

PATTERNS OF PNEUMONIA IN SINGAPORE GENERAL HOSPITAL

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SYNOPSIS

Pneumonia remains a common and often serious problem inspite of the availability of potent antibiotics. Because of the difficulties of microbiological diagnosis, treatment is often empirical. This study was aimed at examining the clinical radiological and bacteriological characteristics of pneumonia as clues to specific diagnosis. 107 cases of pneumonia admitted over one year to a general medical service unit were studied retrospectively. The diagnosis of pneumonia was made on history, clinical findings and radiological evidence of consolidation. 62% of patients smoked tobacco and 21% smoked or swallowed opium. 56% of patients has some form of chronic lung disease. 38.3% of cases were classified as lobar pneumonia and 61.6% as bronchopneumonia. Half of the cases of lobar pneumonia and 79% of cases of bronchopneumonia had a predisposing factor. Cough and sputum production, fever and dyspnoea were the most common complaints and fever the most common sign. Pleural effusion, lung abscess or septicaemia complicated 12.1% of cases. Hypoxaemia occurred in 46% of cases.

Sputum specimens were bacteriologically examined in 69% of cases, blood cultures in 25%. 65% of patients had antibiotic treatment before sputum were obtained. There was no difference in the types or proportion of organisms isolated between the group who had prior antibiotic therapy and the group who did not. The overall mortality rate was 22.4%. This study emphasized the poor bacteriological yield of sputum cultures and suggested likely reasons for it. There is an obvious need for improved methods of sputum collection, frequent blood cultures and the detection of bacterial antigens in sputum and serum in a similar prospective study.

INTRODUCTION

Pneumonia continues to be a serious problem despite the availability of many potent antibiotics. In Singapore, it is the 4th most common cause of death. However, no formal published observations on pneumonia patterns have been made. Many reports from various observers have attested to the difficulty of establishing an aetiological diagnosis of pneumonia. Even in prospective studies in which great care is taken to secure adequate sputum samples, the specific aetiological agent could be identified with certainty in about half of all cases. The difficulties in microbiological diagnosis have often resulted in empirical treatment of pneumonias with various antibiotics, which may lead not only to an increase in mortality but create the problem of hospital acquired superinfections by the patients.

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The aim of this study is to examine the clinical, radiological and bacteriological characteristics of pneumonia in a medical service unit in a general hospital and assess whether they provide helpful diagnostic clues towards specific diagnosis. It is assumed that the proportion of such cases is representative of the overall hospital admissions for pneumonia into the medical wards.

METHODS AND MATERIALS

Patients

All patients diagnosed as having pneumonia during 1978 in a 160-bed medical service unit in Singapore General Hospital (SGH) were included. There are three such units in SGH.

Early in 1978, the writers attempted to popularize blood cultures in cases of pneumonias in the above medical unit. No other special diagnostic or therapeutic procedures were suggested. The patients were admitted under the care of the physicians in charge. At the end of the year, the files of all the in-patients with a diagnosis of respiratory tract infections were extracted from the medical records department. The criteria for a retrospective diagnosis of pneumonia consist of a history of cough of recent onset, fever, pleuritic chest pain, bronchial breath sounds or crepitations and radiological evidence of pneumonia. All cases of bacteriologically proven and suspected tuberculous pneumonia were excluded from the study.

All cases were categorised into two main groups:

- (1) Lobar pneumonia defined as homogeneous consolidation of one or more bronchopulmonary segments. Incomplete segmental pneumonia are also included in this group.
- (2) Bronchopneumonia defined as patchy infiltrates in one or more lung fields.

Each group is further divided into those with primary pneumonia and those with pneumonia secondary to other diseases (such as diabetes mellitus, congestive cardiac failure, chronic lung diseases, after strokes, in the course of malignant diseases.)

