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MORTALITY PREDICTORS IN COMMUNITY-ACQUIRED PNEUMONIA

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ABSTRACT

Objective: To determine mortality predictors among patients admitted for community-acquired pneumonia to the medical wards of Ladoke Akintola University of Teaching Hospital between Jan. 2003 and Dec. 2005.

Methods: The case notes of 65 patients admitted for community-acquired pneumonia were studied with respect to their admission Pneumonia Severity Index (PSI) (Score) and functional class. The duration of admission, side of lung affected on chest X-ray, co-morbid illness and outcome were also noted.

Results: The mean Pneumonia Severity Index score for patients who were discharged and those who died was 65.48^{+} 32.6 and 95.47^{+} 32.9 respectively (.P<0.05). Bedridden patients have higher mortality than patients who walked without problems on admission (P<0.05). The mean duration of admission of discharged patients was 9.5^{+} 8.9 days while that of patients who died was 4.82^{+} 2.7 days (P<0.05). The side of lung involvement of chest X-ray does not seem to affect mortality (P>0.05). Sixteen co-morbid illnesses were identified.

Conclusion: The Pneumonia Severity Index score remains an important mortality predictor in patients with community-acquired pneumonia, but there is need to widen its scope to include functional class, duration of admission, and locally important co-morbid illnesses.

Key Words: Community-Acquired Pneumonia, Mortality Predictors *(Accepted 25 April 2008)*

INTRODUCTION

Community-acquired pneumonia (CAP) is a common infectious illness all over the world, and it accounts for significant morbidity and mortality. Between 1973 and 1986, Harries et al[1] found CAP to be among the first three causes of admissions and death on the medical wards in Malawi, while it has been reported as the fourth commonest communicable disease on the medical ward in Port Harcourt, Nigeria[2]. We found CAP to be the commonest respiratory disease in our chest clinic in 2002 at Osogbo, Nigeria [3]. The incidence rate of CAP in the more technologically advanced parts of the world has been estimated to be about 11.6/1,000 adults per year of which approximately 30% require admission to hospital [4]. Since Fine et al [5,6] developed a Pneumonia Severity Index PSI-Score (a predictor of mortality) for CAP based on 19 clinical, laboratory and radiographic variables, this author is not aware of any study to apply it to Nigerians with CAP, and to identify other possible predictors of mortality in them. Fine et al also did not consider other factors that might be important in mortality such as functional status on admission, site of care, process of care, and ethnicity. This study was therefore carried out to relate PSI to the mortality, and to identify other possible of mortality among Nigerian patients with CAP.

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MATERIALS AND METHODS

The case notes all patients admitted to the medical wards of the Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State, Nigeria for CAP between January 2003 and December 2005 were reviewed. CAP diagnosis was made when a patient presented with two or more symptoms or signs such as cough (productive or not), pleuritic chest pain, dyspnoea, fever (temperature >38^{0}C), and crackles, or bronchial breathing on auscultation of the chest plus chest X-ray evidence of pneumonia as interpreted by the attending physician.

The following information were obtained from each file:

1. PSI

The following clinical and laboratory severity parameters were sought for and the corresponding marks awarded, and then the total addition was made for each patient as the PSI Score [6].

- Age (male = X years, female = X-10 years, where X is the age of the patient in actual number)
- Alteration in level of consciousness (+20)

Respiratory rate >30/min (+20)
. Systolic and/or diastolic blood pressure $<^{90}/_{60}$ mmHg (+20)
. Blood Urea > 7mmol/L (+20
. Co-morbid diseases
-Neoplastic (+30)
-Liver (+20)
-Congestive cardiac failure (+10)
-Cerebrovascular disease (+10)
- Renal disease (+10)
. Blood glucose > 13.9mmol/L (+10)
. Packed cell volume <30% (+30)
. Serum Na^+ >130mmol/L (+20)
. $Sa0_2$ <90% (+10)
. Arterial pH<7.35 (+30)
. Temp $<35^0$ or 40^0C (+15)
. Pulse rate > 125/min (+15)
. Total wbc <4,000/cmm or >30,000/cmm (+15)

2.Functional class on admission
The following information was obtained: whether patient was:
(a)walking without problems
(b)walking with assistance
(c)in the wheelchair
(d)bedridden

3.Duration of admission (in days)
4.Side(s) of lung involvement on chest X-ray (CXR)
5.Antibiotics used
6.Outcome (Discharged or Died).

