Original Article

A study of clinical profile of community - acquired pneumonia in diabetes mellitus

Sameer Yadav[1], Pramod Darole[1*], Tukaram Jamale[2], N D Moulick[3]

[1]Assistant Professor, [3]Professor and HOD, Department of Medicine, LTMMC and LTMGH, Mumbai, Maharashtra, INDIA.
[2]Associate Professor, Department of Nephrology, Seth G.S. Medical College & KEM Hospital, Mumbai, INDIA.
Email: darole_pramod@rediffmail.com

Abstract

Background: Community- acquired pneumonia may cause significant morbidity and mortality, especially in patients who have comorbidities. Diabetes mellitus is associated with increased susceptibility to infection due to its deleterious effect on immunity and thus may affect pneumonia outcomes. **Objective:** To study the clinical, etiological, radiological profile and outcomes of community- acquired pneumonia in patients having diabetes mellitus. **Methods:** This was a cross-sectional observational study done in a tertiary care hospital over one year. We studied 115 adult patients who were hospitalized with a diagnosis of pneumonia and had pre-existing diabetes or who were first time detected to have diabetes. They were evaluated by clinical history, physical examination, chest X ray, blood investigations, sputum smear and culture. Blood sugars were done on admission and monitored frequently during hospital stay. Empirical antibiotic therapy was started till any definite microorganism with drug sensitivity patterns were identified, followed by specific therapy. Patient outcomes were recorded. **Results:** Out of 115 patients, 88 (76.5%) had type 2 diabetes and 27 (23.4%) had type 1 diabetes. Cough was the commonest symptom of pneumonia in both groups followed by dyspnea. Commonest chest radiographic pattern was multilobar lung involvement in type 1 DM and predominantly lower lobe involvement in type 2 DM. Mycobacterium tuberculosis was found to be the commonest organism causing pneumonia in 85% of type 1 DM cases, while S. pneumonia was commonest organism in type 2 DM patients (34%). There were 15 deaths in the study (13.04%). Mean HbA1c was high (11.9%) in the mortality group. **Conclusions:** Cough and dyspnea were predominant symptoms of pneumonia rather than fever. Pulmonary tuberculosis was the commonest cause of pneumonia in T1DM patients and TB should be borne in mind as a cause of pneumonia in diabetic patients. Uncontrolled hyperglycemia was associated with poorer outcomes as were impaired consciousness, leucocytosis and raised BUN.

Keywords: Community acquired pneumonia; Diabetes mellitus; Tuberculosis.

[*]**Address for Correspondence:**
Dr. Pramod Darole, Department of Medicine, Lokmanya Tilak Municipal Medical College and General Hospital, Dr. B. R. Ambedkar Road, Sion, Mumbai, India - 400022.
Email: darole_pramod@rediffmail.com
Received Date: 20/06/2016 Revised Date: 18/07/2016 Accepted Date: 29/08/2016

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 01 September 2016

INTRODUCTION

Diabetes mellitus is a metabolic syndrome characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism associated with absolute or relative deficiency in insulin secretion and/or insulin action[1]. It is associated with high morbidity and mortality. It is estimated that by 2020, India will harbor the largest number of diabetic patients in the world. DM is often regarded as an independent risk factor for development of a lower respiratory tract infection, the spectrum of which includes pneumonia, lung abscess, pleural effusion, empyema, etc. Pneumonia in itself is a serious illness associated with considerable morbidity and mortality, and any associated condition decreasing the body's immunity may lead to severe disease and worse outcomes. There is enough evidence in literature to suggest that lungs can be affected by hyperglycemia as are kidneys, heart, eyes. Host defenses are weakened in diabetes due to impaired chemotaxis, phagocytosis, bactericidal activity and reduced number of circulating

How to site this article: Sameer Yadav, Pramod Darole, Tukaram Jamale, N D Moulick. A study of clinical profile of community - acquired pneumonia in diabetes mellitus. *International Journal of Recent Trends in Science and Technology*. September 2016; 20(2): 163-168. http://www.statperson.com (accessed 03 September 2016).

monocytes.[2] Defective neutrophil functions reverse following treatment with insulin.[3] Lungs are being increasingly seen as target organ of damage by chronic hyperglycemia.[4] Infections due to S. aureus, Gram negative bacteria and Mycobacteria occur with increased frequency in diabetic patients. DM increases the risk of community acquired pneumonia(CAP) besides increasing the morbidity and mortality in CAP.[5] Diabetic patients have a 2-6 fold high incidence of TB. Pulmonary TB can also have clinical presentation similar to CAP, is likely to be more extensive, less symptomatic and possibly multi drug resistant, leading to delayed diagnosis and more complications.[6] Present study was aimed at studying the clinical, radiological, etiological profile and outcome of CAP in diabetic patients and also assessing the impact of hyperglycemia on mortality.

