

**// A DESCRIPTIVE STUDY OF COMMUNITY ACQUIRED  
PNEUMONIA AS SEEN AT KENYATTA NATIONAL  
HOSPITAL //**

**BY**

**DR. IRENE E.A. OCHIENG  
MB;ChB (NAIROBI)**

**A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR  
THE DEGREE OF MASTER OF MEDICINE (MEDICINE) OF  
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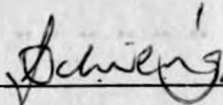


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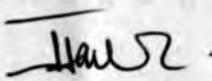
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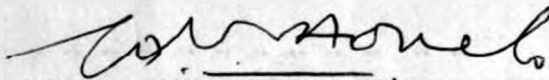
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Signed: \_\_\_\_\_



Dr. Ndinya-Achola  
MB; ChB (Nbi), MSc (Lon)

Signed: \_\_\_\_\_



Prof. G.B.A. Okelo  
MD, FRCP, MBBS, MRCP  
DTM&H, CBiol, MIBiol (Lond), FAAS

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**ABBREVIATIONS**

**HIV** - Human immunodeficiency virus

**ml(s)** - millilitre(s)

**cm** - centimetre

**Hb** - haemoglobin

**WBC** - white blood cell

**no** - number

**Ip** - in patient

**ZN** - Ziehl Neelson

**AIDS** - Acquired immunodeficiency syndrome

## SUMMARY

Over an eight-month period between the months of June 1988 and January 1989, 42 adult patients; 24 males and 18 females were studied at the Kenyatta National Hospital. The study was conducted to find out the bacterial causes of community acquired pneumonia, the antibiotic sensitivity of the causative organisms and the relationship between HIV infection and respiratory infections at Kenyatta National Hospital.

The results showed that a bacteriological diagnosis was made in 40.5% of the cases with Streptococcus pneumoniae accounting for 23.8% and Mycobacterium tuberculosis accounting for 9.5% of the cases. Staphylococcus aureus, Escherichia coli and Acinetobacter anitratus each accounted for 2.4% of the cases, while Branhamella catarrhalis accounted for 4.8% of the cases.

76.2% of the patients studied improved on treatment with benzyl penicillin given as initial drug therapy. 9.5% improved on a combination of benzyl penicillin and gentamycin after failing to improve on benzyl penicillin alone. 11.9% did not improve on benzyl penicillin and gentamycin, but improved on streptomycin and thiazina.

**19.1% of the patients studied were found to have HIV infection. There was no association between the HIV status of the patients and their employment status, neither was there any association between the HIV status and response to antibiotic therapy.**



## INTRODUCTION

Pneumonia is defined as inflammation of the lung parenchyma. Although the inflammation may have many different causes and varying durations, the term pneumonia most commonly refers to acute infections.

Defense mechanisms exist throughout the respiratory tract, and in the absence of disease they serve to maintain essentially sterile airways and lung parenchyma. The development of pneumonia implies either a defect in normal lung defense mechanisms; an overwhelming inoculation or challenge by a particularly virulent organism.

Inhalation of aerosolized material and aspiration of oropharyngeal contents represent the most common means of entry of pathogens into the lung. Healthy adults harbour potential pathogens such as Streptococcus pneumoniae, Staphylococcus aureus, Haemophilus influenzae in their oropharynx. These cause pneumonia when aspirated into the alveoli in situations where the lung defense mechanisms are defective. Anaerobes although numerous in the oral cavity, are weak pathogens individually but can cause pneumonia as mixed infections.

Because of the wide variety of organisms involved in causing pneumonia, the identification of the causative organism is important

for proper therapy. Broad spectrum 'shotgun' therapy can be dangerous and expensive.

The common bacterial causes of community acquired pneumonia are Streptococcus pneumoniae, Staphylococcus aureus, Haemophilus influenzae, Klebsiella pneumonia and mixed anaerobic bacterial infections. Community acquired pneumonia commonly occurs in people with some impairment of the defense mechanism. Predisposing factors include alcohol, old age, chronic lung diseases and diabetes. It may however occur in healthy individuals. The onset of the illness is acute with development of a sudden chill. This is usually followed by an elevated temperature, cough productive of mucopurulent sputum and pleuritic chest pain. On physical examination, the patient is found to be febrile, tachypnoeic and tachycardic. Localised pulmonary abnormalities include crepitations, bronchial breathing and dullness to percussion. If an effusion is present, the breath sounds will be decreased. In some patients, the physical examination may be normal. The chest radiograph usually reveals areas of parenchymal involvement either as a dense lobar consolidated or a bronchopneumonic pattern. White blood cell counts are usually elevated with an increase in the immature forms. Haemoglobin levels are usually normal.

Several diagnostic methods can be used in identifying the causative organism. A gram stain and culture of an expectorated sputum specimen on appropriate culture media provide useful information

on microscopic examination. Limitations to the identification of organisms using this technique include an inadequate sputum sample consisting mainly of saliva, and inadequate gram stained specimens [1].

Tuberculosis can sometimes present as an acute pneumonia, and if this is suspected, the sputum sample should be stained for acid-alcohol fast bacilli using Ziehl Neelson stain.

Transtracheal aspiration using a special catheter inserted into the trachea, through the cricothyroid membrane is another method of obtaining sputum. This method gives more accurate results than expectorated sputum because it avoids contamination by oral flora. It however requires co-operation from the patient. Although it is generally safe [2]. It may be hazardous in those with clotting abnormalities.

Other methods of obtaining sputum from the lower respiratory tract include transthoracic lung aspirates using a needle and syringe; and bronchoscopy. Pneumothorax and pulmonary haemorrhage sometimes complicate lung aspiration.

Pneumonia is sometimes accompanied by a bacteraemia and blood cultures may grow the offending organism. Some bacteria-like legionella and bacteria-like organisms like Mycoplasma pneumoniae are difficult to culture from sputum specimens and need serology for diagnosis.

