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EVALUATION OF CURB-65 (CONFUSION, BLOOD UREA NITROGEN, RESPIRATORY RATE, BLOOD PRESSURE AND AGE) AS A PREDICTOR OF SEVERITY ASSESSMENT IN THE MANAGEMENT OF COMMUNITY ACQUIRED PNEUMONIA.

Pulmonary Medicine

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ABSTRACT

India being a developing country with transitional healthcare system it is essential to prioritize the severely ill Community Acquired Pneumonia to make an optimal usage of limited resources that are available. The aim is (1) To evaluate the ability of the CURB-65 Score to stratify patients into different management groups; to correlate CURB-65 score to 48 hour and 30 day mortality & to relate mortality with association of comorbid illness and smoking. Prospective observational study, sample size is 72, simple random sampling method. The data was collected using pre-structured questionnaire and checklist to estimate CURB-65 score and has been analysed and presented in the form of frequency tables, proportions, pie-charts and bar graphs wherever necessary; p value has been calculated. Among total 72 cases, 27 (37.5%) cases were having CURB-65 score 0-1 (Mild), 27 (37.5%) cases with score 2 (Moderate) and 18 (25%) cases with score 3-5 (Severe); CURB-65 score > 3, co-morbidities like COPD had a statistically significant association with higher mortality whereas co-morbidities like asthma, tuberculosis and habit of tobacco smoking were falling short of statistical significance. Most common (56.6%) causative agent of CAP isolated was Pneumococcus. The CURB -65 score is an effective tool to classify CAP cases into different management groups & prioritize the severe CAP cases for ICU admission or using ventilator facilities.

KEYWORDS

Community Acquired Pneumonia, CURB-65, Management Groups

INTRODUCTION:

Man has been confronted with so many diseases of respiratory system; among them pneumonia is one of the commonest diseases. Pneumonia is defined as inflammation and consolidation of lung tissue due to an infectious agent. Pneumonia that develops outside the hospital is considered community acquired pneumonia (CAP) [1,2].

Community Acquired Pneumonia (CAP) is a common disorder with an incidence of about 20% to 30% in developing countries compared to an incidence of 3% to 4% in developed countries[5]. The incidence varies markedly with age, being much higher in the very young and the elderly[3,4,5,6].

The mortality rate is less than 1% for persons with CAP who do not require hospitalization. The mortality rate averages from 12% to 14% among hospitalized patients with CAP. Among patients who are admitted to the Intensive Care Unit (ICU) or who are bacteraemic or who are admitted from a nursing home, the mortality rate averages from 30% to 40%. Therefore, it is crucial that physicians recognize and treat CAP appropriately[7].

Prognostic factors significantly associated with mortality were male sex, absence of pleuritic chest pain, hypothermia, systolic hypotension, tachypnoea, diabetes mellitus, neoplastic disease, neurological disease, bacteraemia, leukopenia, and multilobar radiographic pulmonary infiltrates[8].

Streptococcus pneumoniae is the most common cause of pneumonia[1,9] with mortality rates of 10% but responds very well to many antibiotics. Staphylococcus aureus causes severe pneumonia in hospitalized and high-risk patients and following influenza A and B and develops lung abscesses causing the death of lung tissue (necrosis) with mortality rate of 30 - 40%. Mycoplasma and chlamydia are the most common causes of mild pneumonias and are most likely to occur in children and young adults[10]. Pseudomonas aeruginosa and Klebsiella pneumoniae cause abscesses and severe lung tissue damage.

Although a prospective cohort study from the United States also found that a delay in giving the first dose of antibiotic of more than four hours was associated with increased mortality, it also found however that altered mental state, absence of fever and hypoxia, and increasing age were independently associated with such a delay[11,12].

In view of the high and increasing incidence and mortality rates, the knowledge of relevant prognostic factors might be useful for early identification of patients at high risk requiring intensive care treatment[13]. The decision regarding the most appropriate site of care, including whether admission to hospital is warranted, is the first and single most important decision in the overall management of CAP. It has consequences both for the level of treatment received by the patient as well as the overall costs of treatment[14]. Prognostic scoring systems for CAP have been developed to address these issues[13,15,16].

