

Aetiology of bacterial pathogens from adult patients with community-acquired pneumonia in Arba Minch Hospital, South Ethiopia

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Abstract: Background: Community-acquired pneumonia (CAP) is major causes of morbidity and mortality. The etiology of CAP varies by geographic region; knowing the etiology might help for the management of the case in case of emergency and to guide treatment. So, in resource limited countries it is wise to identify the most common pathogens of CAP. The objective of this study was to determine bacterial etiology of CAP among adult patients visiting Arba Minch Hospital. Methods: A cross sectional study was conducted in Arba Minch Hospital, Southern Ethiopia from March 01 to June 01, 2013. Data was collected from adult patients with CAP visiting Arba Minch Hospital using face to face interviews, observation using checklist and laboratory examinations. Sputum specimens were collected and microbiological investigations were performed using standard procedures. Data was processed and analyzed with SPSS version 16.0 and Excel 2007. Results: Out of 170 cases, only 68 (40%) were culture positive. One pathogen was demonstrated in 63 (92.6%) patients and 6 (7.4%) had mixed infection. The common isolates of single bacterial pathogens from sputum specimens were *S. pneumoniae* 20 (11.8%), *S. aureus* 15 (8.8%), *P. aeruginosa* 10 (5.8%), *K. pneumoniae* 8 (4.7%), *E. coli* 4 (2.4%), *H. influenzae* 4 (2.4%), *P. mirabilis* 1 (0.6%), and *P. vulgaris* 1 (0.6%). The commonest mixed bacterial isolate was *K. pneumoniae* and *P. aeruginosa* 2 (1.2%). Conclusion: In this study, common bacteria isolated were *S. pneumoniae*, *S. aureus* and gram negative bacteria. Significant numbers of Gram negative bacteria were isolated which may indicate a shift of infection trend to Gram negative bacteria. Hence, periodic monitoring of etiologic agents with their drug resistant pattern is essential for better management of CAP and treatment strategies.

Keywords: CAP, Bacterial Etiology and Arba Minch Hospital

1. Introduction

CAP is a common and potentially serious illness. It is associated with considerable morbidity and mortality, particularly in elderly patients and those with significant co-morbidities (1). The 2004 World Health Organization (WHO) Global Burden of Disease Study estimated that lower respiratory tract infections (LRTIs), which include CAP, were responsible for 429.2 million episodes of illness worldwide and were the leading cause of disease burden measured in terms of disability-adjusted life years (DALYs) among all age groups, accounting for 94.5 million DALYs. In adults aged over 59 years, 1.6 million deaths annually are attributed to CAP (2). In sub-Saharan Africa this disease ranks consistently high as a cause of admission in hospital based series (3).

The pattern of microbiological organisms causing community acquired pneumonia in developed countries has been well characterized (4,5). In addition etiology of pneumonia in elderly is somewhat different from that seen in Younger adults (6). So, it is important to know local pattern of bacterial etiology to guide the treatment required and mobilize resources to it.

2. Methods and Materials

A cross sectional study was conducted from March 01 to June 01, 2013 in Arba Minch Hospital, Southern Ethiopia. A total of 170 adult patients with typical symptoms of the disease, such as productive cough less than 15 days, fever and chest pain consistent with pneumonia was included in this study.

All relevant demographic, clinical and laboratory data were collected through face to face interviews, observation using checklist and laboratory examinations.

The sputum specimens were accepted for culturing if they contained at least 25 polymorphonuclear leukocytes per low-power field (7). Sputum was inoculated onto Blood, MacConkey, Manitol Salt agar (MSA) and Chocolate agar (Oxoid Ltd, UK) plates (8).

Streptococcus pneumoniae were differentiated by sensitivity to 14mm Optochin disk on blood agar. *S. pneumoniae* isolates were also confirmed by the bile solubility test. X and V factors required for growth of *Haemophilus influenzae* were used to confirm colonies of this bacterium. *Staphylococcus aureus* were differentiated by their growth on MSA, colonial morphology, hemolytic activity on Blood agar plate, and their Catalase as well as Coagulase positive test results after sub-culturing to nutrient agar (9).

Bacteria which grow on MacConkey agar plate were inoculated on different biochemical media such as MIU (Motility Indole Urea), LDC (Lysine decarboxylase), oxidase and Citrate utilization tests to identify different Gram-negative bacteria (7, 9, 10). Gram stain was done whenever it was deemed necessary.

3. Result

3.1. Socio-Demographic Information of Study Participants

A total of 170 adult patients clinically suspected to have CAP in Arba Minch Hospital were selected and participated in this study (table 1). Of these, 95 (55.9%) were males and 75 (44.1%) were females. The mean age of patients was 42.7 years (± 14.9 SD).

Table 1. Socio-demographic characteristics of study participants (n=170)

Variables	Frequency (Percentage)
Gender	
Male	95 (55.9)
Female	75 (44.1)
Age	
15-25	23 (13.5)
26-45	67 (39.5)
46-65	63 (37)
>65	17 (10)

3.2. Etiologic Agents

Sputum culture was performed for all 170 adult patients; of which 68 (40%) samples were positive for bacterial growth, while 102 (60%) yielded no growth.