**OBJECTIVES**

The objectives of this descriptive study were:-

- a) To find out the bacterial causes of community acquired pneumonia seen at Kenyatta National Hospital.
  
- b) To determine the relationship between HIV infection and respiratory infections at Kenyatta National Hospital.
  
- c) To determine the antibiotic sensitivity of the bacterial causes of pneumonia.

## MATERIALS AND METHODS

The study was conducted at the Kenyatta National Hospital, Nairobi, between the months of June 1988 to January 1989. Kenyatta National Hospital is a public hospital which not only caters for those cases which have been referred from other health institutions, but also caters for new cases which have not been referred.

A total of 42 adult patients, male and female were studied. All patients studied were those who had not received any antibiotic treatment at all since the onset of their illness and who fulfilled the clinical and radiological criteria of acute pneumonia, namely: history of chest pains which had developed within hours or a few days, and cough which was productive of mucopurulent sputum. Fever and shortness of breath was present in the majority of the patients.

A full physical examination was performed on all the patients. Signs of consolidation and crepitation were looked for. Signs and symptoms referable to other systems were also noted. Each patients had a postero-anterior chest radiograph done at admission and the radiological findings noted. History and full physical examination for each patient was recorded as shown in Appendix I.

Each patient was provided with a sterile sputum bottle and instructed to cough deeply and put a sputum sample into the bottle. Blood was then withdrawn from each patient by venepuncture using aseptic techniques as follows:-

Using a sterile cotton swab soaked in spirit, the skin over a vein in the forearm was cleaned. 12 mls. of blood was withdrawn using a sterile disposable needle and syringe. Using the appropriate technique 1 ml. of blood was introduced into a blood culture bottle containing 10 mls. of aerobic broth culture media. The remaining 11 mls. of blood was distributed into biochemistry, haematology and serology bottles.

The patient was started on antibiotic treatment soon after sputum and blood samples had been obtained. Benzyl penicillin was used as initial drug therapy in a dose of 2 mega units every six hours except where there was history of allergy to penicillins. One patient presented with signs of meningeal irritation and was started on both benzyl penicillin and chloramphenicol from the beginning. Where there was no clinical response after 48 hours of treatment with benzyl penicillin, the drug was changed or another antibiotic added. The clinical response was assessed by the return of the temperature to normal within 48 hours and the improvement in the dyspnoea and the chest signs on auscultation.

The sputum and blood specimens were transported to the laboratory for various procedures. The blood culture bottle was incubated at 37°C. Subcultures were done after 24 hours, 48 hours and one week of incubation. The blood culture procedure was as described by J.A. Washington [3]. Haematological analysis was performed by the coultergram. The indices obtained included haemoglobin level, total white blood cell counts and platelets counts. The sera for biochemistry was used for determining the levels of urea electrolytes, uric acid and creatinine. HIV serology was done by ELISA using Organon, Wellcome or Du Pont ELISA Kits. Those reacting positive were then confirmed by Western blot using Du Pont Western Blot test kit.

Microbiological analysis of sputum was done by the gram stain, Ziehl Neelson stain for acid fast bacilli and culture for non acid fast bacterial pathogens. Gram stain was used for assessing the quality of the sputum and for determining the presence of gram positive diplococci. The quality of sputum was graded depending on the number of polymorphs per high power field. The grading is as shown below:-

1+ = 0 - 4 polymorphs per high power field.

2+ = 5 - 10 polymorphs per high power field.

3+ = 11 - 20 polymorphs per high power field.

4+ = Greater than 20 polymorphs per high power field.

Sputum specimens registering 2+ and above were considered to be good quality specimens. In addition to recording the number of pus cells, the bacteria seen were also recorded.

The sputum was cultured on blood sugar, chocolate agar and MacConkey's agar. The petri dishes used were plastic flat bottomed dishes, 9 cm. in diameter with close fitting lids. The culture method is described as follows:-

A little sputum was obtained from the sputum bottle using a wire loop which had been sterilized by heating in a flame and allowing it to cool. The sputum was spread over part of the surface of the medium. The wire loop was sterilized again and then passed several times through the inoculated area onto a fresh area of medium. Similar transfers were made from the second area to a third area, and from the third to a fourth area. An optochin disc was placed on the culture media appropriately. The same method described was used on the remaining two media. The three plates were incubated at 37°C. The blood and chocolate agar plates however, were cultured under carbon dioxide enriched environment. After 18 hours, the culture plates were removed and the organisms which had grown were identified. Antibiotic sensitivity testing using multidisks was done on any pathogen which was grown.



The staining and microbiological procedures were done by the same people to minimize observer error. The laboratory and clinical results were recorded on a data sheet as shown in Appendix II.

### SEX

Of the total number of patients studied, 28 (57.1%) were males and 21 (42.9%) were females.

### AGE

The ages of the males studied ranged from 18 years to 50 years with a mode of 25 years. The ages of the females studied ranged from 18 years upto 70 years with a mode of 34 years. The frequency distribution of the ages of the patients studied are shown in Tables 1 and 2.

### RESIDENCE

20 (71.4%) of the patients studied were residents of Nairobi, while 12 (28.6%) were either visiting relatives or were on route to some other place when they became ill. Of the 20 patients from Nairobi, 7 (35.0%) were from Mathare Valley. This is an urban slum area. Another 5 (25.0%) of the 20 patients were from Kibera. This is another urban slum situated not far away from Kenyatta National Hospital. The remaining 8 (40%) of the patients were from other sections of Nairobi.

## **RESULTS**

The total number of patients studied was 42.

### **SEX**

Of the total number of patients studied, 24 (57.1%) were males and 18 (42.9%) were females.

### **AGE**

The ages of the males studied ranged from 19 years to 50 years with a mode of 25 years. The ages of the females studied ranged from 18 years upto 70 years with a mode of 24 years. The frequency distribution of the ages of the patients studied are shown in Tables 1 and 2.