To improve the care of patients with CAP, numerous national societies have developed guidelines for management of CAP. These groups include the American Thoracic Society (ATS), the British Thoracic Society (BTS) as well as the Infectious Diseases Society of America (IDSA). The two prominent tools for this purpose are the pneumonia severity index (PSI), developed in the USA after Pneumonia Outcome Research Trial (PORT), and the BTS rule, which has recently been modified to the CURB-65 rule. The Pneumonia Severity Index (PSI) developed by Fine et al in the USA. Unfortunately it is complicated to use, requiring computation of a score based on 20 variables, and hence may not be practical for routine application in busy hospital emergency departments or the primary care setting. This score is heavily age dependent, many young patients fall into the first three classes when it is readily apparent that they should be admitted. In addition, it is best validated for assessing patients with a low mortality risk who may be suitable for home management rather than those with severe CAP at the time of hospital admission[17]. Hence the present study have taken the task of assessment of severity of Community Acquired Pneumonia by using CURB - 65 score.

AIMS & OBJECTIVES:

1.To evaluate the ability of the CURB-65 Score to stratify patients with Community Acquired Pneumonia into different management groups.

2.To determine the mortality rate of hospitalized CAP patients and to correlate CURB-65 score to 48 hour and 30 day mortality.
3.To relate mortality with association of comorbid illness and smoking.

METHODOLOGY:

A prospective observational study was conducted at the Department of Pulmonary Medicine, S.V.R.R. Govt., General Hospital, S.V. Medical College, Tirupati, A.P. A total of 72 number of patients were studied by simple random sampling using lottery method. Patients who attended Pulmonary Medicine O.P. and those who were admitted in Pulmonary Medicine Ward with Community Acquired Pneumonia were included in the study.

Inclusion Criteria:

a. Age > 14 years.
b. Patients who were not hospitalized recently for other reasons
c. Patients with consolidation on Chest X- Ray
d. Before the illness the patient should not have any neurological deficits.
e. Before the illness the patient has history of good renal function.
f. Patients who are not known hypertensive.
g. Willingness of the patient to participate in the study.

Exclusion Criteria:

a. Age < 14 years
b. Patients who had been hospitalized in the previous 14 days.
c. Patients with past H/O neurological deficits.
d. Patients with past H/O Renal diseases.
e. Patients who are known hypertensives.
f. Patients who are not willing.
g. Patients who are Seropositive for HIV.
h. Patients who are chronically Immunosuppressed.
I. Patients with Pulmonary Tuberculosis.

The patients were completely informed about the aim and procedure of the study. In those patients who were diagnosed with Community Acquired Pneumonia, a detailed history, both present and past were recorded. General examination, Systemic examination and necessary investigations were done. In the general examination pulse rate, blood pressure, respiratory rate were recorded at the time of presentation. Blood urea nitrogen (To convert from mg/dL of blood urea nitrogen to mmol/L of urea, divide by 2.8 as each molecule of urea having 2 nitrogens, each of molar mass 14 g/mol) is done. Age is recorded and consciousness/ the state of new mental confusion is evaluated by using Abbreviated Mental Test Score(AMTS) [18]. It is a 10 point questionnaire where, each question correctly answered scores one point. A score of 6 or less suggests confusion or cognitive impairment. The following questions were put to the patient to assess
AMTS:
1.What is your age?
2.What is the time to the nearest hour?
3.Give the patient an address, and ask him or her to repeat it at the end of the test.
4.What is the year?
5.What is the name of the hospital where the patient is situated?
6.Can the patient recognize two persons (the doctor, nurse etc.)?
7.What is your date of birth? (day and month sufficient)
8.In what year did we get independence.
9.Name the present Chief Minister/Prime Minister/President.
10.Count backwards from 20 down to 1.

After scoring AMTS by above measures, the CURB-65 score is calculated and patients are stratified based on severity of the disease and treatment plan [1,19,20,21,22,23] as follows:

- Confusion (defined as an AMTS of 6 or less)
- Urea ≥7 mmol/l (Blood Urea Nitrogen >19)
- Respiratory rate ≥ 30 breaths per minute
- Blood pressure less than 90 mmHg systolic or diastolic blood pressure 60 mmHg or less
- Age 65 or older.

