

## Diabetes Mellitus Prevalence and Burden among Community Acquired Pneumonia Patients

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### ABSTRACT

This work aimed at measuring the prevalence of Diabetes Mellitus among community acquired pneumonia (CAP) patients and declaring its effect on CAP patient's outcome. Both community acquired pneumonia and diabetes mellitus are common in Egypt, and patients with associated CAP and DM need special care and supervision. This prospective study was carried out on 108 CAP patients admitted to Abassia Chest Hospital during the period from January 2016 to December 2016. Clinical and radiological diagnosis of pneumonia and DM diagnosis were performed. DM recorded a prevalence of 39.8% among community acquired pneumonia patients. Disturbed level of consciousness is more frequent among diabetic patients than non diabetics. diabetic patients recorded higher rate of hospital admission, longer duration of hospital stay, higher rate of ICU admission and more severe pneumonia than among non diabetic patients. CURB-65 score showed significant positive correlation with HbA1c of the patients. Associated community-acquired pneumonia and diabetes mellitus is frequent in our locality and labor a double burden on the affected patients leading to poorer prognosis, higher rate of hospitalization with longer duration of hospital stay and ICU admission. So CAP patients with DM need intimate care.

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## 1. INTRODUCTION

Community acquired pneumonia (CAP) is the lower respiratory tract infection obtained outside the hospital or long term health care facility. It is diagnosed in the community or during the first 48 hours of a hospital admission [1]. CAP is one of the most common infections and a leading cause of morbidity and mortality worldwide. CAP caused by typical bacterial pathogens as *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. However, with the progress in technology and presence of novel diagnostic techniques, viral respiratory tract infections are being identified as common etiologies of CAP. Human rhinovirus and influenza virus are the most common viruses obtained from hospitalized patients admitted with CAP [2].

Diabetes mellitus (DM) is a group of metabolic disorders in which there is hyperglycemia over a prolonged duration. Uncontrolled diabetes associated with many sequelae and complications [3]. Diabetes mellitus (DM) is a significant public health problem, representing one of the most common chronic diseases worldwide and the upcoming emerging disease in 21<sup>st</sup> century. It is associated with high morbidity and

mortality. The increasing prevalence of DM and other comorbidities has been suggested as a triggering factor for the rising burden of infection-related hospitalizations [4]. Respiratory infections are among the major infections associated with diabetes [5]. Community-acquired pneumonia (CAP) is one of the most common infectious diseases requiring hospitalization in developed countries. On Association of DM with CAP, hospitalizations have been suggested previously. However, information regarding this combined burden and outcomes of CAP in patients with DM, specially its relationship with hospitalization and mortality expectation, is still limited [6].

Multiple scoring systems are available to assess the severity of CAP and to help in deciding whether a patient is in need for hospitalization or admission to the intensive care unit (ICU). The CURB-65 score is one of the scores recommended by the 2007 Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines [7]. This work aimed at estimating the prevalence of Diabetes Mellitus among CAP patients admitted to Abassia chest hospital, Cairo, Egypt, and evaluation of its impact on CAP outcome. Glycated Hb (HbA1c) level represents the mean glucose concentration over the previous 8-12 weeks and provides better suggestion of long-term glycemic control than blood and urinary glucose [8].

## 2. RESEARCH METHOD

This prospective observational study was carried out in Abassia Chest Hospital within the period from January 2016 to December 2016 after taking a permission from committee of medical ethics and scientific research, faculty of Medicine, Menoufia University and taking a written consent from each patient. All patients diagnosed as CAP meeting inclusion and exclusion criteria of this study were enrolled. Patients aged > 18 and < 80 years, those presented with a new radiographic infiltrate. Showed at least two compatible clinical symptoms (eg, body temperature > 38°C, productive cough, chest pain, shortness of breath, crackles on auscultation) were included.