### **RESIDENCE**

30 (71.4%) of the patients studied were residents of Nairobi, while 12 (28.6%) were either visiting relatives or were en route to some other places when they became ill. Of the 30 patients from Nairobi, 7 (23.3%) were from Mathare Valley. This is an urban slum area. Another 5 (16.7%) of the 30 patients were from Kibera. This is another urban slum situated not far away from Kenyatta National Hospital. The remaining 18 (60%) of the patients were from other sections of Nairobi.

## OCCUPATION

23 (54.8%) of the patients studied had some form of employment while 45.2% were unemployed.

## ALCOHOL

Alcohol was consumed by 6 (14.3%) of the patients studied. Of these six, only one was a female. All the patients who consumed alcohol took the legally commercially prepared beer. The number of years of consumption ranged from 1½ years to 10 years. It was difficult to quantify the volume of alcohol consumed by each patient.

## CIGARETTE SMOKING

The cigarette smokers were 5 (11.9%) and they were all males. The number of cigarettes smoked per day were between 4- 20 cigarettes with the duration in years ranging from 2 - 12 years. 60% of those who smoked also drank alcohol.

## OTHER ILLNESSES

3 (7.1%) of the patients studied had other illnesses apart from pneumonia. 2 of these patients had bronchial asthma and one had signs of meningitis. 39 (92.9%) of the patients had pneumonia as the only illness.

### GRAM STAIN OF SPUTUM

Gram stain slides from 12 patients (28.6%) were graded as 1+. These were considered to be poor quality specimens. 30 (71.4%) were regarded as good quality specimens. A pathogenic organism was identified in 10 (33.3%) of the good quality specimens. Gram positive diplococci morphologically resembling Streptococcus pneumoniae were found predominating in slides stained from 9 (21.4%) of the total number of patients studied.

A gram stain slide from one patient representing 2.4% of the total, had numerous gram negative diplococci resembling Branhamella catarrhalis. These results are shown in Fig. 1.

### SPUTUM CULTURE

The yield of pathogenic organisms from sputum culture was 11.9% (5 patients). 2 (4.8%) of the cultures grew Streptococcus pneumoniae. One culture each grew Branhamella catarrhalis, Acinetobacter anitratus and Escherichia coli in significant quantities to be regarded as pathogenic. Each represented 2.4% of the total. In 37 (88.1%) of the patients, there was either no organism grown or insignificant growth of upper respiratory tract flora. These results are shown in Fig. 2.

### BLOOD CULTURE

Organisms were grown from the blood of 3 patients (7.1%). These were Streptococcus pneumoniae from one patient, Staphylococcus aureus from one patient and Branhamella catarrhalis from one patient. Each represented 2.4% of the total. In 39 (92.9%) of the patients, no organism was grown from the blood. The results are shown in Fig. 3.

### ZIEHL NEELSON STAIN

4 (9.5%) of the 42 patients were sputum positive for acid fast bacilli by Ziehl Neelson Stain. The remaining 38 (90.5%) were sputum negative for acid fast bacilli. These results are shown in Table 4.

### IN VITRO ANTIBIOTIC SENSITIVITY

The frequency of pathogenic organisms grown from either sputum or blood cultures of the patients studied are as shown in Table 6. One case of Streptococcus pneumoniae was found to be resistant to benzyl penicillin, minocycline, methicillin, cotrimoxazole and ampicillin. It was sensitive to erythromycin, chloramphenicol and lincomycin. Due to unavailability of new antibiotic sensitivity discs, it was not possible to verify its true penicillin resistance.

The other pathogens were sensitive to the drugs commonly used to treat infections caused by these organisms.

Table 6 shows the antibiotic sensitivity of the organisms that were grown.

### HAEMATOLOGY

The haemoglobin level in 12 (50%) of the males studied was less than 14 grammes per decilitre; the normal adult male values being 14 - 18 grammes per decilitre [4]. 11 (61%) of the females had haemoglobin levels less than 12 grammes per decilitre; the normal values for adult females being 12 - 16 grammes per decilitre [4]. Further laboratory analysis was not done to specify the type of anaemia in those who had low haemoglobin levels.

A leucocytosis with white blood cell counts greater than  $11.0 \times 10^9 / l$  was found in 22 (52.4%) of patients, with 14 (33.3%) of them being males. A normal white blood cell count was found in 17 (40.5%) of the patients with 10 (23.8%) of them being males. The normal white blood cell counts is  $4.5-11.0 \times 10^9 / l$  [4]. 3 patients (7.1%) had a leucopenia with white blood cell counts less than  $4.5 \times 10^9 / l$ . The 3 leucopenic patients were all females. One of them had pancytopenia. The platelets were within the normal range of  $140 \times 10^9 / l - 440 \times 10^9 / l$  in all the subjects studied except the one with pancytopenia. The results are shown in Table 3 and Fig. 5.

## HIV ELISA AND HIV WESTERN BLOT

Both HIV ELISA and HIV Western Blot were found positive in 8 patients making 19% of the total, with half being males and the other half females. None of the patients who were HIV positive were found to be positive for acid fast bacilli. Four of the patients had Streptococcal pneumonia while one had Acinetobacter anitratus pneumonia. In three of the patients, no pathogenic organism was identified. The HIV results are shown in Tables 6 - 8.

## BIOCHEMISTRY

All the 42 patients studied had serum analysis done for urea, electrolytes, uric acid and creatinine. There was no notable abnormality in any of the patients.

## IN VIVO DRUG RESPONSE

41 (97.6%) of the 42 patients were treated with benzyl penicillin as initial therapy. The remaining patient had signs of meningitis as well and was started on benzyl penicillin and chloramphenicol from the onset. 32 (76.2%) of the patients showed clinical response within 48 hours of penicillin therapy. 4 (9.5%) of the patients were sputum positive for acid fast bacilli and responded to streptomycin and thiazina. They had failed to respond to benzyl penicillin and gentamycin. 5 (11.9%) of the patients had gentamycin added to the penicillin therapy before clinical response was noted. Results are shown in Fig. 4.

