Additionally triggered is the syndrome of systemic inflammatory response, which causes systemic problems such as respiratory alkalosis. Additionally, pneumonia can develop as a result of haematogenous dissemination or can be secondary to condition brought on by an empyema, mediastinal infection, sub-diaphragmatic infection. Other possible sources of infection are bronchoscopic or surgical inoculation, and macro-aspiration of the gastric contents.

PATHOGENESIS:

CAUSUATIVE AGENT: Some pathogens escape human immune defence mechanisms like leigio: (10,11)

- Proteases from Pneumococcus & Meningococcus can break secretory IgA.
- M.Tuberculosis is resistant to phagocytosis.
- Pneumococcal capsular polysaccharide prevents phagocytosis.
- Chlamydia and mycoplasma injure the cilia.
- The mucosal membrane and the aged epithelium are attacked by Gram negative bacteria.

Thus, these microorganisms induce infection by entering the alveoli.

***Pneumococcal infection:*** The commonest cause of pneumonia. Additionally, patients with heart failure, COPD and aspiration-induced pneumonia are at increased risk of acquiring pneumonia (CAP). 25% of individuals with pneumococcal pneumonia develop para- pneumonic effusions. Even in immune-competent adults "smoking" is independent risk factor for development of serious invasive illness, especially in the middle-aged population. Lobar pneumonias are the common picture on a chest X-ray. In hospitalized patients, mortality can be up-to 7%.

***Haemophilus influenza***: Infections caused by gram-negative cocco-bacilli. More frequent in people with cystic fibrosis and COPD.

***Legionella species***: Incidence is 2-9% of all pneumonias. Naturally it is discovered in freshwater. As a result of contamination, the hot tubs, hot water tanks, and huge air conditioners, cooling towers can also be potential sources. It cannot be transmitted from person to person. The incubation period is 2 to 9 days. People who have Legionnaires Disease present with Fever with chills, Cough with expectoration, haemoptysis. Extrapulmonary features like GI symptoms (loose stools and vomiting) occur in about 50% of the patients, CNS symptoms like cognitive impairment are other manifestations. Relative bradycardia is a common sign. Deranged LFT and hyponatremia are seen in many patients. The list of organisms are L.pneumophila which is seen in 90% of legionella infections, L.longbeachaee, L.feeleii, L.micdadeii and L.annisa.

***Mycoplasma Pneumonia infection:*** It presents as atypical pneumonia, which presents as fatigue, fever, cough, headache, generalized myalgias. Since the majority of the patients can move around, the condition is called "walking pneumonia." Extrapulmonary symptoms like autoimmune

clinical features, CNS or skin involvement may occur in 25% of patients. In places where people are in close proximity [12] to one another like jails, schools, military bases,hostels

***Staphylococcus aureus infection:*** The prevalence of community-acquired MRSA is higher in communities of homosexuals, I.V. drug users, prisoners and homeless people. It is followed by an illness that resembles the flu in young adult who is otherwise asymptomatic. The number of cases caused by MRSA which causes CAP and VAP are on an increasing trend, in last 20 years. Multi-lobar cavitaties [13,14,15] and necrotizing pneumonia are common in the most severe variants. The need for ICU and mechanical ventilation and mortality are high with MRSA pneumonia.

***Gram negative bacilli:*** The frequency of gram negative organisms causing pneumonia has increased as a result of gram negative organisms colonizing the oral cavity in alcoholics and diabetics. Since it occurs more frequently in people who are disabled, the mortality rate is higher. Klebsiella is the cause for red current jelly sputum, bulging fissure sign on radiograph. Treatment for Acinetobacter is challenging as there is emergence of resistance. To prevent resistance, beta-lactams & aminoglycosides are frequently combined.

***Chlamydial Pneumonia:*** Due to differences in the diagnostic techniques [16,17] used, there is a large variation in the incidence of this organism among investigations. Droplet-based transmission, which has been linked to outbreaks and higher incidence in crowded locations, has been observed. Chlamydia does not exhibit seasonal fluctuations like influenza does. According to numerous studies, it ranks as the 3$^{rd}$ or 4$^{th}$ most prevalent etiology of pneumonia, and pneumococcus co-infection is frequent.

***Group A Streptococcus infection:*** Young adults are most commonly involved. It typically results in a fulminant pneumonia with empyema formation. Despite being more uncommon, these organisms are constantly present. Despite being unconnected to influenza infection, they can quickly lead to death in otherwise healthy adults[18]. ***Anaerobic infection:*** Lung abscess and aspiration pneumonia are the most common manifestations. The genera of anaerobes that are most frequently isolated are porphyromonas, fusobacterium, bacteroides, peptostreptococcus, and prevotella. Predisposing variables include poor oral hygiene, periodontitis, gingivitis, and phenytoin medication. Patients with IV drug addictions, stroke patients, and alcoholics are at increased risk. Another frequent occurrence in this group is the development of acute empyema.

***Viral infection:*** Flu, parainfluenza viruses, adenoviruses, rhinoviruses, Respiratory Syncitial Virus (RSV), Hanta virus, Corona virus, Epsteinn Barr virus (EBV), Cyto-megalo virus (CMV), Coxsakie Virus, Herpes Zoster Virus & Human Meta Pneumo Virus are the common viruses. There are numerous ways to harm tissues. While the majority of them are caused by inflammation due to an immune response, some of them directly infect pneumocytes.

***Influenza pneumonia:*** They are responsible for the seasonal changes in pandemics. Even in young, immunocompetent people, they have a significant death rate. Transmission happens when an infected person coughs, sneezes, or talks and releases droplets or minute particles. Typically, the incubation phase lasts 1-2 days. After a few days, it can either result in primary pneumonia (caused by the virus alone) or secondary pneumonia (caused by both the virus and superadded bacterial infection). Pleural effusion and myocarditis can happen simultaneously.

***Other uncommon microbes:*** Commonly, COXIELLA BURNETII causes Q fever, a zoonotic infection. It is obtained through polluted aerosols from diseased sheep, cattle, and goats. FRANCISELLA TULARENSIS which causes tularaemia, can be contracted from rabbits and PSITTACOSIS from parrot. Other uncommon causes of bacterial pneumonia include nocardia, actinomycosis, listeria, melioidosis, and glander's pneumonia.

***Fungal infection:*** Immune-compromised individuals are more susceptible to fungal pneumonia such as patients receiving immunosuppressive therapy, diabetics, patients receiving chemotherapy, and PLHIV. Histoplasmosis is frequently encountered by visitors to the Ohio islands. Travelers to the south west of the United States are much more likely to contract coccidioidomycosis.

HOST FACTORS:

***Altered consciousness*** [(20)]: Aspiration of stomach contents (usually seen in stroke, seizure, anaesthesia, alcohol addiction) as well as aspiration of upper airway secretions (often while sleeping) contribute to risk factors in the elderly population The most frequent bacterium found in 20–60% of patients is pneumococcus. The risk factors in the elderly are malnourishment, age >65 years, immunodeficiency, poor oral hygiene, aspiration risk, frequent hospitalizations and dementia. Legionella pneumophila and H. influenzae were commonly isolated (5–14%) [(4,21).] Microbiological patterns seen in elderly are typically not different from those in younger people. The systemic disease is fatal and very prevalent.