Specimens and Laboratory Studies

The following specimens were obtained for laboratory studies from a variable proportion of the patients:

- (1) Sputum for culture of predominant pathogenic organisms. Smear for acid fast bacilli and culture for mycobacteria tuberculosis.
- (2) Blood cultures for aerobic and anaerobic pathogens.
- (3) Blood for viral serological studies on admission Day 1 and Day 14.
- (4) Blood for full blood count and arterial punctures for blood gas analysis.

Bacterial Cultures and Sensitivity Testing

The sputum specimens were treated as follows: 1 ml of proteolytic enzyme was added and the specimen shaken for ten minutes. One loopful was streaked onto the blood agar plate with streaks of oxford staphylococci added and the specimen incubated in

10% CO₂. Another inoculum was made onto an eosin. methylene blue plate.

RESULTS

Age, Sex, Ethnic Groups and Distribution

Of the 107 patients, there was more men than women in the ratio of 2:1. The majority of cases occurred in the group aged over 40 years. (Table 1), 72% of the men and 80% of the women in the group were over 40 years old.

The distribution according to ethnic groups was 86% Chinese, 13% Indian and 1% Malay.

TABLE 1

AGE :	<40	41-65	>65
MALE	21	20	31
FEMALE	6	11	18
TOTAL	27	31	49

Smoking Habits

62% of patients smoked tobacco and almost all smoked more than 10 cigarettes daily. 21% smoked or swallowed opium and 17% gave a history of taking both cigarettes and opium.

Previous Pneumonia and Other Pulmonary Diseases

23% of patients had previous pneumonia and 56% had some other form of lung disease - tuberculosis, chronic bronchitis, bronchiectasis or asthma.

Classification of Pneumonia

Of the 107 patients, 41 (38.3%) were classified as lobar pneumonia and 66 (61.6%) as bronchopneumonia. Patients with lobar pneumonia were distributed equally between primary and secondary pneumonia, while in the bronchopneumonia group, 79% were secondary. 78.6% of patients under 40 years old had lobar pneumonia. 26% of all patients had R. sided pneumonia, 15% of patients had L. sided pneumonia and 60% of patients had bilateral pneumonia.

Clinical Findings

The frequency of presenting symptoms are as in Table 2a. Cough and sputum production were present in 79% of cases. Chest pain was a complaint in about one-quarter of patients and dyspnoea and fever in about two-thirds of patients. 10.3% complained of

TABLE 2a

FREQUENCY OF SYMPTOMS

- COUGH 85 (79%)
- SPUTUM PRODUCTION 83 (77.6%)
- DYSPNOEA 60 (56%)
- PLEURITIC CHEST PAIN 23 (21.5%)
- HAEMOPTYSIS 11 (10.3%)

haemoptysis. Almost all patients (90%) had symptoms for under a week before admission.

Pyrexia (above 37.5°C) was observed in 70% of patients, tachycardia (over 100/min.) in 41%, tachypnoea (over 20 breaths/min.) in 60.7%, hypotension and arrhythmia in 7.5% each. The arrhythmias comprised 6 cases of frequent ventricular ectopics, 2 cases of atrial ectopic, 2 of atrial fibrillation and 1 case of transient complete heart block. (Table 2b).

TABLE 2b
FREQUENCY OF SIGNS

FEVER 75 (70%)
TACHYPNOEA 65 (60.7%)
CREPITATION/RHONCHI 44 (41%)
TACHYCARDIA 44 (41%)
HYPOTENSION 8 (7.5%)
ARRHYTHMIA 8 - 2 ATRIAL FIBRILLATION (7.5%) - 6 VENTRICULAR ECTOPICS - 2 ATRIAL ECTOPICS - 1 COMPLETE HEART BLOCK

Response to Treatment

In 63 out of 75 patients with pyrexia (84%), the temperature returned to normal within one week, and in 31 out of 44 cases (71%), auscultatory findings in the lungs disappeared under one week.