**MORTALITY**

One patient (2.4%) died. This particular patient was a 25-year old unemployed male who had signs of meningitis as well as bilateral pneumonia. His serum was negative for HIV test by both ELISA and Western Blot. No organism was demonstrated in the gram stain or culture of the cerebrospinal fluid. Post mortem examination could not be carried out in this patient.

15-19	1	150
20-24	1	150
25-29	1	150
30-34	1	150
35-39	1	150
40-44	1	150
45-49	1	150
50-54	1	150
55-59	1	150
60-64	1	150
65-69	1	150
70	1	150
TOTAL	11	1650

This table shows the distribution of patients by age group with HIV being less than 10 years of age.



**TABLE I: Frequency Distribution of Ages of Male Patients Studied.**

Age in Years	Frequency	Percentage
15 - 19	1	4.2
20 - 24	4	16.7
25 - 29	6	25.0
30 - 34	6	25.0
35 - 39	5	20.8
40 - 44	1	4.2
45 - 49	0	0
50 - 54	1	4.2
55 - 59	0	0
60 - 64	0	0
65 - 69	0	0
70	0	0
<b>TOTAL</b>	<b>24</b>	<b>100.1</b>

This table shows that most males were of a young age group with 95.9% being less than 45 years of age.

**TABLE 2: Frequency Distribution of Ages of Female Patients Studied.**

Age in Years	Frequency	Percentage
15 - 19	2	11.1
20 - 24	4	22.2
25 - 29	4	22.2
30 - 34	2	11.1
35 - 39	1	5.6
40 - 44	0	0
45 - 49	1	5.6
50 - 54	0	0
55 - 59	0	0
60 - 64	1	5.6
65 - 69	2	11.1
70	1	5.6
<b>TOTAL</b>	<b>18</b>	<b>100.1</b>

This table shows that most females were in a young age group with 72% being less than 45 years of age.

**TABLE 3:** Table showing the results of the haemoglobin in the 42 patients studied.

Sex	Normal Hb Level	Reduced Hb Level	Total
Male	12	12	24
Female	7	11	18
Total	19	23	42

The table shows that 12 (50%) of the males had normal haemoglobin levels while 12 (50%) had reduced haemoglobin levels. 7 (38.9%) of the females had normal haemoglobin levels, while 11 (61.1%) had reduced haemoglobin levels.

**TABLE 4:** Table showing results of Zielh Neelson staining done from the 42 patients studied.

Sex	Zielh Neelson stain positive	Zielh Neelson stain negative	Total
Male	2	22	24
Female	2	16	18
Total	4	38	42

Table 4 shows that a total of 42 patients had their sputum stained by Zielh Neelson stain. Out of the total 42 patients, 4 (9.5%) were Zielh Neelson stain positive for acid fast bacilli. 2 (4.8%) were males and 2 (4.8%) were females.

**TABLE 5:** The in vitro antibiotic sensitivity of pathogens grown from sputum and blood.

Organism	Drugs tested for							
	A	B	C	D	E	F	G	H
<i>Streptococcus pneumoniae</i>	-	-	-	-	+	-	+	+
<i>Streptococcus pneumoniae</i>	+	+	+	-	+	+	+	+
<i>Streptococcus pneumoniae</i>	+	+	+	+	+	+	+	+
<i>Staphylococcus aureus</i>	-	+	+	-	+	-	-	+
<i>Escherichia coli</i>	-	+	+	+	+	+	+	+
<i>Branhamella catarrhalis</i>	+	+	+	-	-	+	+	+
<i>Branhamella catarrhalis</i>	+	+	+	-	-	+	+	+
<i>Acinetobacter anitratus</i>	-	+	-	-	-	-	-	-

**Key:**

A = Crystalline penicillin

B = Minocycline

C = Methicillin

D = Cotrimoxazole

E = Erythromycin

F = Ampicillina

G = Chloramphenicol

H = Lincomycin

+ = Sensitive

- = Resistant

**TABLE 6:** The results of the HIV ELISA and Western Blot tests done on the 42 patients studied.

Sex	HIV ELISA and Western Blot Positive	HIV ELISA and Western Blot Negative	Total
Male	4	20	24
Female	4	14	18
Total	8	34	42

Table 6 shows that 42 patients had their blood tested for HIV ELISA and Western Blot. Out of the total 42 patients, 8 (19.1%) were both HIV ELISA and Western Blot positive with 4 (9.5%) being male and 4 (9.5%) being females.

**TABLE 7:** Employment status and HIV status of the patients.

HIV status	Employed	Unemployed	Total
Positive	3 (15%)	5 (35.7%)	8 (19%)
Negative	20	14	34
Total	23	19	42

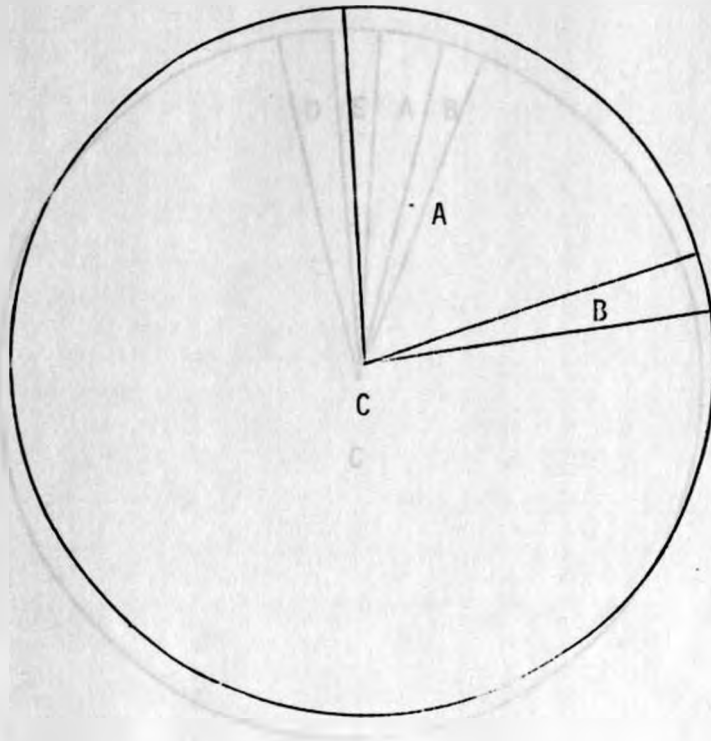
$\chi^2 = 1.22$        $p > 0.25$ . This is not statistically significant.