While the patients presented by conditions mimic pneumonia, Heart failure, Liver cell failure, Renal failure, Cancer patients, Human immune-deficiency virus infection, Patients on hemodialysis, Chronic suppurative lung diseases, Been hospitalized in the last 90 days before the start of the study, TB patients, Hospital Acquired pneumonia, Ventilator associated pneumonia, COPD with acute exacerbation were excluded from this study. The total collected number in the study duration was 108 patients.

Informed consent was taken from each patient prior to their enrollment in the study. CAP patient was defined by the presence of an acute illness with two or more of the symptoms and signs of lower respiratory tract infection: fever, new or increasing cough or sputum production, dyspnoea, chest pain and new focal sign on chest examination and presence of infiltration in the chest radiograph on or within 48 hours of admission) that was consistent with acute infection [9]. CURB-65 scoring was done by calculating scores on confusion of new onset (Mini mental state score  $\leq 8$ ), respiratory rate ( $\geq 30/\text{min}$ ), presence of hypotension (systolic blood pressure <90 mm of Hg and diastolic blood pressure  $\leq 60$  mm of Hg) on admission, blood urea nitrogen (BUN) level ( $\geq 7$  mmol/L) and age ( $\geq 65$  years) [10].

A diagnosis of diabetes mellitus was based on history of treatment with oral anti-diabetic agents or insulin. Alternatively, diagnosis could be established during this episode of pneumonia when the fasting plasma glucose concentration was  $\geq 126$  mg/dL and/or 2 hours post load blood sugar was  $\geq 200$  mg/dL on two or more separate occasions or may be based on HbA1c level ( $> 6.4$ ) [11].

Immediate and short outcome was assessed; immediate outcome was defined as outcome of first setting in terms of hospital duration, improvement, referral to ICU, development of complications or mortality (outcome during the hospital course). Improvement of the patient means clinical wellbeing, improvement of blood chemistry (Renal function tests) & radiological improvement.

### 2.1. Statistical analysis

The collected data was tabulated and analyzed using Statistical package for Social Science version 20 (SPSS Inc., Chicago, IL, USA). Quantitative data was described as mean, Standard deviation ( $\pm$  SD) and range while numbers and percentage was the description of categorical data. Student t test was used to compare two sets of normally distributed quantitative data meanwhile Mann Whitney U test was used in comparing two groups of not normally distributed quantitative data. Chi squared test was used for comparing qualitative data and Spearman correlation was used to assess correlation between CURB-65 score and HbA1c. P value was considered significant at a value  $\leq 0.05$ .

## 3. RESULTS AND DISCUSSION

The current study was carried out on 108 CAP patients with mean age ( $51.20 \pm 17.79$ ) years and ranged from 18 – 80 years, 65.7% of them were male with male to female ratio (1.9:1). The prevalence of diabetes mellitus among

CAP patients were 43 cases (39.8%). Diabetic CAP patients were of older age than non diabetic CAP patients; meanwhile there is no difference between them regarding sex distribution. CAP associated with DM cases showed significantly more frequent disturbed level of consciousness (51.5% VS 10.7%) than non diabetic CAP patients (P value= 0.001), while, there was no significant difference between diabetic and non diabetic CAP patients regarding systolic blood pressure, diastolic blood pressure, pulse and body temperature (Table 1).

Regarding Laboratory investigations, there was non significant difference between diabetic and non diabetic CAP patients regarding urea, Sa.O<sub>2</sub>%, Hb & platelets while TLC was significantly lower among diabetic group and HbA1c was of significantly higher level among diabetic CAP patients than those non diabetics (P value <0.001). Also, diabetic CAP patients were with more sever pneumonia as they show higher CURB 65 score than non diabetics (Table 1).