The observation of radiological resolution was incomplete in the majority (80%) of cases. In 21 documented cases, 6 resolved in one week, 2 in one to two weeks, and 13 within two weeks to one month.

Complications

12.1% of pneumonia were complicated by either pleural effusion on the same side - 9 cases, lung abscess - 3 cases and septicaemia - 1 case.

Laboratory Results

Blood gases showed that hypoxaemia (below 70 mmHg) was found in only 46% of cases and hypoxaemic respiratory failure in 7.7%, (Table 3). Hypercapnia (>40 mmHg) occurred in 30% of cases while hypocapnia (<30 mmHg) in 17%. All except 2 cases with hypercapnia, had chronic obstructive airway disease. One of the two cases was depressed and debilitated; the other had evidence of severe bronchopneumonia.

55 out of 91 patients (57.3%) who had white cell count estimated, had leucocytosis (over 11,000/cu mm). Anaemia was only seen in 27% of cases.

Purulent sputum is more often found in the presence of leucocytosis than when the leucocyte count is normal. 84% compared with 45%.

Bacteriological Findings

69% of patients submitted sputum specimens for bacteriological studies. Blood cultures were performed in 27 patients (25%). Acute phase and con-

TABLE 3

LABORATORY FINDINGS	NO. OF PATIENTS
TOTAL NO. OF PATIENTS	52
HYPOXAEMIA > 60 mm Hg	16
< 60 mm Hg	4
< 40 mm Hg	4
NON HYPOXAEMIC	28 (53.8%)
HYPERCAPNIA > 40 mm Hg	30%
HYPOCAPNIA < 30 mm Hg	17%
NORMOCAPNIA	53%

valescent samples for viral serology were taken from 12 patients (11%). 12 patients were given antibiotics by their own medical practitioners prior to admission and 48 patients (65%) received at least one dose of antibiotic before bacteriological specimens were taken.

There is no significant difference in the types or proportions of organisms isolated between the group who received antibiotic therapy before the specimens were collected and the group without previous antibiotic therapy (Table 4).

Out of the 12 paired sera estimated, 4 pairs showed at least a four-fold increase in antibody titre to mycoplasma pneumonia.

Hospital Antibiotic Therapy

Table 5 shows the pattern of antibiotic therapy grouped under three headings: The mortality, the presence or absence of leucocytosis and the radiological distribution of pneumonia. This is an attempt to examine whether the use of antibiotics was influenced by the clinical assessment of severity, indirect evidence of bacterial aetiology, and the presence of lobar or bronchopneumonia.

Ampicillin appeared to be the most popular single antibiotic in 82% of the cases and was used in combination with one or more antibiotics in 12%.

It would seem that the choice of antibiotic is totally empirical and did not take into account the type of pneumonia, predisposing conditions or the severity of the disease.

Mortality

The overall death rate was 22.4%. The largest number of deaths 17 out of 24 occurred in bronchopneumonia with other severe underlying diseases, while the mortality for lobar pneumonia was low.

DISCUSSION

This study shows the clinical patterns of pneumonia are similar to studies carried out in other countries like Britain (1), U.S.A. (2, 3) and Australia (4). Since the bacteriological yield was poor, it was not possible to compare the aetiological pattern.

The preponderance of men to women, the majority of cases occurring in those over 40 years of age are further similarities. The ethnic distribution of pneumonia corrected for the pattern of ethnic groups in the hospital population, showed that pneumonia was a

more frequent reason for hospitalization among the Chinese and Indians compared with the Malays.

The predisposing factors were smoking, previous chronic pulmonary diseases, congestive cardiac failure, diabetes mellitus and strokes, which occurred in more than half of all cases. This is similar to findings noted by others (1, 2, 3, 5).