One point is given to each finding and total score is calculated as 0 to 5. If none of the findings are present, score is 0 and if all the findings are present the score is 5. The following table shows how the patients are classified depending on CURB-65 Score:

CURB-65 Score	Grading	Recommendation
0 to 1	Mild	Low risk; consider home treatment
2	Moderate	Short inpatient hospitalization or closely supervised outpatient treatment
3 to 5	Severe	Severe pneumonia; hospitalize and consider admitting to intensive care

Other investigations done are chest X-Ray PA and Lateral view to detect consolidation, Oxygen saturation measurement, routine investigations like Hb%, TC, DC, ESR, Random Blood Sugar and Serum Creatinine, Sputum for Gram staining and Culture and Sensitivity, Sputum for AFB Staining, EIA testing for the diagnosis of H.I.V, Blood culture and ABG analysis when ever necessary.

Patients with mild severity with score 0 and 1 were treated with oral antibiotics for 7 days on outpatient basis and for inpatients started with IV antibiotics and then switched over to oral antibiotics for 10 to 14 days. Symptomatic treatment (Bronchodilators and Antipyretics etc.) and supportive measures like IV fluids, oxygen inhalation and nutritional supplementation were given whenever necessary.

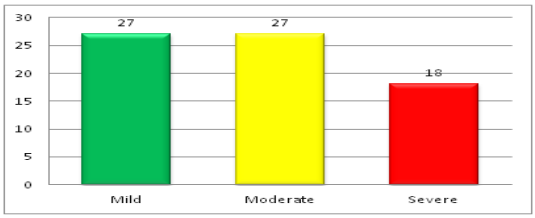
At the clinical end points (hospital discharge or death) the following parameters were recorded:
(i) Duration of antibiotics
(ii) Time taken for defervescence (resolution of fever, chest pain; respiratory rate <24 per minute; arterial oxygen saturation of > 90% while breathing room air; and ability to perform basic daily activities without support.)
(iii) Need of admission to ICU
(iv) Need for mechanical ventilation
(v) Condition at 30 day to 6 weeks after discharge from the hospital for follow up.
(vi) The outcome of the Patient is noted as Cured, Early (48 hours) mortality and 30 day mortality.
(vii) Any complications noted.

The data thus collected has been analysed and presented in the form of frequency tables, proportions, pie-charts and bar graphs wherever necessary; p value has been calculated and $p < 0.05$ has been taken as statistical significance at 95% confidence level.

RESULTS:

Out of 72 cases 53 (73.6%) cases were males and 19 (26.4%) cases were females. Among total 72 cases, 27 (37.5%) cases were having CURB-65 score 0-1 (Mild), 27 (37.5%) cases with score 2 (Moderate) and 18 (25%) cases with score 3-5 (Severe) (Fig 1).

Fig1: Bar Chart Showing Classification Of Subjects According To CURB-65 Score



Out of 72 cases, 26 (36.2%) cases belong to 41-50 years of age group. The mean age being 46.5±1.5 years and median age is 45 years. Around 5 out of 11 deaths occurred in 61-70 years of age group. There is statistically significant ($p < 0.05$) relation between increase of age and increase in CURB-65 score.

Out of 27 cases with CURB – 65 Score between 0-1 (Mild), 20 (74%) cases were treated on outpatient basis and 7 (26%) cases were treated with admission into ward. For another 27 cases with CURB – 65 Score 2 (Moderate), around 24 (88.8%) cases were treated with admission into ward and 3 (11.2%) cases were treated with ICU admission. For 18 cases with CURB – 65 score 3 to 5 (Severe), 13 cases were treated with ICU admission and for 5 cases ventilator support was given (Table 1).