MATERIAL AND METHODS

This was a cross-sectional observational study in a tertiary care hospital done over a period of one year, aimed at studying the clinical, etiological and radiological profile of community acquired pneumonia in patients with diabetes mellitus. The study also included etiology of CAP and outcome of patients.115 patients were included in the study. Adult patients who were hospitalized with a diagnosis of pneumonia and were having pre-existing diabetes or who were first time detected to have diabetes were included in the study. Patients with aspiration pneumonia, those with concomitant cardiac failure were excluded from the study. Written informed consent was taken from all patients included in the study.

Pneumonia was defined as presence of an infiltrate on chest radiograph along with one of the following:

(a) symtoms of acute lower respiratory tract illness for <1 week (i.e. cough, dyspnea or pleuritic chest pain)
(b) Atleast one systemic feature (temperature > 37.7º C, chills and rigors, malaise)
(c) New focal chest signs on examination (bronchial breath sounds, crepitations)

DM was diagnosed based on ADA criteria:

(a) Symptoms of DM plus random blood sugar level > 200 mg%
(b) Fasting blood sugar > 126 mg% or
(c) HbA1C > 6.4% or
(d) 2 hours plasma glucose > 200 mg% during OGTT

Clinical history, demographic data, examination findings, blood investigations, microbiological data, radiological data from X rays, and patient outcomes were recorded. Random blood sugars were done on admission and repeated as necessary. Patients were started on empirical antibiotic therapy till sputum culture and drug sensitivity results were available following which organism specific therapy was started. Antibiotic therapy consisted of a beta lactam antibiotic with a macrolide antibiotic (Azithromycin). Patients developing complications like hypotension, hypoxemia requiring assisted ventilation or hyperglycemic crises were managed in ICU. Duration of antibiotic treatment was 7 to 14 days. Blood sugars were maintained below 180 mg% using subcutaneous or intravenous insulin therapy. Patients were assessed for end organ damage by fundoscopy, monofilament test, ECG and presence of microalbuminuria.

RESULTS

Demographic data (Refer Table 1)

Total 115 patients were enrolled out of which 88 patients (76.5%) had type 2 diabetes (T2DM) and 27 patients (23.4%) had type 1 diabetes (T1DM). Out of the 27 patients of type 1 DM, majority of patients (66.6%) were in the age group of 10 to 20 years. Majority of patients (67%) with type 2 DM were in the age group of 41 to 50 years. (Table 1) There were more number of males than females affected with diabetes and Community acquired pneumonia (67.8%). Duration of DM was taken as the time since the first documented diagnosis. Duration of DM was less than 10 years in 81% of type1 DM patients and in 85.2% of T2DM patients. 18 patients were newly diagnosed with diabetes during present admission of which 4 had T1DM and 14 had T2DM.

Clinical features and etiological agents (Refer Tables 1,2 and 3)

Cough was the commonest symptom of pneumonia in both forms of diabetes patients (81.4% in T1DM and 94% in T2DM) followed by dyspnea. Fever was noted in 33.3% of T1DM and 35.2% of T2DM patients. Evidence of type 1 respiratory failure was present in 33% of T1DM patients and all except one required ventilatory support. Mean duration of ventilation was 3 days in type1 and 5.3 days in T2DM patients. Hypotension (Systolic Bp < 90 mmHg) was present in 25.9% of pneumonia patients with T1DM and in 44.3% of T2DM patients. Mean duration of inotropic support was 2 days in T1DM and 2.3 days in T2DM. 24 patients (88%) of type1 DM had diabetic ketoacidosis on presentation or during hospital stay, while diabetic ketosis was the commonest abnormality in type 2 DM patients. Mean HbA1C was 10.11% in type 1 DM patients and was 10.4% in type 2 DM patients. Commonest chest radiographic pattern was multilobar involvement in T1DM (77%) and lower lobe involvement in T2DM cases (57.9%). Bilateral CAP was observed in 24.34% of the 115 patients. Mycobacterium tuberculosis was found to be the commonest organism causing pneumonia in 85% of type 1 DM, while S. pneumonia

was commonest organism in type 2 DM patients (34%).(Table 3). Retinopathy was commonest (33%) existing end organ complication in type 1 DM while neuropathy (57%) was commonest existing end organ complication in type 2 DM.