***Chronic obstructive pulmonary disease:*** Patients with CAP frequently co-occur with COPD [(22,23)]. Though prevalence of P. aeruginosa, other Gram-Negative Bacteria is high in majority of COPD patients, the range of the causative microorganisms do not primarily differ between COPD patients & those who don‟t have COPD [(24)]. There is no evidence that COPD increases CAP mortality [(25)].

***History of Alcohol consumption:*** Drinking alcohol increases the risk of CAP. These individuals have a greater rate of CAP. Pneumococcus is the most common pathogen identified. Alcoholics had more severe CAP, but there was no difference in death [(26)]. With CAP, Klebsiella is frequently shown to have a significant connection with alcoholism.

***Diabetes mellitus:*** In Indian data, diabetes is one of the most often reported comorbidities. When compared to the general population [(27)], diabetics had the same rates of bacteraemia and empyema. However, diabetes was strongly linked to a greater death rate and was frequently present in individuals with pneumococcal pneumonia[(28)] and sepsis. Instead of a changed immune response, the most likely mechanism was the exacerbation of pre-existing cardiac and kidney disease. The following are the additional risk factors:

- Acidosis
- Inhalations of toxins
- Uremic Syndrome
- Improper diet
- Cystic Fibrosis
- Bronchiectasis
- Instances of persistent bronchitis in the past
- Syndrome of immobile cilia
- HIV,

- Young's disease (azoospermia, sinusitis, pneumonia)
- Oesophageal Cancer, Scleroderma and Achalasia cardia related dysphagia
- Lung Cancer
- Occlusion of the bronchus due to stenosis, Tumour or Foreign body

***Drugs:*** People on PPIs & H2 blockers [29] have a higher chance of developing CAP. Numerous investigations showed a link between antipsychotic medications and CAP, but exact reason is still unknown [30]. According to one study, elderly patients who need to be hospitalized had 50–60% higher risk of pneumonia when taking antipsychotic medications. COPD patients on inhalational Glucocorticoids are at increased risk of Community acquired pneumonia (CAP) & asthma patients on inhaled anti- cholinergics are at increased risk of pneumonia(CAP) [30].

***STAGING OF PNEUMONIA:*** Lobar and lobular bronchopneumonia [31] are the two major anatomical distribution patterns of bacterial pneumonia. The four stages of lobar pneumonia are as follows:

i. Congestion stage
ii. Red hepatization stage
iii. Grey hepatization stage
iv. Resolution stage

***CLINICAL FEATURES OF PNEUMONIA:*** Fever, change in general condition, symptoms like Cough(90%), Expectoration(66%), Dyspnoea (66%), pleuritic type of chest pain(50%) & Hemoptysis(15%). Signs & symptoms of pneumonia may be milder & obscured by common problems in elderly and immunocompromised people.

Rarely, a patient with a pneumococcal infection comes with a "classic" history, including a sudden onset of rigors, pleuritic type of chest pain, breathlessness, cough associated with rusty sputum. Delay in administering antibiotics by around 4 hrs post admission can increase the risk of death (32).

***LABORATORY ASSESSMENT:*** Once pneumonia is suspected in the patient, laboratory tests like arterial blood gas levels, CBC, RBS and electrolyte levels should be performed. They offer a foundation for deciding whether hospitalization is necessary or not. HIV testing should be done, even in people who don't have any other CAP risk factors. H. influenzae and S. pneumonia have marked leucocytosis with a left side shift. Overwhelming pneumococcal or gram-negative bacterial pneumonia may be accompanied by leucopenia. Both the ESR and CRP are shown to be raised with bacterial pneumonia than with viral pneumonia. Greater pneumonia severity & higher mortality are linked to thrombocytopenia and thrombocytosis. Procalcitonin (PCT), a calcitonin precursor, is more abundant in blood of people who have bacterial infection. PCT assays(33) were used to assess severity, prognosis, progression of pneumonia (CAP). It is crucial because it is used to reduce the strength of antibiotics or to discontinue them when the levels fall below a predetermined threshold (34).

***IMAGING:*** If at least 1 of the following abnormalities is visible on the radiograph, CAP may be suspected as the cause:

(i) Increased opacity, surrounded by an normal aerated lung

(ii) Silhouette sign

(iii) Asymmetric increase in opacification of lung with the presence of air bronchogram

(iv) An enhanced attenuation of cardiac shadow (supine or antero-posterior view)

(v) Chest x-ray with widespread airway disease, the presence of asymmetric/ multifocal opacities.

The most common way to distinguish community acquired pneumonia (CAP) from other causes such as pulmonary edema; pulmonary infarction; pleural effusion; pulmonary TB is with the help of a chest radiograph. During follow-up, the clearance of chest radiograph abnormalities may not coincide with clinical cure since up to half of the patients might not have complete radiographical resolution by the end of 4 weeks.

***MICROBIOLOGICAL ASSESSMENT:*** In patients who require hospital stay 2 blood culture sets obtained before the administration of antibiotics, gram staining and culture of sputum is necessary. In endemic locations or during outbreaks, urine antigen testing is done to isolate Legionella pneumophila. If the clinical history or radiologic results warrant it, a stain for AFB and a sputum culture for TB are obtained. If the history or chest x-ray findings indicate that the patient may have an endemic mycoses, a fungal stain and fungal serology are performed. Pneumocystis jirovecii sputum testing, Nucleic Acid Amplification (NAA) tests for Mycoplasma pneumoniaee; Chlamydophila pneumoniaee; Chlamydophila psittacii, Coxiella burneti, Legionella species & other respiratory viruses (in endemic area/ outbreak) has to be sent as suggested by clinical history or radiologic findings. If there is substantial fluid in the pleura, culture and microscopic examination may be incorporated.

***SUPPLEMENTARY TESTS FOR ICU PATIENTS:*** If the initial tests are inconclusive, hospitalized patients may have further procedures such as gram staining, culture, or BAL of an endotracheal aspirate or bronchoscopically acquired specimen. In hospitalized patients who have clinical indications as indicated below, taking sputum sample for Gram stain & culture is advised, but it is optional for patients without these symptoms, according to the most recent IDSA/ATS guidelines [(1)]. The following are the indications for further testing of CAP:

- Admission to an intensive care unit
- Antibiotic treatment for outpatients who are non-responsive
- Cavities on radiography
- Active alcohol use
- Decreased WBC count
- Severe CLD
- Severe Obstructive pulmonary disease
- Absence of spleen
- History of Recent travel in the last 2 weeks
- Presence of Pleural-effusion.