Table 1: Management /treatment Plan According To CURB-65 Score

Treatment	Mild	Moderate	Severe	TOTAL
	0-1	2	3-5	
Out-Patient(OP)	20	---	---	20
In-Patient(IP)	07	24	---	31
IntensiveCareUnit(ICU)	---	03	13	16
ICU+VENTILATION	---	---	05	05

Total	27(37.5%)	27(37.5%)	18(25%)	72

Out of 27 Mild cases, 21 cases were given treatment for one week and all the 27 cases classified as Moderate case s were given treatment for 2 weeks.

Among 53 male cases, 45 (84.9%) cases survived and 8 (15.1%) cases died and among 19 female cases, 16 (84.2%) cases survived and 3(15.8%) cases died. The mortality rates among males (15.1%) and females (15.8%) were almost similar and there is no statistically significant ($p > 0.05$) association between sex and mortality.

Among 11 cases who died, 10 (90.1%) cases were having CURB-65 score 3 or 4 (>2) i.e. severe cases and 1 (9.9%) case with score 2 i.e. moderate case. This finding was statistically highly significant ($p<0.001$) (Table 2).

CAP cases mostly presented with fever (79.2%), cough (87.5%) with expectoration (sputum production) (77.8%) and dyspnoea (58.3%). The mean duration of symptoms was 6.5±1.5 days (range 4 to 14 days). Around 2 out of 72 patients (2.8%) presented with altered sensorium and both the patients died within 2 days. The 2 patients who presented with altered sensorium were having CURB-65 score 4 and died within 48 hours. Among 5 patients who presented with haemoptysis, 4 cases were severe cases (CURB-65 score 3-5) and 1 case was mild case (CURB-65 score 0). So sometimes we may have to consider other factors also to decide hospital admission and treatment.

Table 2: Mortality among CAP cases after 48 hrs & 30 days in relation to CURB-65 Score

OUTCOME		Mild	Moderate	Severe	Total
		0-1	2	3-5	
Total No. of CAP cases		27 (37.5%)	27 (37.5%)	18 (25%)	72
No. of cases died		0 (0%)	1 (9.1%)	10 (90.9%)	11
p <0.001, highly significant					
After 48 hrs	Survived	27 (42.2%)	27 (42.2%)	10 (15.6%)	64
	Dead	---	—	08 (100%)	08
After 30 Days	Survived	27 (44.3%)	26 (42.6%)	08 (13.1%)	61
	Dead	---	01 (9.9%)	10 (90.1%)	11

Among 2 patients presented with confusion, both the patients (100%) died. Among 15 patients with Systolic Blood Pressure <90 mm Hg or Diastolic Blood Pressure ≤60 mm Hg, 8 patients (53.3%) died and out of 7 patients with age ≥65 years, 3 patients (42.9%) died. All the 11 patients who died in the study were associated with Blood Urea Nitrogen ≥7 mmol/lt and respiratory rate ≥30 breaths/ minute.

The sensitivity and specificity of CURB-65 score ≥3 to predict death was 90.9% and 86.9% and PPV and NPV were 55.6% and 98.1%, respectively. The sensitivity and specificity were most favorable for a CURB-65 score ≥3. Though the specificity increased to 100% when CURB-65 score ≥4 was chosen as the cut-off but there was an unfavorable drop in the sensitivity to 27.3% (Table 3).

Table 3: Efficacy of CURB-65 score in evaluating the mortality

CURB-65 Score	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
≥1	100%	18%	18%	100%	30.6%
≥2	100%	44.3%	24.4%	100%	52.8%
≥3	90.9%	86.9%	55.6%	98.1%	87.5%
≥4	27.3%	100%	100%	88.4%	88.9%

Out of 11 patients who died, 5 (45.5%) cases were associated with Chronic Obstructive Pulmonary Disease (COPD). Among 15 patients with COPD, 5 patients (33.3%) died and among 57 patients without COPD 6 cases (10.5%) died and the relation between COPD and mortality is also statistically significant ($p < 0.05$). Among 8 patients with asthma, 2 patients (25%) died and among 64 patients without asthma, 9 cases (14.1%) died but the relation between asthma and mortality is statistically not significant. ($p > 0.05$). There is no statistically significant association ($p > 0.05$) between past history of pulmonary tuberculosis and mortality (Table 4).