Table 1. Comparison between Diabetics & Non Diabetics CAP Patients as Regards Age, Sex and Clinical Data

	CAP patients				Test of sig.	P value
	Diabetic (N = 43)		Non diabetic (N = 65)			
Age/years X±SD	58.08±16.08		47.76±17.71		U = 2.89	0.004
	No	%	No	%	X <sup>2</sup>	
Sex						
Male	27	62.8	44	67.7	0.28	0.60
Female	16	37.1	21	32.3		
Consciousness						
Full	20	45.5	61	93.8	X <sup>2</sup> = 30.9	<0.001
Disturbed	23	54.5	4	6.2		
RBS	286.47±112.54		123.25±32.49		U = 7.59	<0.001
Respiratory rate	33.67±8.92		30.71±9.35		t-test = 1.64	0.10
Systole	113.14±29.38		114.7±21.72		t-test = 0.32	0.75
Diastole	69.28±16.98		72.0±13.89		t-test = 0.91	0.36
Pulse	108.48±13.65		103.21±13.87		t-test = 1.95	0.05
Temperature	39.06±1.17		38.97±0.72		t-test = 0.50	0.62
Urea	58.38 ± 36.01		46.85 ± 28.25		U = 1.58	0.11
Sa. O <sub>2</sub> %	88.60 ± 7.53		91.78 ± 8.76		t-test=1.95	0.05
TLC (10 <sup>3</sup> )	11.55 ± 5.22		17.35 ± 6.79		U = 3.42	<0.001
Hb	12.23 ± 2.17		12.05 ± 2.16		t-test=0.42	0.67
Platelets(10 <sup>3</sup> )	236.67 ± 85.37		266.97±104.36		U = 1.37	0.17
Hb A1c	7.53±1.05		5.57±0.32		t-test=14.1	<0.001
CURB 65 score						
0	7 (16.7)		19 (27.8)		X <sup>2</sup> = 26.4	<0.001
1	4 (8.3)		21 (29.2)			
2	10 (25.0)		10 (16.7)			
3	5 (8.3)		12 (19.4)			
4	10 (25.0)		2 (4.2)			
5	7 (16.7)		1 (2.8)			

X =mean, SD = standard deviation, U = Mann Whitney U test

CURB 65 score demonstrate significant positive correlation with HbA1c (r = +0.32, P value = 0.001) (Figure 1). Regarding burden of combined CAP and DM, diabetic CAP patients showed prolonged hospital stay, higher rate of ICU admission and also higher rate of complicated cases with pleural effusion than non diabetics (54.5% versus 24%) respectively (Table 2).

Table 2. Comparison between Diabetics &amp; Non Diabetics Groups as Regards Hospital Stay, ICU Admission and Pleural Effusion

	CAP patients				Test of sig.	P value
	Diabetics (N = 43)		Non Diabetics (N = 65)			
Hospital stay X ±SD	8.53±5.24		5.58±5.20		U 3.79	<0.001
ICU admission	No	%	No	%	X <sup>2</sup> 19.8	<0.001
Yes	25	58.1	11	16.9		
No	18	41.9	54	83.1	X <sup>2</sup> 14.9	<0.001
Pleural effusion	21	48.8	10	15.4		
Yes	22	51.2	55	84.6	FE 0.52	0.60
No	21	48.8	10	15.4		
Mortality	34	94.4	70	97.2	FE 0.52	0.60
Alive	2	5.6	2	2.8		
Dead						