***ANTIGEN DETECTION:*** Kits for detecting antigens that are sold commercially, like capsular Pneumococcus polysaccharide antigen kits & Legionella pneumophilae serotype-1 kits are widely accessible[35,36,37] & its results will be obtained in <1hour, which is an advantage. Antibiotics have no effect on the outcomes. Additionally, the level of positivity of Pneumococcal antigens and severity are correlated. However, the issue with legionella is presence of only 1 serotype, L.pneumophila type-1, most common type, quickly identified with this technique. The gold standard method in diagnosis is believed to be nucleic acid amplification techniques for organisms like Chlamydia, bordetella, and other viruses that cannot be detected by conventional cultural methods.

***BRONCHO-ALVEOLAR LAVAGE TESTING:*** With comparable specificity and greater sensitivity, bronchoalveolar lavage is superior to sputum culture in case of M.tuberculosis and fungi but contamination with oral secretions [38] alters the specificity

***DIFFERENTIAL DIAGNOSIS (D/D):*** Other conditions mimicking pneumonia [39] are:

- Pulmonary infarction,
- Adult respiratory distress syndrome,
- Pulmonary oedema,
- Pulmonary Haemorrhage,
- Atelectasis,
- Lung Tumours,
- Radiation Pneumonitis,
- Drug Reactions,
- Pulmonary Vasculitis,
- Pulmonary Eosinophilia,
- Organizing Pneumonia,

All of these should be taken into consideration if there is early resolution or delayed presence of radiological signs.

***PNEUMONIA MANAGEMENT:*** Once diagnosis has been established, it's time to consider the patient's treatment choices and choose whether they require in-patient or out-patient care. The requirement for ICU hospitalization should be assessed in the event of admission. Making decisions is greatly influenced by clinical evaluation. However, it has been demonstrated that clinical judgment alone can lead to either inappropriate hospitalizations or overlooked patients that

need admittance. The use of scoring systems for admission and prognosis access has provided standardization and improved patient outcomes since patients could be triaged properly. As delayed admissions and delayed transfers to the ICU have significantly affected patient mortality and morbidity, the early decision-making process is crucial to the patient's fate. This issue can be resolved by scoring systems and biomarkers because they have a favourable correlation with disease severity. Here are some examples of frequently used scoring systems:

***PSI SCORING:*** Pneumonia Patient Outcome Research Team Prospective Cohort Study gave PSI rule to identify patients with CAP and their mortality risks. Based on probability of death from all causes within 30 days the PSI again divided adults with CAP into 5 classes. Variables based on history, clinical examination, few test results & radiographical abnormalities were noted at the time of presentation. The PSI rule is used in two parts; the first step will identify patients who are at low risk, based on absence of 11 demographic, comorbidities & examination findings. Using total points allotted for each risk factor, PSI score divides rest of the patients into class II,III,IV, V

| Demographics | Points |
|---|---|
| Age | Men (age in years)<br>Women(age in years-10) |
| Nursing home residents | +10 |
| **Comorbidities** | |
| Neoplastic d/s | +20 |
| Liver d/s | +30 |
| Heart failure | +10 |
| Stroke | +10 |
| Renal failure | +10 |
| **Physical examination** | **Points** |
| Altered mental status | +20 |
| RR ≥30/minute | +20 |
| SBP<90 mmHg | +20 |
| Temperature less than 35 degrees or more than 39.9 degrees | +15 |
| HR above 124 | +10 |

| Lab investigations | Points |
|---|---|
| Arterial pH <7.35 | +30 |
| Blood urea nitrogen>29 mg per dl | +20 |
| Na<130 mg per dl | +20 |
| Partial pressure of arterial oxygen <60% | +10 |
| Glucose ≥ 250mg per dl | +10 |
| Pleural effusion on chest radiograph | +10 |
| Hematocrit <30 % | +10 |

| Class | score | Mortality | Management |
|---|---|---|---|
| Class 1 | Below 51 | 0.4% | Out patients |
| Class 2 | 51-70 | 0.7 % | Out patients |
| Class 3 | 71-90 | 2.8% | Brief Hospitalization |
| Class 4 | 91-130 | 8.5% | Prolonged Hospitalization |
| Class 5 | Above 130 | 31.1% | ICU admissions[40] |

Prediction rule is meant to complement, not replace, the clinical judgment. When deciding whether to admit patients with community acquired pneumonia, individual characteristics rather than predictors listed in the rule are significant. In 2007, a study by Labarere J, et al., patients with CAP are evaluated in casualty.

In Low-risk patients (PSI grades1 to 3, no arterial desaturation, no psychosocial C/I to out-patient therapy) outcomes of 944 patients who were treated as outpatients are compared with 549 who are treated as in patients. For in patients, the 30-day mortality rate was greater (2.6 versus 1.0 %), arguing that a doctor's discretion was a suitable addition to the risk Score for stratification. Although there was no change in overall mortality after matching with potential confounding variables, outpatient therapy was linked to earlier return to regular activities & employment.

Certain comorbidities may require a more intense course of treatment than that advised by PSI rule. The regulation only applies to adults with CAP & excludes its application to minors, women who are pregnant, immunocompromised patients and patients who have nosocomial infection/ aspiration pneumonitis.

***CURB 65 SCORING:*** The British Thoracic Society has suggested 1 point (score) to each [41,42] finding

i. Presence of confusion
ii. BUN >19mg/dl or >7 mmol/l
iii. RR of 30 or more per minute
iv. Hypotension, either Sbp(90 mm hg) or Dbp (60 mm hg)
v. Age >=65 years

It is advised to seek outpatient care for 0 or 1 point. Hospitalization is advised for scores of 3 or higher. In-patient/ closely monitored out-patient care is advised for scores of 2. In terms of predicting ICU admissions [43], CURB-65 score(75%) has more specificity than PSI scoring (52.2%) ,but less sensitive.

***EXPANDED CURB 65 CRITERIA:*** It includes LDH, albumin, platelet count

***CRB 65 SCORING:*** It was decided to create a condensed version (CRB-65) that didn't need any laboratory investigation and could be used for decision-making even at a PHC. However, in this scoring, hospitalization is advised if one or more of the criteria are true. Over 6000 patients in tertiary care facilities as well as community hospitals have had their CRB65 scores properly investigated. Several studies claimed that the CRB65 score had comparable discriminatory power to the CURB 65 score.

***ATA/IDSA DEVELOPED CRITERIA:*** 2 Major criteria for direct intensive care unit (ICU) admission[44] were established in 2007 by International Disease Society of America (IDSA/ATS) recommendations for management of CAP:

- Vasopressor support requirement in case of septic shock
- Need for mechanical ventilation

  Minor criteria for ICU Admission: that was acquired without hypotension / respiratory failure.

i. Pao2/Fi02 ratio less than 250 (or) arterial SpO2 <90% on room air
ii. RR>30breaths/min
iii. Pleural effusion or B/L or multi-lobar involvement on a radiograph
iv. Altered mental status or confusion
v. BUN level > 20 mg/dl
vi. Leucocytosis (>20,000cells/dl) or leucopenia
vii. Thrombocytopenia (<100000cells/dl)
viii. Hypothermia (temperature $<36^{0C}$)
ix. Hypotension which is requiring fluid resuscitation

Hospitalization requires the presence of at least 1 Major/ 3 Minor criteria

***TREATING GUIDELINES OF CAP:*** One of these two regimens is the standard treatment for in-patient antibiotic coverage in community acquired pneumonia (CAP):

i. 2nd / 3rd generation cephalosporins + macrolides or
ii. Respiratory fluoroquinolones (levofloxacin, moxifloxacin, or gatifloxacin).