Outcomes (Refer Table 4)

Of the 27 cases of T1DM with CAP, 23 cases (85.18%) were diagnosed to have pulmonary tuberculosis and were discharged on anti TB treatment. Two cases of pneumococcal pneumonia resolved with treatment. Only one patient in the T1DM group expired. Of the 88 cases in T2DM subset, pneumonia resolved with anti microbial therapy in 68.5% cases. Tuberculosis was diagnosed in 16 patients (18.1%) and they were initiated on anti TB therapy. 14 patients in T2DM group expired (15.9%). Overall, there were 15 deaths in both groups out of 115 patients (13.04%). Majority patients were in age group of 40-50 years and the mortality was more in females (11 females out of 15 expired patients). Mean BMI was 28 in the mortality group. All patients showed evidence of respiratory failure on admission and required ventilator support. 86.6% (13 out of 15) had systolic blood pressure less than 90 mmHg on admission requiring inotropic support. 14 of the 15 expired patients had impairment of sensorium. Patients who died had a mean random blood sugar of 454 mg% and were in hyperglycemic crises (HHS, DK and DKA). Mean HbA1c in the mortality group was 11.9%, suggestive of higher mortality in hyperglycemic patients. These patients also had leucocytosis and raised BUN. The commonest etiological agent of pneumonia in the expired patients was S. pneumonia followed by MTB. All expired patients had multilobar lung involvement on chest radiographs.

Table 1: Characteristics of Community Acquired Pneumonia patients with Diabetes

Characteristics	Patients with Type 1 diabetes	Patients with Type 2 diabetes
No. of patients	27	88
Age (years)		
10-20	18 (66.6%)	0
21-30	7 (25.9%)	0
31-40	2 (7.4%)	7 (7.9%)
41-50	0	59 (67%)
51-60	0	18 (20.4%)
61-70	0	2 (2.27%)
71-80	0	3 (3.4%)
Sex		
Males	20 (74%)	58 (65%)
Females	7 (25%)	30 (34%)
Duration since diagnosis of DM (years)		
0- 5	12 (44%)	53 (60.2%)
6-10	10 (37%)	22 (25%)
11-15	0	0
16-20	1 (3.7%)	0
Newly diagnosed	4 (14.8%)	14 (15.9%)
Symptoms of Pneumonia		
Cough	22 (81.4%)	83 (94%)
Dyspnea	15 (55%)	37 (42%)
Fever	9 (33%)	31 (35%)
Chest Pain	9 (33%)	30 (34%)
X- Ray Pattern		
Lower lobe	12 (44%)	51 (57.9%)
Multilobar	21 (77%)	32 (36%)
Bilateral	9 (33%)	19 (21.5%)
Severity Features		
Respiratory rate > 30/min	9 (33%)	37 (42%)
Systolic BP< 90mmHg	7 (25.9%)	39 (44%)
Confusion	1 (3.7%)	13 (14.7%)
BUN > 30mg%	4 (14.8%)	30 (34%)
PaO2 < 60 mmHg	9 (33%)	37 (42%)

Table 2: Diabetes related complications in CAP patients

Characteristics	Patients with Type 1 diabetes	Patients with Type 2 diabetes
Glycaemic crises		
DKA	24 (88%)	1 (12.5%)
HHS	0	6 (6.8%)
Diabetic ketosis	0	22 (25%)
Hypoglycemia	0	1 (1.1%)
Euglycaemic	3	47 (53.4%)
Mean HbA1C	10.11%	10.4%
Diabetes related end organ complications		
Retinopathy	9 (33.3%)	43 (48.8%)
Cardiovascular diseases	0	27(30.6%)
Peripheral vascular diseases	2 (7.4%)	21(23.8%)
Nephropathy	1 (3.7%)	24 (27.2%)
Neuropathy	6 (22.2%)	57(64.7%)

Table 3: Etiology of Pneumonia

Organism	Patients with Type 1 diabetes		Patients with Type 2 diabetes	
	No.	Percentage	No.	Percentage
S. pneumoniae	2	7.4	30	34
S. aureus	1	3.7	4	4.5
Mixed anaerobes	Nil	Nil	4	4.5
Anaerobic streptococci	Nil	Nil	2	2.2
Proteus spp.	Nil	Nil	1	1.1
Acid fast bacilli	23	85	16	18.5
No organism isolated	1	3.7	32	35.3

Table 4: Outcome of CAP

Outcome	Type 1 DM n = 27	Type 2 DM n=88
Resolved with antibiotics	3 (11%)	58 (65.90%)
Discharged on anti tuberculous therapy	23 (85%)	16 (18%)
Expired	1 (3.7%)	14(15.90%)

DISCUSSION

Present study was aimed at studying the etiology and clinical profile of community acquired pneumonia in patients with diabetes mellitus and its inpatient morbidity and mortality.