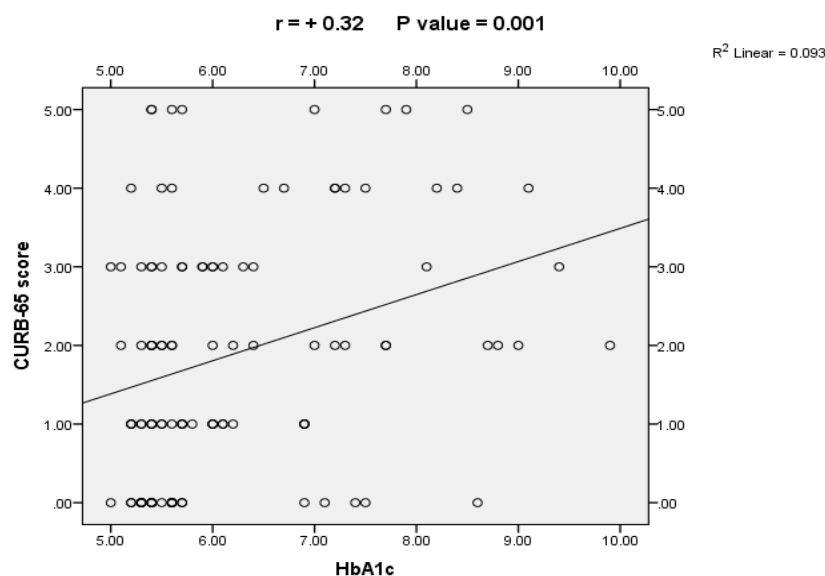
X<sup>2</sup> = Chi square test, FE = Fisher's Exact test

Figure 1. Spearman correlation between CURB -65 score and HbA1c among community acquired pneumonia patients

Based on the fact that DM produce hyperglycemic environment that induce immune dysfunction (e.g., damage to the neutrophil function, inhibition of the antioxidant system, and humoral immunity) consequently, DM increases the susceptibility to infections [10]. In our work, DM prevalence was 39.8% among community acquired pneumonia patients which is much more than a documented prevalence of diabetes mellitus type 2 in Egypt which was about 15.6% of adult populations with aged 20 to 79 [12] but it is in parallel with Khalil et al [13], whose study documented that 40.1% of CAP patients are with DM among Egyptian population sample, also, Akbar, 2001 [14] found that the prevalence of diabetes mellitus among CAP patients was 31% in KSA, Martins et al, 2015[15] documents a higher prevalence of DM among CAP patients (28%) which was larger than the prevalence in general population in Portugal ,furthermore, this significant association between DM and episodes of CAP was documented by de-Andrés et al, 2017 [16] and Kornum et al, 2007 [17].

According to our work, the associated DM and community acquired pneumonia was more frequent in older age patients, this due to the diminished immune system activity with age which predispose to infection, meanwhile, there is no association between this combination and sex of the patients, these results come in parallel with the results of Saibal et al, 2012 [18], Falguera et al, 2005[19] and Akbar, 2001 [14]. The later observed male predominance in CAP diabetic patients. The current work shows a statistically higher rate of disturbed level of consciousness among diabetic patients than non diabetics (51.5% Vs 10.7%) with insignificant difference between both groups regarding systolic & diastolic blood pressure, temperature, pulse and respiratory rate. similar results were recorded by Saibal et al, 2012 [18] in the part that confirm altered

mental status among diabetic CAP patients but it opposes our results as it found that hypotension and tachypnea are common clinical features in diabetic patients with CAP.

Regarding laboratory investigations, this study show significantly lower TLC among diabetic CAP patients which may be due to adverse effect of DM on immunity and resistance to infection. These results are in concordance with the studies of Akbar, 2001[14] & Saibal et al, 2012 [18]. A higher rate of ICU admission and longer hospital stay among diabetic CAP patients was supported by Saibal et al, 2012 [18].

Our results revealed that diabetic CAP patients were presented with more sever pneumonia, longer hospital stay, higher rate of ICU admission and more frequent complication like pleural effusion, the same findings was observed by Saibal et al, 2012 [18] and Falguera et al, 2005[19]. According to the current study, HbA1c is positively correlated with CURB-65 score which determine the severity of pneumonia. This can be explained as HbA1c reflects diabetic control over the last 2-3 months and long term diabetic control is associated with protection from diabetic complications [20].

#### 4. CONCLUSION

Associated community acquired pneumonia and diabetes mellitus is common, this association carries the double burden of both diseases reflected on more need for hospitalization and ICU admission, longer hospital stay and higher rate of mortality. So, special care for diabetic patients and intimate follow up for its control will lead to decline in exposure to infection and also less severe infection if any.

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