Any empirical CAP treatment plan should also be effective against "atypical" organisms like M.pneumoniae, C.pneumoniae and L. pneumophila according to North American recommendations. Improved clinical outcomes are seen with the regimens that cover atypical pathogens & those which adhere to ATS and IDSA recommendations, according to retrospective

assessments of patients hospitalized with CAP. On the other hand, several Northern European recommendations contend that patients without clinical signs of atypical infections do not require atypical coverage. Fluoroquinolones should be used with caution in CAP when tuberculosis is a possibility since it only takes 10 days of fluoroquinolone therapy to develop fluoroquinolone resistant M. tuberculosis.

# MATERIALS & METHODS

# MATERIAL AND METHODS

STUDY SITE:-

The research was carried out in the Department of General Medicine, Sri Devraj Urs Academy of Higher Education and Research, Tamaka , Kolar -563101

SOURCE OF DATA:-

Individuals coming to R.L.Jalappa Hospital and Research Centre attached to Sri Devraj URS Medical College (SDUMC) affiliated to Sri Devaraj URS Academy of Higher Education and Research Centre, Tamaka, Kolar who fulfil inclusion & exclusion criteria.

STUDY DESIGN:-

Cross Sectional Study

STUDY PERIOD:-

Samples will be collected from patients during the period of 2023 to 2025

SAMPLE SIZE CALCULATION :-

Estimated is based on sensitivity of serum albumin which was 91.1% for cut off value ≤34 in predicting mortality at 3month as reported by study done by Chauhan SG et al using below formula

$$n=Z_{\alpha 2)}{}^{2}P\hat{}(1-P\hat{})/d^{2}$$

Where P^ is the pre-determined value of the sensitivity/specificity which is ascertained by previously published data/ physician experience/judgment & for $\alpha = 0.05$, Zα2 is inserted by 1.96.

P^ = 91.1% or 0.91

d = 10% or 0.10.

Using above values at 95% Confidence level, sample size of 32 subjects will be included in this study.

Considering 10% Non-response rate, sample size of 32+ 3.2 = 35 subjects minimum to be included in this study.

STUDY POPULATION:- 35

INCLUSION CRITERIA:-

- Patients with at least 2 signs & symptoms related to CAP like fever with chills, cough with chills, breathlessness, crepitations on auscultation
- New opacities on chest radiograph
- Age >18yrs

EXCLUSION CRITERIA:-

- Immunocompromised patients- post organ transplantation & haematopoetic stem cell transplantation
- Active malignancy receiving chemotherapy
- Patients who are receiving corticosteroids >=20mg daily for >14days

- Malabsorption/malnutrition status
- Tuberculosis patients
- Retro-positive patients
- Age <18yrs
- Chronic liver disease
- Chronic kidney disease

METHODOLOGY:-

"Patients coming to R.L.Jalappa Hospital and Research Centre which is attached to Sri Devraj URS Medical College (SDUMC) affiliated to Sri Devaraj URS Academy of Higher Education and Research Centre,Tamaka,Kolar who fulfil the inclusion and exclusion criteria have been taken into the study

Patient or the patient attenders will be explained about entire procedure and informed consent will be taken in their own understandable language.

Information will be collected through a pre tested proforma for each patient. Detailed history will be sourced from the subject or from relatives of the subject or immediate bystander accompanying the subject.

History regarding onset, duration, progression of symptoms and risk factors like smoking, alcoholism, copd, structural lung diseases like bronchiectasis is collected.

All vital parameters like pulse rate(PR), respiratory rate(RR), blood pressure(BP), saturation will be recorded on admission and monitored.

BASIC BLOOD INVESTIGATIONS:

- Complete hemogram
- Arterial blood gas analysis
- Serum albumin levels
- Chest radiograph
- Sputum gram staining, AFB, culture & sensitivity
- HIV
- Venous & arterial blood samples were drawn separately to test biochemical parameters of patients by using Roche automatic biochemical analyser & supporting reagents.
- ABG analysis was measured using an automatic blood gas analyzer.

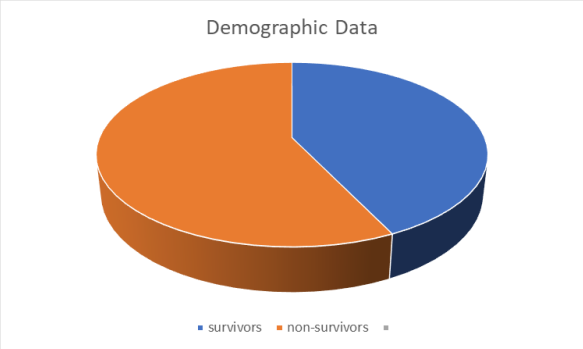
STATISTICAL ANALYSIS:-

Data will be entered into Microsoft excel data sheet & will be analyzed using SPSS 22 version software. Categorical data will be represented in the form of frequencies & proportions.

Chi-square will be used as a test of significance. Continuous data will be represented as mean & standard deviation. Independent t-test will be used as a test of significance to identify mean difference. P value <0.05 will be considered statistically significant.

# RESULTS

# RESULTS




DEMOGRAPHIC DATA

SURVIVORS-20

NON-SURVIVORS-15

Figure 1 shows the demographic data of the study participants. Out of 35 participants ,20 patients were non survivors and 15 were survivors

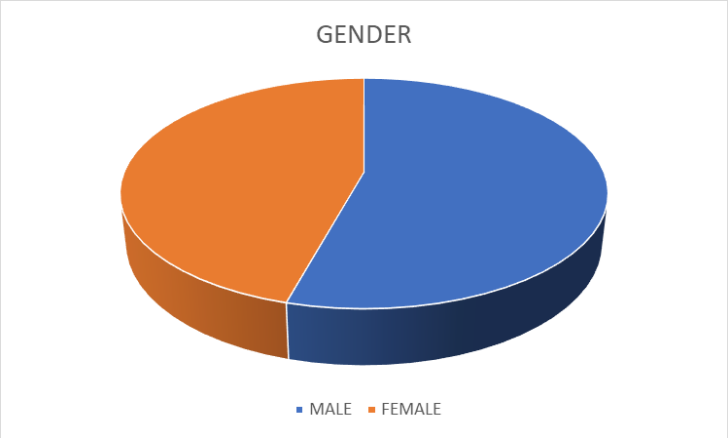



Figure 2 depicts the gender of participants in the study. Of the 35 participants 19 of them were male and 16 were female. In percentage we can tell that 54% were male and 46% were female

| AGE | No. of pts | % |
|---|---|---|
| UPTO 30YRS | 1 | 3% |
| 31-40YRS | 5 | 14% |
| 41-50YRS | 4 | 11% |
| 51-60YRS | 4 | 11% |
| 61-70YRS | 12 | 35% |
| >70YRS | 9 | 26% |
| TOTAL | 35 | 100% |

TABLE :2 – AGE DISTRIBUTION OF STUDY PARTICIPANTS

Table 2 and Figure 3 shows the age distribution of the study participants. 1 of them belonged to the age group up to 30yrs which is 3%, 5 in the range of 31-40yrs which is 14%, 4 between 41-50 years which is 11%, 4 in the range of 51-60 years which is 11%, 12 in the range of 61-70 years which is 35% , 9 above 70 years which is 26%.