Demographics

115 patients of CAP with DM were included in this study out of which type1 DM were 23% and type 2 DM were 77%. Jayesh Dutt *et al*[7] in their study of pneumonia in diabetes, had 90% type 2 DM patients and 10% type1 DM patients. This is a reflection of the predominance of type 2 over type1diabetes in general population. Type 2 DM accounts for around 90% all diabetes worldwide.[8] In our study majority of patients of type1 DM were in age group of 10-20 years while majority of patients (67%) with type 2 DM were in the age group of 41 to 50 years. In the study by Niyas *et al*[9], 53.6% of T2DM patients belonged to age group of 60-69 years. In our study there were was preponderance of males (67%) as compared to females (33%) similar to the male preponderance seen in studies by Jayesh dutt *et al*[7] and Niyas *et al*[9].

Mean duration of diabetes was 0 to 5 years in both type1 and type 2 cases.

Clinical Features

In both types of DM, cough was the commonest symptom (91% patients) followed by dyspnea (45%).This is in concordance with previous studies on CAP.[7,9,10] Fever was present in only 34 % patients, although it is regarded as the cardinal feature of lower respiratory tract infection. In our study, the absence of fever didn't correlate with the type of diabetes, its duration or age of the patient. Dyspnea prevalence was higher in T1DM cases (55%) than T2DM cases (42%). This is part may be due to the frequent presence of ketoacidosis at presentation (88.8%) in T1DM subset. However, dyspnea was complained of by 42% of T2DM cases while ketoacidosis was present in only 12.5 of these cases. This finding may reflect severity of the pneumonia itself in T2DM patients or may be due to an accelerated decline in FEV1 in these patients as shown by Wendi A Davies *et al*.[4] More than 90% of type 1 cases had hyperglycemic crises most common of which was ketoacidosis. This is of particular importance in the initial evaluation where, in a breathless patient with ketoacidosis, pulmonary infection may not be suspected at all.[5] Hyperglycemic crises were less frequent in T2DM patients but of special note was the finding that HHS

(hyperosmolar hyperglycemic state) carried 100% mortality. Mean HbA1C was 10.3% and mean RBS was 387.9% in both types of diabetic patients with CAP. This denotes that chronic uncontrolled hyperglycemia is a risk factor for developing CAP. On chest X ray evaluation multilobar involvement was the most common pattern seen in type 1 cases followed by lower lobe involvement. In type 2 cases, predominantly lower lobe involvement was seen followed by multilobar involvement. Jayesh Dutt *et al*[7] found that multilobar involvement with cavity and fibrosis was predominant (48% cases) in their study.

Etiological agents

An etiological agent could be isolated in 72% of cases. All isolation was done from sputum investigations. The commonest cause of pneumonia in our study was Mycobacterium tuberculosis in 33.9% of both types of diabetes patients followed by Streptococcus pneumoniae in 27%. Most of these TB cases were found in T1DM patients (in 85% T1DM). In the study by Dutt *et al*[7], M. Tuberculosis was the etiological agent of pneumonia in 32% cases. TB accounted for 6% of CAP-like presentation in the study by Niyas[9]. In a study from Congo, Mboussa J *et al*[11] found that diabetes appeared to have an induction and aggravating effect on tuberculosis. These findings suggest that pulmonary tuberculosis may not always present in an indolent fashion and may be an underdiagnosed cause of pneumonia in hospitalized patients. Streptococcus pneumoniae was the commonest organism found in studies by Acharya VK *et al*[12], Ruiz M *et al*[13], Howard *et al*[14] and Lagerstrom F *et al*[15].

Mortality

Mortality was more in CAP patients with type 2 DM (15.9 %) than in type 1 DM (3.7%). Overall mortality of the CAP patients with DM was 13.91%. In study by Miquel *et al*[16], mortality was 17% whereas it was 14% in study by Niyas[7]. In our study mortality was high in patients with uncontrolled blood sugars, with a mean RBS of 454 mg% in the patients who died. Mean HbA1C was 11.9% in the mortality group. In their study by Rajib *et al*[17], hyperglycemia was independently associated with mortality in diabetic patients with pneumonia. High mortality in type 2 DM patients with pneumonia could be due to patients having comorbidities which amplify the risk of infections. Disproportionately high mortality was observed in females in this study (73.3% of the expired patients) while they constituted only 32% of the total cases of CAP with DM. This may reflect gender bias in seeking medical care late for female patients which is not uncommon in the lower socioeconomic groups to which the majority of study population belonged.