**TABLE 8:** The HIV status of the 42 patients and their response to treatment with benzyl penicillin and gentamycin.

HIV Status	Benzyl penicillin alone	Benzyl penicillin + gentamycin	Total
Positive	5	3	8
Negative	30	4	34
Total	35	7	42

$\chi^2 = 3.26$        $p > 0.05$ . This is not statistically significant.

**Figure 1:** Pie chart depicting the percentage yield of pathogenic organisms from gram stain of the sputum.



**Key:**

A = *Streptococcus pneumoniae* (21.4%)

B = *Branhamella catarrhalis* (2.4%)

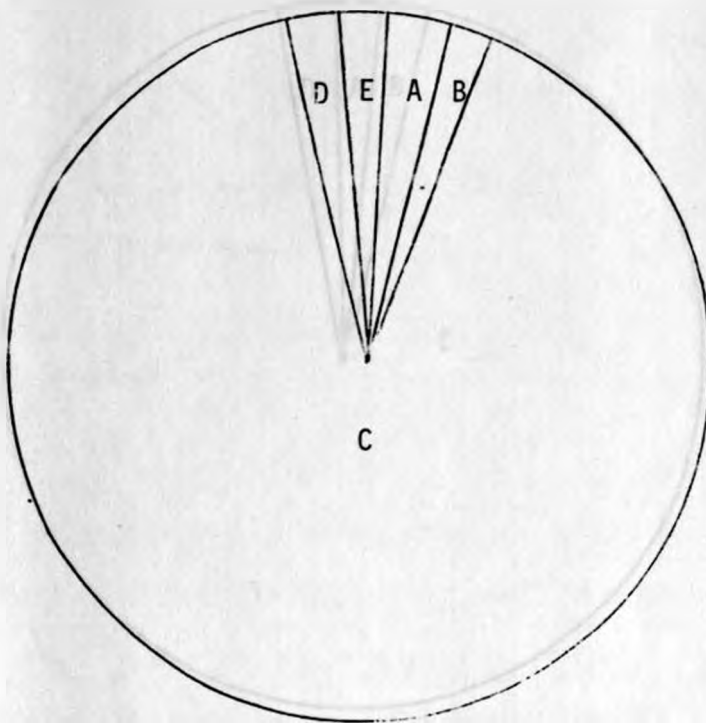
C = No pathogen isolated (76.2%)

D = *Aeromonas hydrophila* (2.4%)

E = *Zanovella* (2.4%)



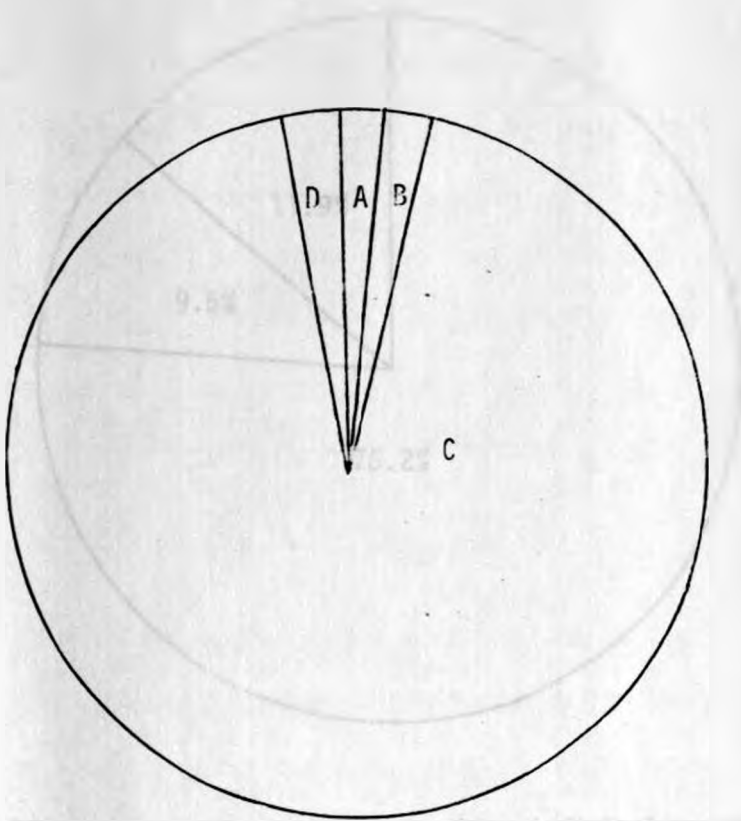
**Figure 2:** Pie chart depicting the percentage yield of pathogenic organisms from sputum culture.