Table 4: Associated Co-morbid Illness Related To Out Come Of CAP Cases

COMORBID LLNESS		Survived	Died	Total	pvalue
COPD	Yes	10	05	15	<0.05 Significant
	No	51	06	57	
PreviousPulmonary Tuberculosis	Yes	06	01	07	>0.05 Not Significant
	No	55	10	65	
Asthma	Yes	06	02	08	>0.05 Not Significant
	No	55	09	64	

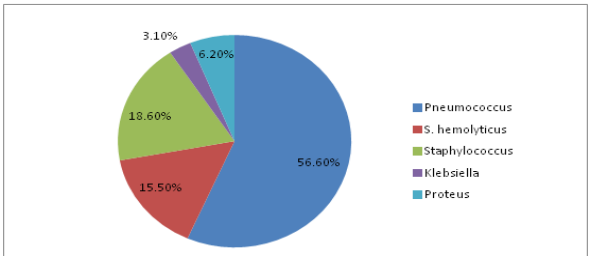
Out of 53 male patients 37 (69.8%) cases were smokers and out of 8 male patients who died, 6 (75%) patients were smokers. None of the female patients were smokers. Among 37 male smokers 6 patients died (16.2%) and among 16 male non-smokers 2 patients (12.5%) died and this finding is statistically not significant ($p > 0.05$) (Table 5).

Table 5: Association Of Tobacco Smoking With Mortality Of CA P Cases

Type of Smoker	MALE		FEMALE		TOTAL
	Survived	Died	Survived	Died	
CurrentSmoker	26	4	---	---	30
Ex-Smoker	5	2	---	---	7
Non-smoker	14	2	16	3	35
TOTAL	45	8(15.1%)	16	3(15.8%)	72
	53		19		

Coming to the microbiological diagnosis, out of the total 72 cases, etiological agent was known for 32 cases. Out of those 32 cases, majority of the cases were due to Pneumococcus (56.6%), followed by Streptococcus hemolyticus (15.5%), Staphylococcus (18.6%), Klebsiella (3.1%) & Proteus (6.2%) (Fig 2).

Fig 2: Pie chart showing the common etiological agents of Community Acquired Pneumonia Cases in the study.



DISCUSSION:

In the present study most of the Community Acquired Pneumonia cases were males (73.6%) similar to that observed in Bashir Ahmed Shah et al [13] and S. Bansal et al [25] studies (60% and 71% respectively). Mortality rates were almost same in both the sexes with mortality rate of 15.1% in males and 15.8% in females and there is no statistically significant relation between sex and mortality.

Most of the CAP cases (87.5%) occurred after 30 years of age with peak incidence (36.1%) in 41 - 50 years of age group. The mean age was 46.5±1.5 years and median age was 45 years. In S. Bansal et al[25] study also most of the cases occurred after 40 years of age group. In 61 - 70 years of age group, maximum patients (75%) were having CURB - 65 score 3-5 and most of the deaths (45.4%) occurred in them similar to P.K. Myint et al[19] study (mortality rate of 21% in older people). There is statistically significant ($p<0.05$) association between increase of age and increase in CURB-65 score. Among patients who died the mean age was 54.9±3.3 years and median age was 60 years. According to Bashir Ahmed Shah et al[13] study also the mean age among patients who died was 67.2 ± 4.5 years.

The severity of Community Acquired Pneumonia is graded as Mild, Moderate and Severe depending on CURB-65 score, with CURB-65 scores 0-1, 2 and 3-5 respectively[2,20,26].

The comparision of mortality rates according to CURB-65 score of present study with other studies is as follows-

	Sample Size (n)	Mortality rates in CURB-65 score		
		0-1 Mild	2 Moderate	3-5 Severe
The present study	72	0%	3.7%	55.6%
Andrea YL Ban et al[27]	161	0.6%	2.5%	12.4%
Lim et al[20]	718	1.5%	9.2%	22%
Capelastegui et al[26]	1776	0.4%	7.6%	26.7%
Bashir Ahmed Shah et al[13]	150	0%	0%	32%

In both Andrea YL Ban et al[27] study and the present study the mortality rate was more with bilateral involvement in chest X - ray but the difference in mortality rates might be due to difference in sample sizes.