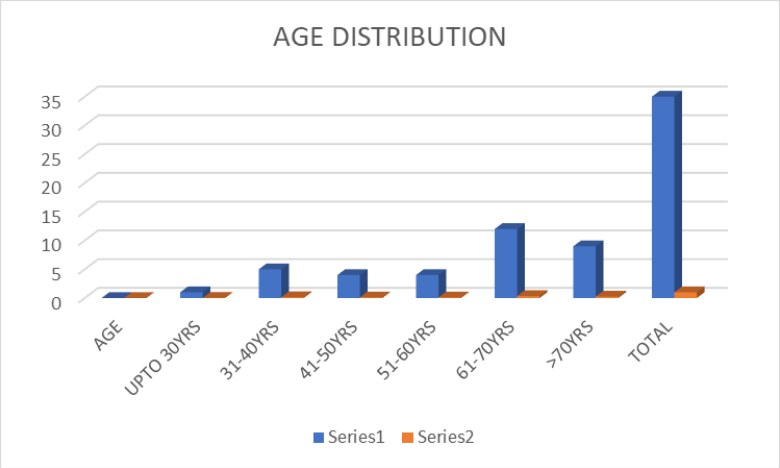



FIGURE-3

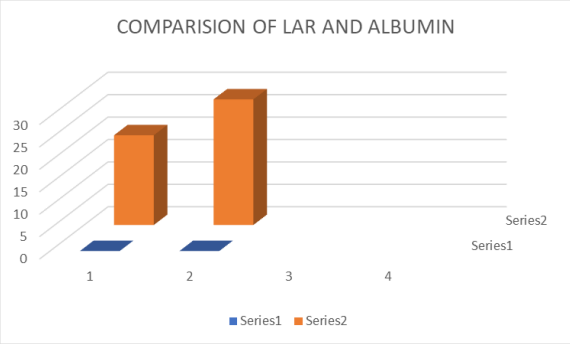



FIGURE-4

TABLE : 3

| ELEVATED LACTATE ALBUMIN RATIO (LAR) | DECREASED ALBUMIN |
|---|---|
| 20 | 28 |

Table-3 and Figure 4 represents the LAR and albumin. The LAR wad elevated in 20 patients whereas albumin was decreased in 28 patients.

TABLE-4

| Column1 | No. of patients | Death | Survived |
|---|---|---|---|
| Elevated LAR | 20 | 20 | 0 |
| Reduced albumin | 28 | 20 | 8 |

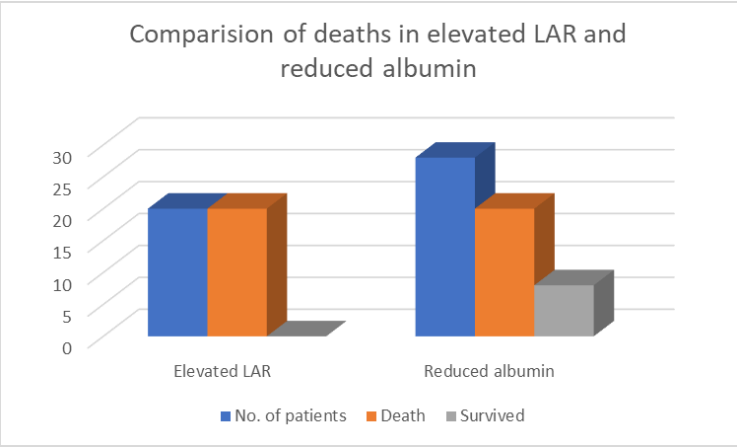



FIGURE-5

Table 4 and Figure 5 represents the mortality by comparing number of deaths in elevated LAR and reduced albumin. All the 20 patients (100%) with elevated LAR died whereas only 20 patients (71%) with reduced albumin died.

RESULTS:

In this study, the demographic composition revealed that the majority of participants were males, representing 54% of the total sample. In contrast, females constituted 46%. This gender distribution indicates a higher prevalence or higher enrolment rate of males in the study.

The age range of the participants showed that a significant proportion, 35%, belonged to 61-70 years age. This suggests that elderly individuals were more affected or more likely to be included in the study. The average age of the patient was calculated to be 50.32 years with a standard deviation of 17.89 years indicating a wide range of age among the patients

The study also suggests mortality rate of 57%. This death rate suggests Lactate Albumin Ratio (LAR) can be used as prognostic marker for community acquired pneumonia patients admitted to ICU.

According to this study there is 100% mortality in patients with elevated LAR. The p value was 0.049 indicating significant difference. So LAR should be considered as a valuable prognostic marker.

# DISCUSSION

# DISCUSSION

Present study was undertaken to determine prognostic significance of Lactate Albumin Ratio in CAP on the day of admission and correlate it with serum albumin.

• In the present study pneumonia is commonly seen in people between 61 to 70 years age group. Low serum albumin levels are also seen in this age group. Pneumonias do not occur usually in young individuals <30years age.

- H Çelikhisar, conducted a study in 86 patients and concluded that elevated LAR is a significant mortality determining factor in CAP patients who are >65 years of age that got admitted to the ICU.
- In various studies conducted, mean age of the patients with Community acquired pneumonia (CAP) was above 60 years.
- In the studies of Capelastegui et al., mean age of study population was 64.1 years and in the studies conducted by Lim et al the mean age was around 61.8 years.
- Serum albumin range of 2.5 to 3.0 is seen in most number of patients.
- Males are commonly affected with community acquired pneumonia since smoking, alcohol and COPD are common in male population.
- The prospective studies conducted by Lim et al showed that males are higher than females who are affected with community acquired pneumonia.
- The studies done in Netherlands also reported the same with a male preponderance of around 54% .
- Both males and females are more in number with a serum albumin range of 2.5 to 3.
- L/A ratio is superior to lactate and albumin levels in terms of prognosis.