The mean of PSI score, and of duration of admission was calculated, their respective standard deviation determined, and t-table used to determine p-value. The frequency of each abnormal functional class is compared with that of patients who were walking without problems, and Chi-square table used to determine p-value. The frequency of occurrence of lung lesion on either side was compared, and Chi-square table used to determine p-value.

RESULTS

A total of sixty-five patients were admitted with a diagnosis of CAP to the medical wards of Ladoke Akintola University Teaching Hospital, Osogbo, during the 3-year study period. They were mostly treated with Penicillin/Cephalosporins with or without macrolides, while a few were treated with fluoroquinolones. Seventeen of them died, giving a mortality rate of 26.15 per cent.

PSI

The mean PSI in the discharged group of patients and the group that died is shown in Table 1. Those who died had a higher PSI than those discharged, and it is of statistical significance ($p<0.05$).

Duration of admission

The mean duration of admission of the two groups is shown in Table 2. The patients that died had a shorter duration of admission than those who were discharged, and this is of statistical significance ($p<0.05$).

Functional Class

Table 3(a) shows the frequency of patients with CAP who were in the different functional classes i.e. walking without problems, walking with assistance, in wheelchair, bedridden at the time of admissions.A total of 28 patients (out of 65) were able to walk without problems at admission, out of which 3 died, constituting a mortality of only 10.7 percent in this group, while out of 16 patients who walked with assistance, 2 (12.5%) died. Out of the 6 patients in wheelchair, 2 (33.3%) died, while out of the 15 who were bedridden, 10 (66.7%) died. Hence, mortality increased with worsening functional status.There is statistical significance in mortality when patients walking without problems are compared with those bedridden (<0.05), but this is not the case when the former is compared separately with those in wheelchair and those walking with assistance at admission ($p>0.05$) Table 3b (i-iii).

Chest X-ray

The side(s) of involvement of the lungs on CXR in CAP is shown on Table 4. Twenty (41.7%) of the 48 discharged patients had their lesion on the right side of the chest, 24 (50%) on the left and 4 (8.3%) had bilateral lesions, while seven (41.2%) of the 17 patients who died had their lesion on the right side, 6 (35.5%) on the left, and 4 (23.5%) had bilateral lesions. On statistical analysis, there is no significant difference between the two groups ($p>0.05$).

Co-morbid illnesses

Table 5 shows the list of co-morbidities which were found in the patients with CAP. Sixteen co-morbid conditions were found in the 65 patients with CAP. Some of the conditions occurred in combinations in the same patient while not all the patients had co-morbid illness. Overall, anaemia and pulmonary tuberculosis were the commonest co-morbid conditions, followed by malaria. Among the discharged patients, pulmonary tuberculosis is the commonest co-morbid condition, while anaemia is the commonest among patients that died, followed by malaria.

Table 1: **PSI Score.**

	No. of Patients	Mean PSI	Standard Deviation
Discharged	48	65.48	32.6
Died	17	95.47	32.9
Total	**65**		

t= -9.2, 1 degree of freedom.
p<0.05

Table 2: **Duration of Admission**

	No. of Patients	Mean Duration of Admission (days)	Standard Deviation
Discharged	48	9.5	8.9
Died	17	4.82	2.7
Total	**65**		

T= 7.38, 1 degree of freedom.
p<0.05

Table 3(a): **Showing Functional Class of Patients with CAP.**

	Discharged No. (%)	Died No. (%)	Total No. (%)
Walking without problems	25 (89.3)	3(10.7)	28 (100)
Walking with assistance	14 (87.5)	2 (12.5)	16(100)
In wheelchair	4 (66.7)	2(33.3)	6 (100)
Bedridden	5 (33.3)	10 (66.7)	15 (100)
Total	**48(73.8)**	**17(26.2)**	**65(100)**

Table 3b (i-iii): **Show the Statistical Analysis of Functional Class Results.**

i)

	X^2	Degree of freedom	p-value
Walking without problems Compared with Bedridden	14.5	1	<0.05

ii)

	X^2	Degree of freedom	p-value
Walking without problems Compared with wheelchair	2.015	1	>0.05

iii)

	X^2	Degree of freedom	p-value
Walking without problems Compared with assistance	0.032	1	>0.05

X^2 = Chi-square, 1 degree of freedom

Table 4: **Side(S) of Lung Involvement.**

	Right No. (%)	Left No (%)	Bilateral No (%)	Total No (%)
Discharged	20 (41.7)	24 (50)	4(8.3)	48 (100)
Died	7 (41.2)	6 (35.3)	4 (23.5)	17 (100)
Total	**27 (41.5)**	**30 (46.2)**	**8 (12.3)**	**65 (100)**