**Key:**

- |                                     |         |
|-------------------------------------|---------|
| A = <i>Streptococcus pneumoniae</i> | ( 4.8%) |
| B = <i>Branhamella catarrhalis</i>  | ( 2.4%) |
| C = No pathogen isolated            | (88.1%) |
| D = <i>Acinetobacter anitratus</i>  | ( 2.4%) |
| E = <i>Escherichia coli</i>         | ( 2.4%) |

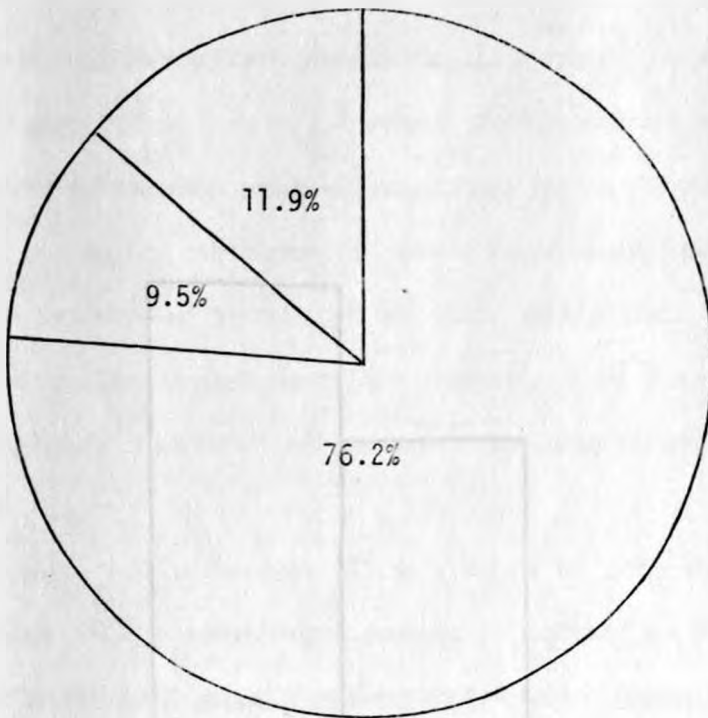
**Figure 3:** Pie chart depicting the percentage yield of pathogenic organisms from blood cultures.



**Key:**

- A = *Streptococcus pneumoniae* ( 2.4%)
- B = *Branhamella catarrhalis* ( 2.4%)
- C = No pathogen isolated (92.9%)
- D = *Staphylococcus aureus* ( 2.4%)

**Figure 4:** Pie chart showing the in vivo drug response in the 41 patients who survived.

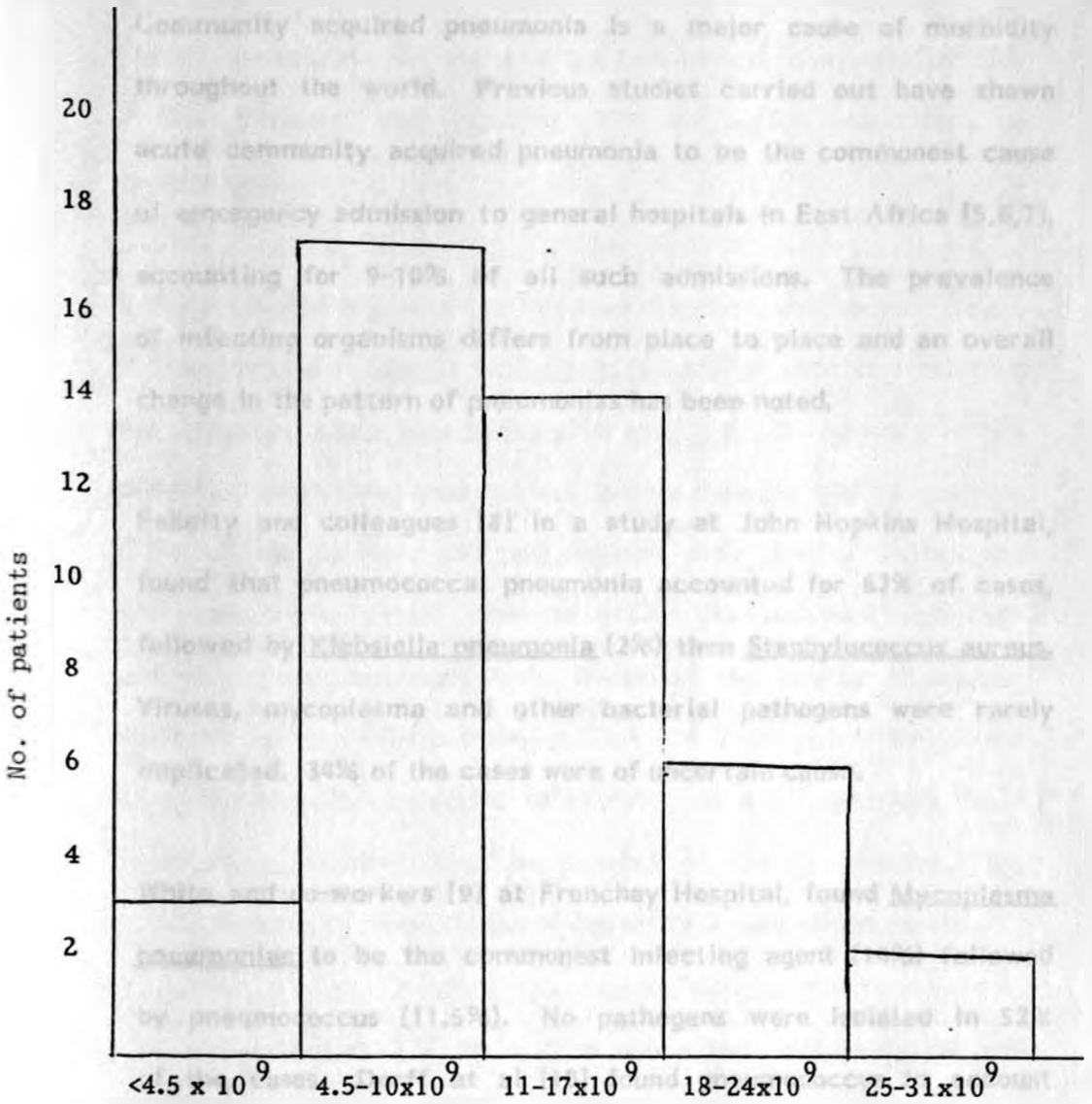


76.2% represents the patients who showed clinical response to benzyl penicillin as initial drug therapy.

9.5% represents the patients who did not respond to benzyl penicillin alone but responded to benzyl penicillin and gentamycin.

11.9% represents the patients who did not respond to benzyl penicillin and gentamycin. They were found positive for acid fast bacilli and responded to streptomycin and thiazina.