- Normal lactate levels can be falsely misinterpreted as good prognosis in high-risk patients.
- In-corporation of albumin in the LAR increases its use in determining prognosis of sepsis patients.
- The time to reach clinical stability is indicated by the stabilization of all 4 vital parameters i.e. heart rate (HR), blood pressure (BP), temperature, Respiratory rate14.
- The normal ranges are respiratory rate < 24/min, heart rate <100bpm, temperature $<99^0$ F on 2 occasions 12hrs apart with no fever spikes between them.
- All the patients with elevated LAR died according to our study indicating it to be a good prognostic marker.
- Higher duration to reach clinical stability i.e. >4 days is seen with people with serum albumin <3g/dl on the day of admission. Not all the patients with decreased albumin levels died, some of them survived.
- The people with a serum albumin between 2.5 to 3.0 took higher time to reach clinical stability.
- On the other hand, serum albumin ranges on a higher side attained clinical stability earlier.
- A total of 12 patients needed mechanical ventilation, among the 12 patients 10 patients have elevated LAR at presentation .
- 13 patients required inotrope support,11 patients have hypoalbuminemia <3g/dl, most of them are between 2.5 to 3.0, 10 patients have elevated lactate levels.
- 4 patients developed empyema, all the individuals have < 3g/dl albumin, 2 of them have serum albumin between 2 to 2.5g/dl.
- Need for mechanical ventilation, inotropes , development of empyema was seen in patients with hypoalbuminemia and elevated lactate on the day of admission.

- With respect to 30day mortality, 3 patients died, of which only 2 of them have serum albumin <2g/dl , 1 of them have serum albumin between 2.1 to 2.5g/dl but all the 3 patients have elevated LAR

## NOVEL BIOMARKERS IN PNEUMONIA7,50,51 :

- C-reactive protein
- S. albumin
- Procalcitonin
- Interleukin-6
- Pro adrenomedullin
- RDW
- D-dimer
- Brain natriuretic peptide
- Kalistatin
- Vistatin
- Copeptin
- Vit-D
- PCT and CRP are late predictors that are elevated in severe illness. More precise predictors of prognosis and mortality are CRP and IL-6[(51)].
- Patients with CRP<100mg/dl have lower mortality rates compared to those with CRP>100mg/dl.
- A serine protease inhibitor is kalistatin. They are essential for transport, inflammation, and blood pressure control.

- Platelet counts <1 lakh and >4 lakh are associated with a worse prognosis.
- The activation and control of the immune system are positively correlated with the SUPAR-soluble urokinase type Plasminogen Activator Receptor.
- This pre-B-cell colony-enhancing substance is called visstatin. According to research, there is a significant correlation between this molecule and the prognosis scores CURB-65 and PSI scoring.
- It is widely known that vitamin D plays a function in immunomodulation. Lack of vitamin D is seen in conditions like pneumonia. Despite the fact that several biomarkers were described, their usefulness in current clinical practice is seriously disputed. All hospitals, with the exception of a few tertiary centres, do not always have access to the majority of them. They must be accessible 24 hours a day, even in higher tertiary centres, should be beneficial in setting the proper tone and triaging the cases. However, these indicators aren't accessible 24/7. Additionally, they are quite expensive, which precludes them from being used regularly to track the progression of the condition. Consequently, the need for a biomarker that is readily available, affordable, and repeatable for disease monitoring emerges.

## LACTATE ALBUMIN RATIO(LAR) IN COMMUNITY ACQUIRED PNEUMONIA:

- Lactate/albumin ratio (LAR) = blood lactate level (a marker of anaerobic metabolism) / serum albumin level (a marker of overall health and inflammation).
- Various Studies have shown that a higher LAR is a strong predictor of in-hospital mortality of patients with community acquired pneumonia (CAP) admitted to the Intensive care unit (ICU).
- Elevated LAR suggests severe illness, poor prognosis and high risk of mortality.
- LAR can be used as an independent predictor of mortality, even after taking into consideration other factors like age, comorbidities, severity scores.
- Lactate: Elevated lactate levels indicate tissue hypoxia or impaired oxygen utilization (sign of severe infection or sepsis).
- Albumin: Low albumin levels can be a sign of inflammation, malnutrition, or underlying chronic conditions.
- Some studies have identified an optimal LAR cutoff value for predicting mortality, which is >0.15 or 1.6, associated with increased risk.
- The area under receiver operating curve (ROC) for LAR in predicting mortality has been shown to be greater than lactate/ albumin alone.
- LAR can be a used as a risk stratification tool for in-patients with CAP, allowing physicians to identify those at higher risk of complications.
- Early recognition of a high LAR may prompt more aggressive treatment and monitoring, thereby improving outcomes.

# CONCLUSION

# CONCLUSION

According to this study there is 100% mortality in patients with elevated Lactate albumin ratio. So LAR can be used as a good prognostic marker for predicting mortality in community acquired pneumonia patients admitted to ICU.

1. The complications such as requirement of mechanical ventilation, prolonged duration of hospital stay, development of empyema, death, need for vasopressor support can be predicted by serum levels of albumin on the day of admission.
2. Serum albumin levels are reduced in case of sepsis as there is extravasation of protein rich fluids into the tissues secondary to capillary dysfunction.

**Early Indicator**: Lactate levels rise within hours of an inflammatory insult, providing that LAR will be an early warning sign of sepsis, unlike some traditional biomarkers like albumin that may take longer to reduce.

Serial measurements of LAR can serve as a helpful tool in clinical assessment of critically ill patients who are at risk of a poor prognosis. For instance, patients who do not exhibit increased LAR during the first 6 hours of ICU admission have less chances of sepsis, providing early reassurance and guiding clinical decision-making. Furthermore, after 24 hours, the absence of elevated LAR strongly predicts ICU survival.

# LIMITATIONS

# LIMITATIONS

1. Small sample size– the study cannot be attributed to entire population.
2. The study was conducted at single tertiary hospital & the results of which cannot be generalized.
3. Only hospitalized patients were included thereby outpatients prognosis cannot be commented.

Dynamic changes that occur in serum albumin levels on fluid administration was not studied.

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# ANNEXURES

# ANNEXURE – I: PROFORMA

**PROFORMA**

**CORRELATION OF ARTERIAL BLOOD LACTATE TO SERUM ALBUMIN RATIO WITH SERUM ALBUMIN FOR IN-HOSPITAL MORTALITY OF PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA ADMITTED TO INTENSIVE CARE UNIT**

| | |
|---|---|
| **NAME** | |
| **AGE** | |
| **GENDER** | |
| **DATE OF ADMISSION** | |
| **PRESENTING COMPLIANTS** | a. Shortness of breath –<br>b. Severe cough (with/without sputum) -<br>c. Fever |
| **Risk factor :**<br>**1. SMOKER (Y/N)**<br>**If Yes , number of pack years**<br>**2. Tobacco chewing (Y/N)**<br>**3. OCCUPATION :** | |
| **Is the patient already a known case of Pneumonia** | |
| **If Yes then details about treatment history** | |
| **Treatment history** | ● Antibiotics(Y/N) |

| | |
|---|---|
| | • Nasal oxygen therapy (Y/N)<br>• Anti-pyretics |
| **CORMORDBIDITES** | |
| **DURATION OF STAY IN HOSPITAL** | |

# PATIENT INFORMATION SHEET

**Study title : Correlation of arterial blood lactate to serum albumin ratio with serum albumin for in-hospital mortality of patients with community acquired pneumonia admitted to Intensive Care Unit**

Principal investigator: Dr. REDDY. HARI PRIYA VANI VINEELA/ DR.SRINIVASA.S.V.