3.2.1. Single Bacterial Isolates

Single bacterial pathogen was isolated in 63 (92.6%) CAP patients. The isolated bacteria were *Streptococcus pneumoniae* 20 (11.8%), *Staphylococcus aureus* 15 (8.8%), *Pseudomonas aeruginosa* 10 (5.8%), *Klebsiella pneumoniae*

8 (4.7%), *Escherichia coli* 4 (2.4%), *Haemophilus influenzae* 4 (2.4), *Proteus mirabilis* 1 (0.6%) and *Proteus vulgaris* 1 (0.6%) “Fig 1”

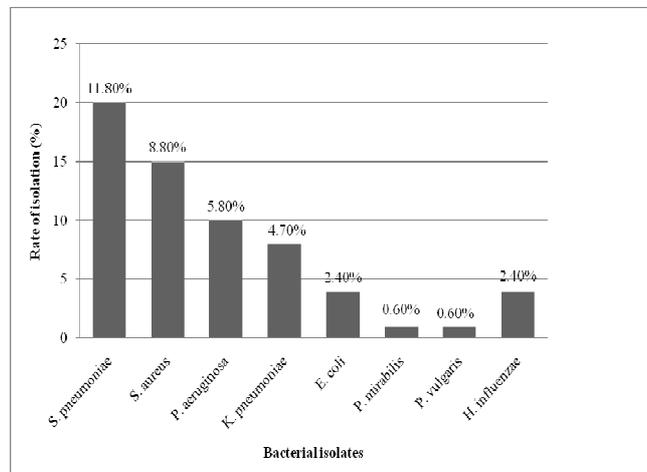


Figure 1. Single bacterial isolates from sputum samples of study participants.

3.2.2. Mixed Bacterial Isolates

Mixed bacterial infection was found in 5 (2.9%) of adult CAP patients. *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* were isolated from 2 patients while *Staphylococcus aureus* and *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Proteus mirabilis* were isolated from one patient each. “Table 2”

Table 2. Mixed bacterial infections from sputum samples of study participants

Mixed bacterial isolates	Frequency (percentage)
<i>Pseudomonas aeruginosa</i> + <i>Klebsiella pneumoniae</i>	2 (1.2)
<i>Staphylococcus aureus</i> + <i>Escherichia coli</i>	1 (0.6)
<i>Staphylococcus aureus</i> + <i>Klebsiella pneumoniae</i>	1 (0.6)
<i>Staphylococcus aureus</i> + <i>Proteus mirabilis</i>	1 (0.6)
Total	5 (2.9)

4. Discussion

In the present study, bacterial pathogens were found in 40% of the patients, which is similar to other studies which isolated bacterial causative pathogens in the range of 37–60% of CAP cases (11); Iran (44%) (12), Nigeria (47.2%) (13) and Nicaragua (45%) (14).

Twenty (11.8%) *S. pneumoniae* were isolated, which is comparable to studies conducted in Chili (10.2%) (15), Iran (12%) (12), Nigeria (12.5%) (13) and Singapore (12%) (16). *S. aureus* accounts 8.8%, which is comparable to studies conducted in India (6%) (17), Singapore (4.2%) (16) and Nicaragua (5%) (14), but higher than studies conducted in

Chili (2.8%) (15) and Nigeria (2.4%) (13).

Twenty-four (14%) Gram negative bacilli were isolated, which is comparable to studies conducted in Iran (15%) (12) and India (19%) (17), but higher than from studies conducted in Singapore (10%) (16), Nicaragua (5%) (14), Chili (5.2%) (15) and Nigeria (4.8%) (13). *P. aeruginosa* accounts 5.8%; this finding is comparable to studies conducted in Iran (7%) (12) and Nigeria (5.6%) (18); but higher than from study conducted in Nigeria (1.2%) (13). *K. pneumoniae* accounts 4.7%; this finding is comparable to study conducted in Iran (4%) (12), but lower than study conducted in Nigeria (14.8%) (18). *E. coli* accounts 2.4%; this finding is comparable to study conducted in Iran (4%) (12), but lower than study conducted in Nigeria (7.1%) (68). *H. influenzae* isolates accounts 2.4%; which is comparable to study conducted in Iran (3.3%) (12), but lower than study conducted in Singapore (5.2%) (16).

In most studies conducted in different parts of the world indicated that Gram negative bacteria accounts only 3-10% of total prevalence (19), but this study isolated more Gram negative bacteria. This brings an attention in the area to conduct further investigation and in fact change in trend of infection may bring to a new approach to diagnosis and treatment of CAP adult patients. In addition, a shift toward Gram-negative bacteria and opportunistic flora may occur with increasing age and the severity of the concomitant medical illness (6).

Prevalence of mixed bacterial infections in this study was 2.9%, which is comparable to study conducted in Nigeria (4.7%) (20); this finding is also consistent with the fact that the prevalence of mixed bacterial infections in community acquired pneumonia adult patients does not usually exceed 30% as has been observed in other study (21). However, the identification of polymicrobial infection is very important for treatment strategies and to avoid a false impression of clinically resistant strains. The most frequent mixed bacterial infection in this study was *K. pneumoniae* and *P. aeruginosa* (1.2%) which is comparable to study conducted in Nigeria (2%) (13).

Variation in prevalence and etiology of bacterial isolates that causes CAP in adults is due to the fact that it varies by geographic region (22).

5. Conclusion

In this study, common bacteria isolated were *S. pneumoniae*, *S. aureus* and gram negative bacteria. Significant numbers of Gram negative bacteria were isolated which may indicate a shift of infection trend to Gram negative bacteria. Hence, periodic monitoring of etiologic agents with their drug resistant pattern is essential for better management of CAP and treatment strategies.

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