The analysis of the anatomical distribution of pneumonia yielded several interesting findings: The single largest group consisted of those with secondary bronchopneumonia, and bronchopneumonia is more common than lobar pneumonia. This pattern appears to be even more extreme than the findings in other urban hospitals (1, 2, 3, 4), where lobar pneumonia is a much less common though still predominant type of pneumonia. This contrasts with the studies in New Guinea (6), Nigerian (7) patients in whom lobar pneumonia is at least twice as frequent as bronchopneumonia.

The yield of potentially pathogenic bacteria was low, of the organisms isolated, all were enterobacteria and pseudomonas pyocyaneus. No pneumococcus was isolated. This results is surprising and certainly contrary to the known reports in the post-antibiotic era, in which the pneumococcus is still the predominant causative organism in acute pneumonia (4, 8, 9, 12, 13). Several factors in this study could have caused the poor yield. The most obvious (13, 14) is the fact that two-thirds of all the patients who had bacteriological studies performed, had already received at least one dose of an antibiotic either before

admission or in the hospital prior to the collection of the specimens. In the great majority of cases, the antibiotic was initiated only after arrival at the hospital. Crofton (10) states that "even a single dose of an antimicrobial agent before admission may suppress growth, particularly of pneumococci". This difficulty of practising the concept of obtaining specimens before starting therapy has been reported by Spencer (8). In view of the equally poor yield of pathogens in the sputum specimens cultured from the two groups of patients, previous therapy is not the only explanation. The failure to culture pneumococcus can be due to an inadequate specimen, delay in transport and in initiating culture. The difficulty of recovering pneumococcus from mixed culture may be the result of population pressure and the antagonistic effects of unlike organism (9).

The clinical significance of the enterobacteria and pseudomonas is difficult to define and is most likely due to previous antimicrobial therapy (8, 11), and to contamination.

The choice of antimicrobial therapy appeared to be entirely empirical. Although the response to treatment was favourable in the majority of cases, 12 deaths occurred in patients who received only 1 antibiotic throughout the course of their illness.

Several considerations could argue against the practice of continuing to culture sputum in acute pneumonia. Sputum cultures represent one of the largest workloads and expenses for the hospital bacteriology laboratory. The difficulty of establishing

TABLE 4

SPUTUM CULTURES FROM PATIENTS WITH AND WITHOUT ANTIBIOTICS BEFORE SPECIMENS COLLECTION

PATHOGENS ISOLATED	NO. OF PATIENTS STUDIED = 74	WITHOUT ANTIBIOTIC	WITH ANTIBIOTIC
PSEUDOMONAS PYOCYANEUS		11.5%	8.3%
KLEBSIELLA		7.6%	12.5%
HAEMOPHILIS INFLUENZA		3.8%	2.0%
E COLI		3.8%	2.0%
NO PATHOGENS		73.3%	75.0%

TABLE 5

HOSPITAL ANTIBIOTIC THERAPY

	ANTIBIOTIC	COMBINATION	CHANGE OF ANTIBIOTIC	NO ANTIBIOTIC
1. NO. OF DEATHS	12	3	1	7
2. WBC - RAISED	39	7	4	
WBC - NORMAL	35	1	1	
3. BRONCHOPNEUMONIA				
Primary	17	1		
Secondary	45	6	3	
LOBAR				
Primary	18	5	1	
Secondary	15	0	1	

an aetiological diagnosis of pneumonia in patients admitted to city hospitals has been repeatedly reported (5, 9, 12, 13, 14, 15).

Bacteriological diagnostic difficulties and the limited value of clinical diagnostic criteria have resulted in the empirical use of antibiotics which may then lead to the acquisition of hospital acquired pulmonary superinfections in the treated patients.

All these emphasize the need for available data base for rational therapy derived from epidemiological surveys of the frequency of the various pathogens in different local clinical settings.

This will require improved methods of sputum collection, transtracheal aspiration (16, 18) on selected patients, detection of bacterial antigens in sputum and serum (17) and blood cultures in a prospective survey of patients with acute pneumonia.

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