**Figure 5:** Histogram depicting the total white blood cell counts of the 42 patients studied.



No. of white blood cells per cubic millilitre

## DISCUSSION

Community acquired pneumonia is a major cause of morbidity throughout the world. Previous studies carried out have shown acute community acquired pneumonia to be the commonest cause of emergency admission to general hospitals in East Africa [5,6,7], accounting for 9-10% of all such admissions. The prevalence of infecting organisms differs from place to place and an overall change in the pattern of pneumonias has been noted.

Fekely and colleagues [8] in a study at John Hopkins Hospital, found that pneumococcal pneumonia accounted for 62% of cases, followed by Klebsiella pneumonia (2%) then Staphylococcus aureus. Viruses, mycoplasma and other bacterial pathogens were rarely implicated. 34% of the cases were of uncertain cause.

White and co-workers [9] at Frenchay Hospital, found Mycoplasma pneumoniae to be the commonest infecting agent (14%) followed by pneumococcus (11.5%). No pathogens were isolated in 52% of the cases. Dorff et al [10] found pneumococcus to account for majority of cases (53%). Mycoplasma pneumoniae accounted for only 6%.

Slack and co-workers [11] working at Kenyatta National Hospital, Nairobi, were able to make a bacteriological diagnosis in 55% of the patients they studied, 37% of which were due to pneumococcus.

In the present study, a bacteriological diagnosis was made in 40.5% of the cases with Streptococcus pneumoniae accounting for 23.8% and Mycobacterium tuberculosis for 9.5% of the cases. In this study, bacteriological analysis was largely done by sputum analysis. 28.6% of the patients did not produce good quality sputum and this could partly explain the low yield. Transtracheal aspiration and lung aspiration could have improved the quality of sputum obtained, however, these methods were not employed in this study. Antigenic sera for detection of certain bacterial pathogens could have also increased the bacteriological yield, however, the prohibitive cost of these reagents limited their use in this study.

Fick and colleagues [12] in a three and a half year study at Yale University, School of Medicine, Connecticut found bacterial causes to account for 63.8% of the cases with pneumococcus accounting for majority of the cases (46%). Legionella pneumoniae accounted for 4%. There were no cases of Pneumocystis carinii pneumonia. A decade later, the same workers working at the same hospital found that bacterial causes had dropped from 63.8% to 48%.

Legionella pneumoniae cases had dropped from 4% to 2%. Pneumocystis carinii accounted for 2.1% of all the cases. In this current study, Pneumocystis carinii and legionella species were not examined for.

Various factors have been identified as contributing to the changing pattern of pneumonias, namely: the emerging antibiotic resistance to various micro-organisms, new community acquired diseases, especially the acquired immunodeficiency syndrome, the increased virulence of previously overlooked etiologic agents and the finding of man as a new host by some zoonotic organisms.

Haemophilus influenzae, an important cause of childhood meningitis and pneumonia is also known to cause primary adult pneumonia [13]. From 1974 onwards, ampicillin resistant strains of Haemophilus influenzae have been reported. The resistance is due to plasmid mediated production of B lactamase which disrupts the B lactam ring in the penicillin molecule. Hirschmann [13] reports 9 cases of Haemophilus influenzae resistant to ampicillin. Most of the cases occurred in previously healthy individuals. Charles Stratton and co-workers [11] reported five similar cases. In this particular study, no cases of Haemophilus influenzae were identified. However, one of the patients studied in whom Streptococcus pneumoniae was identified as the causative organism, showed an in vitro resistance to penicillin. This particular organism was also resistant to minocycline, methicillin, ampicillin and

cotrimoxazole. The patient however improved on benzyl penicillin given in a dose of 2 mega units intramuscularly every six hours. The reason for this discrepancy is not clear.

Since the majority of patients in this study responded rapidly to benzyl penicillin, this drug should continue to be included in the initial antibiotic regime of the patients with acute pneumonia who present at Kenyatta National Hospital, unless the presentation of the patient dictates against this. Only a small proportion of the patients required the addition of gentamycin to their treatment. Slow responders to this combined therapy need to be screened for tuberculosis as was seen in this study.

The acquired immunodeficiency virus, HIV, is known to infect T lymphocytes, thereby depressing cell mediated immunity. Fungal, viral and mycobacterial infections are therefore common in patients with the acquired immunodeficiency syndrome. Recent reports however, indicated that HIV virus also affects B lymphocyte function and thus increases a patient's risk of bacterial infection. Witt et al [14] at Boston City Hospital, Massachusetts, in a study of bacterial infections in 59 patients with AIDS or AIDS related complex, found that 21 of these patients had community acquired pneumonia. Ten of the episodes were caused by Streptococcus pneumoniae, Mycobacteria and Branhamella catarrhalis. All 21 patients were treated with appropriate antibiotics and survived. All cases occurred in parenteral drug abusers or patients with no identifiable risk factors. In many of the cases, bacterial



infections preceded the diagnosis of AIDS or AIDS related complex.

In this current study, 8 patients tested positive for both ELISA and Western Blot. In four of them, the causative organism for the pneumonia was Streptococcus pneumoniae. In one of the patients, Acinetobacter anitratus was the causative organism. In the remaining three patients, no bacterial diagnosis was made as to the cause of the pneumonia.

Acinetobacter anitratus, a gram negative coccobacillus has been an infrequently recognized human pathogen and was only thought to be of low virulence. Reports show it to be an important cause of community acquired pneumonia and in many cases associated with alcoholism. In this study, Acinetobacter anitratus was identified in one patient. This patient was not an alcoholic but she had HIV infection. Both HIV infection and alcoholism are conditions which lower the body's immune system, although they do so by different mechanisms. Alcoholism does so by decreasing granulocyte mobility and adherence while HIV infection infects T lymphocytes.