1. I Dr. REDDY. HARI PRIYA VANI VINEELA, Post graduate student in Department of general medicine at Sri Devraj Urs Medical College, will be conducting a study titled **"Correlation of arterial blood lactate to serum albumin ratio with serum albumin for in-hospital mortality of patients with community acquired pneumonia admitted to Intensive Care Unit",**this study will be useful to predict mortality in community acquired pneumonia patients admitted to Intensive Care Unit. The funds needed for the serum albumin levels will be done at my own expense.2 ml of blood will be drawn for estimation of arterial blood lactate levels ,complete haemogram, serum albumin levels from each of the participating patients in this study .Chest radiograph, sputum gram stain, AFB, culture and sensitivity, HIV status will be done. Complications of arterial blood gas analysis if present will be taken care by the principal investigator free of cost. This study will be done under the guidance of Dr.SRINIVASA.S.V. Professor of Department of GENERAL MEDICINE .

All the data will be kept confidential and will be used only for research/publication purpose. You are free to provide consent for the participation of yourself in this study. You can also withdraw yourself from the study at any point of time without giving any reasons whatsoever. Your refusal to participate will not prejudice you to any present or future care at this institution.

In case of any clarifications are needed you are free to contact me on this mobile number – 8142285784

Name and Signature of the Principal Investigator

Date-

Patient or patient bystanders Signature

# ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆ

**ಅಧ್ಯಯನದ ಶೀರ್ಷಿಕೆ : ತೀವ್ರ ನಿಗಾ ಘಟಕದಲ್ಲಿ ದಾಖಲಾಗಿರುವ ಸಮುದಾಯ ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡಿರುವ ನ್ಯುಮೋನಿಯಾ ರೋಗಿಗಳ ಆಸ್ಪತ್ರೆಯಲ್ಲಿನ ಮರಣಕ್ಕೆ ಸೀರಮ್ ಅಲ್ಬುಮಿನ್‌ನೊಂದಿಗೆ ಸೀರಮ್ ಅಲ್ಬುಮಿನ್ ಅನುಪಾತಕ್ಕೆ ಅಪಧಮನಿಯ ರಕ್ತದ ಲ್ಯಾಕ್ಟೇಟ್ ನ ಪರಸ್ಪರ ಸಂಬಂಧ**

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ: ಡಾ.ಆರ್.ಎಚ್.ಪಿ.ವಿ.ವಿನೀಲಾ/ಡಾ.ಶ್ರೀನಿವಾಸ.ಎಸ್.ವಿ.

ನಾನು ಡಾ.ಆರ್.ಎಚ್.ಪಿ.ವಿ.ವಿನೀಲಾ, ಶ್ರೀ ದೇವರಾಜ್ ಅರ್ಸ್ ಮೆಡಿಕಲ್ ಕಾಲೇಜಿನ ಸಾಮಾನ್ಯ ವೈದ್ಯಕೀಯ ವಿಭಾಗದ ಸ್ನಾತಕೋತ್ತರ ವಿದ್ಯಾರ್ಥಿ, ಸಮುದಾಯದ ರೋಗಿಗಳ ಆಸ್ಪತ್ರೆಯಲ್ಲಿನ ಮರಣಕ್ಕೆ ಸೀರಮ್ ಅಲ್ಬುಮಿನ್‌ನೊಂದಿಗೆ ಅಪಧಮನಿಯ ರಕ್ತದ ಲ್ಯಾಕ್ಟೇಟ್ ಮತ್ತು ಸೀರಮ್ ಅಲ್ಬುಮಿನ್ ಅನುಪಾತದ ನಡುವಿನ ಅಧ್ಯಯನವನ್ನು ನಡೆಸುತ್ತಿದ್ದೇನೆ. ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡಿರುವ ನ್ಯುಮೋನಿಯಾವನ್ನು ತೀವ್ರ ನಿಗಾ ಘಟಕಕ್ಕೆ ದಾಖಲಿಸಲಾಗಿದೆ", ತೀವ್ರ ನಿಗಾ ಘಟಕಕ್ಕೆ ದಾಖಲಾದ ಸಮುದಾಯ ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡ ನ್ಯುಮೋನಿಯಾ ರೋಗಿಗಳಲ್ಲಿ ಮರಣವನ್ನು ಊಹಿಸಲು ಈ ಅಧ್ಯಯನವು ಉಪಯುಕ್ತವಾಗಿದೆ. ಸೀರಮ್ ಅಲ್ಬುಮಿನ್ ಮಟ್ಟಗಳಿಗೆ ಅಗತ್ಯವಿರುವ ಹಣವನ್ನು ನನ್ನ ಸ್ವಂತ ಖರ್ಚಿನಲ್ಲಿ ಮಾಡಲಾಗುತ್ತದೆ. 2 ಮಿಲಿ ರಕ್ತ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವ ಪ್ರತಿಯೊಬ್ಬ ರೋಗಿಗಳಿಂದ ಅಪಧಮನಿಯ ರಕ್ತದ ಲ್ಯಾಕ್ಟೇಟ್ ಮಟ್ಟಗಳು, ಸಂಪೂರ್ಣ ಹೆಮೊಗ್ರಾಮ್, ಸೀರಮ್ ಅಲ್ಬುಮಿನ್ ಮಟ್ಟವನ್ನು ಅಂದಾಜು ಮಾಡಲು ತೆಗೆದುಕೊಳ್ಳಲಾಗಿದೆ ಹಾಜರಿದ್ದಲ್ಲಿ ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಗಳು ಉಚಿತವಾಗಿ ನೋಡಿಕೊಳ್ಳುತ್ತಾರೆ. ಈ ಅಧ್ಯಯನವನ್ನು ಡಾ.ಶ್ರೀನಿವಾಸ.ಎಸ್.ವಿ ಅವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ಮಾಡಲಾಗುತ್ತದೆ. ಜನರಲ್ ಮೆಡಿಸಿನ್ ವಿಭಾಗದ ಪ್ರಾಧ್ಯಾಪಕರು.

ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಗೌಪ್ಯವಾಗಿ ಇರಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಸಂಶೋಧನೆ/ಪ್ರಕಟಣೆ ಉದ್ದೇಶಕ್ಕಾಗಿ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಗೆ ಒಪ್ಪಿಗೆ ನೀಡಲು ನೀವು ಸ್ವತಂತ್ರರಾಗಿದ್ದೀರಿ. ಯಾವುದೇ ಕಾರಣಗಳನ್ನು ನೀಡದೆ ನೀವು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು. ಭಾಗವಹಿಸಲು ನಿಮ್ಮ ನಿರಾಕರಣೆಯು ಈ ಸಂಸ್ಥೆಯಲ್ಲಿ ಯಾವುದೇ ಪ್ರಸ್ತುತ ಅಥವಾ ಭವಿಷ್ಯದ ಕಾಳಜಿಗೆ ನಿಮ್ಮನ್ನು ಪೂರ್ವಾಗ್ರಹ ಮಾಡುವುದಿಲ್ಲ.