X^2= 0.28, 1 degree of freedom.
p>0.05

Table 5: **Co-Morbid Illnesses**

S/N	Condition	Discharged Patients No	Patients That Died No	Total No
1.	Sepsis syndrome	0	2	2
2.	Cerebrovascular disease	1	1	2
3.	Chronic renal failure	2	1	3
4.	Anaemia	2	4	6
5.	Diabetes mellitus with hypoglycaemia	0	1	1
6.	Pulmonary tuberculosis	6	0	6
7.	Disseminated tuberculosis	0	2	2
8.	Benign prostatichypertrophy with obstructive uropathy	0	1	1
9.	Acute pyelonephritis	0	1	1
10.	Hypertension	3	0	3
11.	Hypertensive heart failure	0	1	1
12.	Bronchial asthma	1	0	1
13.	Malaria	2	3	5
14.	COPD with cor pulmonale	0	1	1
15.	Gastroenteritis	1	1	2
16.	Chronic hepatitis	0	1	1

DISCUSSION

From this study, the mortality rate of patients with CAP is 26.15%. This is on the high side when compared with the results from other centres around the globe. For example, Marie and Wu [7] recorded a mortality rate of 8.1%, but they studied 3,043 in- patients with CAP in a multi-centred fashion in the United States of America (USA) where better facilities are available for patient management. Arozullah et al, also working in the U.S reported a mortality rate of 9.1% among patients admitted for HIV associated CAP [8]. They studied the case records of 1,415 hospitalized patients from 1995 to 1997 at 86 hospitals in seven metropolitan areas. The factors responsible for the higher mortality rate in this study may include:
(i) The mono-centred nature of the study, (ii) the fewer number of patients studied, and (iii) the poorer facilities generally available for patient management in a developing country like Nigeria. Riquelme et al, also in the US, reported a crude mortality rate of 26% among elderly patients with CAP[9]. More patients with higher PSI died when compared with those with lower PSI in this study (p<0.05), and this lends further weight to the work of Fine et al [5] and other workers[7] that the PSI, when calculated for patients with CAP, is a powerful predictor of mortality.From the results of this study, the duration of admission is also a possible predictor of mortality in Nigerians. Shorter duration of admission is associated with higher mortality than longer duration of admission (p<0.05). This is in contrast to the finding of Marie and Wu [7] who found that mortality in patients with CAP increased with duration of admission. Further studies are necessary to settle these conflicting findings and the site of care (locality) and processes of care have to be taken into consideration.There is a significant difference in the mortality of patients with CAP who were able to walk without problems at admission and those who were bedridden at admission from the results of this study (p<0.05). But there is no significant difference when the former group of patients is compared with either

those in wheelchair at admission or those walking with assistance at admission. In the study of Marie and Wu [7], they found that patients who were in wheelchair or bedridden were 1.4 times and 4 times respectively, more likely to die compared to patients who walked without problems, and they regarded the functional status at the time of admission as an independent predictor of mortality. Bedridden state also had a relative risk of 10.75 for mortality in the study by Riquelme et al[9]. Davies et al[10] found that among patients admitted to hospital for either cerebrovascular disease or pneumonia, functional status had as much predictive value for in-hospital mortality as laboratory data, requirement for total assistance with bathing being the single predictor of in-hospital mortality. Although multilobar involvement on CXR in CAP patients is known to be a predictor of mortality [5,6,11], this study has not demonstrated any significant difference in mortality among patients with bilateral lung involvement. Also, the side of the lung affected in CAP (right or left) does not seem to affect mortality ($p>0.05$).Co-morbid illness adversely affects mortality in CAP [5,6,11]. Fine et al [5] have listed only five co-morbid conditions for determining PSI, but from the present study, 16 different co-morbid conditions were found with patients with CAP in Nigeria, and they could be more. Anaemia, pulmonary tubersulosis, malaria, and hypertension are the common ones. This finding calls for the inclusion of conditions common in a particular locality to the list of co-morbid illness in CAP patients for the possible prediction of mortality. In conclusion, the results of this study have shown that patients on admission for CAP in Nigeria have increased mortality with increased PSI at admission, and reduced functional status, especially the bedridden state at admission and shorter duration of admission. The side of lung involvement and bilaterality of lesion on CXR do not seem to affect the mortality from the result of this study. But the list of co-morbid conditions to be considered in CAP patients is much more than the five listed by Fine et la[5]. Hence the need for the consideration of locally-relevant co-morbid diseases in CAP patients. Functional status at admission and possibly duration of admission should also be considered as mortality predictors.

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