There is now enough evidence that Mycoplasma pneumoniae is an important cause of lower respiratory tract disease in civilian as well as military populations. Studies in Great Britain, Netherlands and Sweden [15] have shown Mycoplasma pneumoniae to be responsible for 10 - 33% of all pneumonias. Annual incidence

of pneumonia in one large civilian population was estimated at 1.5 per 1,000 persons. Mycoplasma pneumoniae has now been reported in every country where appropriate diagnostic tests have been undertaken to identify it. It has been found to be responsive to tetracycline, erythromycin and rifampicin. In this study, the antisera for identifying this organism was not available.

Eiknella corrodens, a gram negative rod was once considered a normal human flora. Goldstein and colleagues [16] isolated Eiknella corrodens by transtracheal aspirate and percutaneous aspiration from seven patients with pneumonia and lung abscess. The diagnostic methods used to identify this organism were not used in this study.

Legionnaires disease [17] caused by Legionella genus gained prominence in 1976 when a mysterious type of pneumonia affected members of a convention in Philadelphia with a mortality of 6%. Vigorous search for the cause led to identification of Legionella species in 1977. At the Interational Symposium of Legionella disease in November 1978, Eickloff [18] reviewed 10 recorded epidemics of legionella disease. Four of the epidemics had occurred before the Philadelphia epidemic of 1976 but were diagnosed retrospectively from paired sera that had been stored from these patients throughout the years. Most of the epidemics were associated with air cooling systems. Sporadic cases have been

reported from other countries including Netherlands, Great Britain, Italy, France and Spain.

This organism responds to tetracycline and erythromycin. If untreated, mortality can be high. Macrae [19] and others working in Nottingham, England reported 41 cases of this disease with 21 deaths occurring. The antigenic sera for identifying this organism was not available in this study. The fact that untreated mortality from legionnaires pneumonia is high, and that no patient in this study required tetracycline or erythromycin, could be extrapolated to mean that there were no cases of legionnaires pneumonia among the patients studied. Definite conclusions however, can only be made after antigenic testing for the organism.

Patients with acute bacterial pneumonia normally do not have a fall in the haemoglobin or haematocrit level unless they have an underlying chronic disorder. In this study, 54.8% of the patients were found to have haemoglobin levels less than the lower limits of normal for their ages and sexes. Only 4.8% of the patients studied were found to have other underlying disorders namely: bronchial asthma. Bronchial asthma on the contrary, tends to increase haemoglobin and haematocrit levels in patients because of the chronic hypoxaemia.

Although more work would have to be done to find out the causes of anaemia in the patients studied, possible explanations could

be the high unemployment rate (45.2%) that was noted in this study, and the fact that 28.6% of the patients were from slum areas around Nairobi. These two factors could reflect on the socio-economic status and thus on the diet of these patients.

A leucocytosis is not invariable in patients with acute pneumonia and this was noted in this study. Although the percentage of those with leucocytosis (52.4% of the patients) was lower than one would have expected, this is not surprising. Kasili et al [20] working in Nairobi found that the total leucocyte counts and particularly the neutrophil counts in healthy indigenous African adults in East Africa is lower than the textbook figures. The exact reason for this is not yet clear.

## CONCLUSIONS

The following conclusions can be drawn from this study:-

1. Blood cultures, gram stain and culture of expectorated sputum have a low microbiological yield in acute lobar pneumonia.
2. The majority of patients who present at Kenyatta National Hospital with acute lobar pneumonia respond to benzyl penicillin as initial drug therapy.
3. The sex of a patient, alcohol consumption and cigarette smoking are not important predisposing factors in the causation of acute lobar pneumonia in patients seen at Kenyatta National Hospital.
4. The total white blood cell counts of patients who present at Kenyatta National Hospital with acute lobar pneumonia shows no predictable pattern.
5. A 19% HIV infection rate in patients with acute lobar pneumonia who present at Kenyatta National Hospital is high and needs further study.

## **RECOMMENDATIONS**

My recommendations are that:-

1. Blood cultures, gram stain and culture of expectorated sputum should not be used alone when trying to identify the causative organism in a patient with acute lobar pneumonia at Kenyatta National Hospital. Other diagnostic techniques such as lung aspiration, transtracheal aspiration and serology could improve the yield.
2. Benzyl penicillin should continue being used as initial drug therapy in patients with acute lobar pneumonia at Kenyatta National Hospital.
3. Patients presenting at the Kenyatta National Hospital with acute lobar pneumonia should be screened for HIV infection.

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APPENDIX I

1. Date.....
2. Name.....
3. Study No. ....
4. Age .....
5. Sex .....
6. Residence.....
7. Occupation.....
8. (a) Alcohol taken    yes .....    no .....
- (b) No. of years of consumption .....
- (c) Types of alcohol consumed .....
- .....
9. (a) History of cigarette smoking. yes ..... no .....
- (b) No. of years smoked .....
- (c) Approximate no. of cigarettes/day .....
10. Any other present illness (specify)
- .....
11. Clinical history of pneumonia:
- .....
- .....
12. Physical findings:
- .....
- .....
13. Chest radiograph findings:
- .....

APPENDIX II

## LABORATORY DATA, DRUG TREATMENT AND CLINICAL RESPONSE.

1. Date.....
2. Name of patient.....
3. I.P. No. .... 4. Study No. ....

SpecimenTest

- |                       |  |
|-----------------------|--|
| 5. Sputum             | Gram stain .....                                   |
| 6. Sputum             | Culture .....                                      |
| 7. Sputum             | ZN stain .....                                     |
| 8. Blood              | Haemogram .....                                    |
|                       | Hb level .....                                     |
|                       | Total WBC .....                                    |
|                       | Platelet count .....                               |
| 9. Blood              | HIV ELISA .....                                    |
|                       | (If test positive then repeat on<br>same specimen) |
| 10. Blood             | Western Blot test .....                            |
| 11. Blood             | Aerobic culture                                    |
| 12. Blood             | Urea and electrolytes                              |
|                       | .....  |
| 13. Drug treatment    | .....  |
| 14. Clinical response | .....  |
|                       | .....  |