ಯಾವುದೇ ಸ್ಪಷ್ಟೀಕರಣಗಳ ಅಗತ್ಯವಿದ್ದಲ್ಲಿ ನೀವು ಈ ಮೊಬೈಲ್ ಸಂಖ್ಯೆಗೆ ನನ್ನನ್ನು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ - 8142285784

ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಯ ಹೆಸರು ಮತ್ತು ಸಹಿ

ದಿನಾಂಕ-

ರೋಗಿಯ ಅಥವಾ ರೋಗಿಯ ವೀಕ್ಷಕರ ಸಹಿ

# INFORMED CONSENT FORM

Date:

I, Mr/Mrs _____ ,have been explained in my own vernacular language that I/We will be included in **Correlation of arterial blood lactate to serum albumin ratio with serum albumin for in-hospital mortality of patients with community acquired pneumonia admitted to Intensive Care Unit,** hereby I/We give my valid written informed consent without any force or prejudice for recording the observations of haematological and clinical parameters . The nature and risks involved have been explained to me, to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I provide consent voluntarily to allow myself / my relative as a participant in this research. I hereby give consent to provide history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc to the doctor / institute etc. For academic and scientific purpose the operation / procedure, etc may be video graphed or photographed. All the data may be published or used for any academic purpose.

_____

Name of Patient/Guardian

(Relation with patient)

_____

(Signature of Patient / Attendant)

(Signature & Name of Research doctor)

# ಮಾಹಿತಿ ನೀಡಿದ ಒಪ್ಪಿಗೆ ನಮೂನೆ

ದಿನಾಂಕ:

ನಾನು, ಶ್ರೀ/ಶ್ರೀಮತಿ _____, ನಾನು/ನಾವು ಸೇರಿಸಿಕೊಳ್ಳಲಾಗುವುದು ಎಂದು ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ**ತೀವ್ರ ನಿಗಾ ಘಟಕಕ್ಕೆ ದಾಖಲಾದ ಸಮುದಾಯ ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡಿರುವ ನ್ಯುಮೋನಿಯಾ ರೋಗಿಗಳ ಆಸ್ಪತ್ರೆಯಲ್ಲಿನ ಮರಣಕ್ಕೆ ಸೀರಮ್ ಅಲ್ಬುಮಿನ್‌ನೊಂದಿಗೆ ಅಪಧಮನಿಯ ರಕ್ತದ ಲ್ಯಾಕ್ಟೇಟ್ ಮತ್ತು ಸೀರಮ್ ಅಲ್ಬುಮಿನ್ ಅನುಪಾತದ ಪರಸ್ಪರ ಸಂಬಂಧ**,ಈ ಮೂಲಕ ನಾನು/ನಾವು ಹೆಮಟೊಲಾಜಿಕಲ್ ಮತ್ತು ಕ್ಲಿನಿಕಲ್ ನಿಯತಾಂಕಗಳ ಅವಲೋಕನಗಳನ್ನು ದಾಖಲಿಸಲು ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯನ್ನು ನೀಡುತ್ತೇವೆ. ಒಳಗೊಂಡಿರುವ ಸ್ವಭಾವ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ, ನನ್ನ ತೃಪ್ತಿ. ನಡೆಸುತ್ತಿರುವ ಅಧ್ಯಯನದ ಬಗ್ಗೆ ನನಗೆ ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವವನಾಗಿ ನನ್ನನ್ನು/ನನ್ನ ಸಂಬಂಧಿಯನ್ನು ಅನುಮತಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಒಪ್ಪಿಗೆಯನ್ನು ನೀಡುತ್ತೇನೆ. ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಗಾಗಲು, ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳಿಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ, ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ ಮಾಡಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಬಳಸಬಹುದು.

_____

ರೋಗಿಯ/ರಕ್ಷಕನ ಹೆಸರು

(ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)

_____

(ರೋಗಿ / ಅಟೆಂಡೆಂಟ್ ಸಹಿ)

(ಸಂಶೋಧನಾ ವೈದ್ಯರ ಸಹಿ ಮತ್ತು ಹೆಸರು)

## MASTER CHART

| S.NO | AGE(YEARS) | GENDER | LACTATE (G/DL) | ALBUMIN (G/DL) | LACTATE-ALBUMIN RATIO |
|---|---|---|---|---|---|
| 1 | 64 | F | 2.417 | 2.8 | 0.863 |
| 2 | 47 | M | 2.578 | 3.4 | 0.758 |
| 3 | 62 | M | 1.617 | 2.9 | 0.557 |
| 4 | 71 | M | 8.056 | 3.0 | 2.685 |
| 5 | 60 | F | 3.061 | 3.8 | 0.805 |
| 6 | 36 | M | 1.772 | 3.6 | 0.492 |
| 7 | 70 | M | 4.995 | 2.5 | 1.998 |
| 8 | 42 | M | 6.123 | 2.9 | 2.111 |
| 9 | 37 | M | 2.73 | 2.4 | 1.137 |
| 10 | 27 | F | 9.023 | 3.4 | 2.653 |
| 11 | 37 | M | 1.45 | 3.0 | 0.483 |
| 12 | 48 | M | 0.805 | 3.5 | 0.230 |
| 13 | 70 | F | 8.864 | 2.1 | 4.190 |
| 14 | 54 | M | 4.028 | 3.0 | 1.342 |
| 15 | 42 | M | 0.966 | 3.8 | 0.254 |
| 16 | 64 | F | 0.021 | 3.7 | 0.006 |
| 17 | 70 | F | 10.634 | 2.6 | 4.090 |
| 18 | 68 | F | 9.023 | 2.8 | 3.222 |
| 19 | 70 | M | 0.024 | 2.9 | 0.008 |
| 20 | 72 | M | 8.701 | 2.4 | 3.625 |
| 21 | 60 | F | 9.357 | 2.6 | 0.359 |
| 22 | 66 | F | 6.715 | 2.1 | 3.197 |
| 23 | 58 | M | 8.365 | 3.0 | 2.788 |
| 24 | 48 | M | 5.154 | 2.8 | 1.840 |
| 25 | 67 | M | 0.265 | 2.9 | 0.091 |
| 26 | 60 | F | 1.328 | 3.6 | 0.368 |
| 27 | 36 | M | 11.256 | 2.2 | 0.351 |
| 28 | 60 | M | 5.964 | 2.5 | 5.116 |
| 29 | 48 | F | 7.324 | 2.0 | 3.66 |
| 30 | 46 | M | 1.128 | 3.5 | 0.358 |
| 31 | 60 | F | 4.688 | 2.3 | 2.038 |
| 32 | 70 | F | 12.654 | 2.2 | 5.751 |
| 33 | 63 | F | 1.563 | 3.2 | 0.488 |
| 34 | 54 | M | 9.657 | 2.0 | 5.828 |
| 35 | 56 | M | 6.324 | 1.9 | 3.328 |