In evaluating mortality for CURB-65 score, with increase of CURB-65 score the Sensitivity and Negative predictive value were decreasing whereas Specificity and Positive predictive values were increasing. These parameters were more optimal for CURB - 65 score ≥3 (Sensitivity - 90.9%, Specificity: 86.9%, Positive predictive value: 55.6% and Negative predictive value: 98.1%). Comparison of Sensitivity, Specificity, Positive predictive value and Negative predictive values in different CURB-65 scores in my study and that of Bashir Ahmed Shah et al[13] and Lim et al[20] studies showed comparable results.

With associated comorbid illness like COPD and Asthma the mortality was more when compared to those who were not associated with any comorbid illness in the present study which was comparable to Lim WS etal & Fine MJ etal studies [20,15].

Pneumococcus was the common etiological agent of CAP cases in the present study, in comparison to N C Karalus et al study[28].

CONCLUSION & RECOMMENDATIONS:

CURB-65 is a useful scoring system to predict the severity of CAP. It helps in deciding the mode of management whether to treat the patient as outpatient or inpatient (ward or ICU or with ventilatory support).

- Patients with CURB-65 score 0 and 1 can be managed mostly on OP basis, with score 2 mostly as inpatient in wards, few requiring ICU treatment, with score 3 -5 managed in ICU, few requiring ventilatory support.
- Consideration of associated clinical features is necessary to decide on mode of treatment in some cases.
- With increasing CURB - 65 score the mortality increases.
- Most of the deaths occurred within 48 hours.
- All the parameters like Sensitivity, Specificity, Diagnostic accuracy, Positive Predictive value and Negative Predictive value are highly optimal for CURB-65 score ≥ 3 in evaluating mortality.
- Most severe form of disease and poor prognosis is seen in elderly patients (>60 years).
- Bilateral or multilobar involvement on chest radiographs associated with higher CURB-65 scores and mortality rates.
- When associated with comorbid illness the mortality and CURB-65 score increases.
- The most common organism isolated was Pneumococcus.
- Smokers are presenting with higher CURB-65 scores.

REFERENCES:

1. Dr. Judy Lam, Dr.CM Chu; Management of Community Acquired Pneumonia; VOL.11 NO.5 MAY 2006 Medical Bulletin.
2. Alfred P. Fishman, Jack A. Elias, Jay A. Fishman, Michael A. Grippi, Robert M. Senior, Allan I. Pack; Fishman`s Pulmonary diseases and Disorders ; 4th edition.
3. Foy HM, Cooney MK, Allan I, et al. Rates of pneumonia during influenza epidemics in Seattle, 1964–1975. JAMA 1979; 241:253–258.
4. Mark Loeb, Community-acquired pneumonia, Respiratory disorders (acute), BMJ.
5. Mc Connochie KM, Hall CB, Barker WH. Lower respiratory tract illness in the first two years of life: epidemiologic patterns and costs in a suburban pediatric practice. Am J Public Health 1988; 78:34–39.
6. Murphy TF, Henderson FW, Clyde WA, et al. Pneumonia: an 11 year study in a pediatric practice. Am J Epidemiol 1981; 113:12–21.
7. R Prasad, Sanjay; Community Acquired Pneumonia : Evidence Based Management; Pulmon 2007; 9 : 1 : 4 - 12.
8. Mark Loeb, Community-acquired pneumonia, Respiratory disorders (acute), BMJ.
9. R Prasad, Sanjay; Community Acquired Pneumonia : Evidence Based Management; Pulmon 2007; 9 : 1 : 4 - 12.
10. Nisar N, Guleria R, Kuman S, Chand Chawla T, Ranjan Biswas N. Mycoplasma pneumoniae and its role in asthma. Postgrad Med J. 2007; 83:100-104.
11. Recent changes in the management of community acquired pneumonia in adults Hannah J Durrington, Charlotte Summers; BMJ 2008;336;1429-1433.
12. Waterer GW, Kessler LA, Wunderink RG. Delayed administration of antibiotics and atypical presentation in community-acquired pneumonia. Chest 2006; 130:11-5.
13. Bashir Ahmed Shah, Wasim Ahmed, Ghulam Nabi Dhobi, Naveed Nazir Shah, Syed Quibtiya Khursheed and Inaamul Haq, Validity of Pneumonia Severity Index and CURB-65 Severity Scoring Systems in Community Acquired Pneumonia in an Indian Setting, The Indian Journal Of Chest diseases And Allied sciences, 2010;Vol.52.
14. Guest JF, Morris A. Community-acquired pneumonia: the annual cost to the National Health Service in the United Kingdom. Eur Respir J 1997; 10:1530-4.
15. Michael J. Fine, M.D., Thomas E. Auble, Ph.D., Donald M. Yealy, M.D., Barbara H. Hanusa, Ph.D., Lisa A. Weissfeld, Ph.D., Daniel E. Singer, M.D., Christopher M. Coley, M.D., Thomas J. Marrie, M.D., and Wishwa N. Kapoor, M.D., M.P.H.; A Prediction Rule to Identify Low-Risk Patients with Community-Acquired Pneumonia; The New england Journal of Medicine, January 1997, Volume 336:243-250.
16. Pedro P. España, Alberto Capelastegui, Inmaculada Gorordo, Cristobal Esteban, Mikel Oribe, Miguel Ortega, Amaia Bilbao and José M. Quintana; Development and Validation of a Clinical Prediction Rule for Severe Community-acquired Pneumonia; American Journal of Respiratory and Critical Care Medicine Vol 174. pp. 1249-1256, (2006).
17. British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009.
18. Hodkinson, HM (1972). "Evaluation of a mental test score for assessment of mental impairment in the elderly." Age and Ageing 1 (4): 233-8.
19. P. K. Myint, a. V. Kamath, s. L. Vowler, d. N. Maisey, b. D. W. Harrison; The CURB (confusion, urea, respiratory rate and blood pressure) criteria in community-acquired pneumonia (CAP) in hospitalised elderly patients aged 65 years and over: a prospective observational cohort study; doi:10.1093/ageing/afh234; 75-77.
20. Lim WS, Van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, Lewis SA, Macfarlane JT. Clinical prediction rule to stratify patients with community acquired pneumonia (CAP) Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. Thorax 2003; 58:377-82.
21. British Thoracic Society Pneumonia Guidelines Committee. BTS guidelines for the management of community-acquired pneumonia in adults - 2004 update.
22. American College of Physicians; Community Acquired Pneumonia December ACP Observer.
23. P Nadarajan, L Wilson, B Mohammed, M Connor, SJ Lane; Departments of Respiratory Medicine and Phsyiotherapy, AMNCH, Tallaght, Dublin ; Compliance in the Measurement of CURB-65 in Patients with Community Acquired Pneumonia and Potential Implications for Early Discharge; IMJ Online Paper.
24. Zara Hoare, Wei Shen Lim; Pneumonia: update on diagnosis and management; BMJ 2006 332:1077-1079, doi:10.1136/ bmj.332. 7549.1077.
25. S. Bansal, S. Kashyap, L.S. Pal and A. Goel ; Clinical and Bacteriological Profile of Community Acquired Pneumonia in Shimla, Himachal Pradesh; Indian J Chest Dis Allied Sci 2004; 46 : 17-22.
26. Capelastegui A, Espana PP, Quintana JM, Areitio I, Gorordo I, Egurrola M, et al. Validation of a predictive rule for the managment of community-acquired pneumonia. Eur Respir J 2006; 27:151-7.
27. Andrea YL Ban, Noradina AT ,Fauzi Ma, Roslan H, Roslina AM ; Validation of curb-65 score in hospitalized Patients with community acquired Pneumonia in malaysia., Department of Medicine, Faculty of Medicine, University Kebangsaan Malaysia.
26. N C Karalus, R T Cursons, R A Leng, C B Mahood, R P G Rothwell, B Hancock, S Cepulis, M Wawatai, L Coleman; Community acquired pneumonia: aetiology and prognostic index evaluation, Thorax 1991; 46:413-418.