CONCLUSIONS

In this study of community acquired pneumonia in diabetes mellitus patients, cough and dyspnea were the predominant symptoms rather than fever. Multilobar involvement of lung was common. MTB was the major etiological agent in type 1 DM patients while in type 2 DM patients Streptococcus pneumoniae was common pathogen of CAP. This denotes the importance of screening diabetic patients for TB in a country like India where TB is rampant. Patients with hyperglycemic crisis, high leucocyte count and BUN > 30 mg% were associated with increased mortality. Hence early diagnosis, maintaining euglycemia, meticulous monitoring, aggressive management and high index of suspicion for MTB as etiology for CAP will help in decreasing adverse outcomes in CAP patients with DM. Immunisation in DM patients by pneumococcal vaccine and H. influenza vaccine will help in prevention of CAP in DM patients.

REFERENCES

1. Krall L P, Levine R, Barnett D. The history of diabetes. Chap1, Joslin's diabetes mellitus. Edit- Kahn C R., Weir G.C. 13th ed., Waverly International Balt, 1994, pg1-14.
2. Johnston CLW: Infection and diabetes mellitus. In Textbook of Diabetes. 2nd ed. Pickup J, Williams G, Eds. Oxford, U.K. Blackwell Science, 1997, p. 1–14.
3. Bagdale J, Root R, Bulger R. Reversible abnormalities of phagocytic function in poorly controlled diabetic patients.
4. Davis W A, Knuiman M, Kendall P et al. Glycemic exposure is associated with reduced pulmonary function in type 2 diabetes: The Fremantle Diabetes study. Diabetes Care, 2004; 27:752-757.
5. Koziel H, Koziel MJ. Pulmonary complications of diabetes mellitus: Pneumonia. Infect Dis Clin North Am. 1995 Mar; 9(1):65-96.
6. Bashar M, Alcabes P, Rom W N et al. Increased incidence of multi-drug resistant tuberculosis in diabetic patients on the Bellevue Chest Service, 1987 to 1997. Chest, 2001: 120(5):1514-1519.
7. Dutt J, Dabhi LA. Study of pneumonia in diabetic patients. Int J Med Sci Public Health 2014; 3:974-976.
8. Mohan et al: Epidemiology Of Type 2 Diabetes. Indian J Med Res 125, March 2007, pp 217-230.
9. Niyas VKM, Kumar KGS. Community acquired pneumonia in type 2 diabetes mellitus: A study of clinical and bacteriological profile. J. Evid. Based Med. Healthc. 2016; 3(17), 656-661. DOI: 10.18410/jebmh/2016/149
10. Müller B, Harbarth S, Stolz D et al. Diagnostic and prognostic accuracy of clinical and laboratory parameters in community-acquired pneumonia. BMC Infect Dis. 2007 Mar 2;7:10
11. Mboussa J, Monabeka H, Kombo M, Yokolo D, Yoka-Mbio A, Yala F. Course of pulmonary tuberculosis in diabetics. Rev Pneumol Clin 2003; 59:39-44.
12. Acharya VK, Padyana M, Acharya PR, et al. Microbiological profile and drug sensitivity pattern among community acquired pneumonia patients in

tertiary care centre in Mangalore, coastal Karnataka, India. . J clin Diagn Res 2014; 8(6):MC04-6.
13. Ruiz M, Ewig S, Marcos MA, et al. Etiology of community-acquired pneumonia: impact of age, comorbidity and severity. Am J Respir Crit Care Med 1999; 160:397-405.
14. Howard LSGE, Sillis M, Pasteur MC, et al. Microbiological profile of community acquired pneumonia in adults over the last 20 years. J Infect 2005; 50:107–13.
15. Lagerstrom F, Bader M, Foldevi M, et al. Microbiological etiology in clinically diagnosed community-acquired pneumonia in primary care in Orebro, Sweden. Clin Microbiol Infect 2003; 9:645–52.
16. Falguera M, Pifarre R, Martin A, Sheikh A, Moreno A. Etiology and outcome of community-acquired pneumonia in patients with diabetes mellitus. Chest 2005; 128(5):3233-3239.
17. Rajib K Bhattacharya, Jonathan D Mahnken, Sally K Rigler. Impact of admission level blood glucose on the outcomes in community acquired pneumonia in older patients. Int J Gen Med 2013; 6:341–344. Published online 2013 May 6. doi: 10.2147/IJGM.S42854.

Source of Support: None Declared
Conflict of Interest: None Declared