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Original Articles

ANTIBIOGRAM OF BACTERIAL AGENTS OF LOWER RESPIRATORY TRACT INFECTIONS IN A CENTRAL NIGERIAN HOSPITAL

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ABSTRACT

BACKGROUND: Lower respiratory tract infections (LRTIs) are one of the major public health concerns in Nigeria. They are associated with significant morbidity and mortality in children and adults.

AIM: To identify bacterial causative agents of lower respiratory tract infections and to determine their antibiotic susceptibility profile to locally available antibiotics.

METHODS: This was a retrospective study conducted at National Hospital Abuja (NHA). Laboratory data of processed sputum samples of patients with suspected lower respiratory tract infection at National Hospital Abuja were extracted, reviewed and analyzed from 1st January 2016-1st December 2016.

RESULT: Out of the six hundred and thirteen cases, 89 (14.5%) had an established bacterial cause. The prevalence of LRTIs was higher in males (56.1%) than females. Age group 21-40 (25.8%) had the highest cases of LRTIs followed by those aged 41-60 (20.2%). Klebsiellapneumoniae (52.8%) was the most predominant isolates, followed by Pseudomonas aeruginosa (15.7%), Staphylococcus aureus (13.5%), Escherichia coli (7.9%), Enterococcus spp (5.6%) and Proteus spp (4.5%). The predominant bacterial pathogens were generally highly susceptible to fluoroquinolones, aminoglycosides and carbapenems.

CONCLUSION: Klebsiellapneumoniae was the most common bacterial causative agent of LRTIs in Abuja. Fluroquinolones, aminoglycosides and carbapenemsare antibiotics of good choice for empiric management of this infection in this locality. Regular monitoring of trends of this aetiologic agent and its antimicrobial susceptibility profile is important in effective management of these infections.

KEY WORDS: Antibiogram, Bacterial Isolates, LRTIs, National Hospital Abuja, Nigeria

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INTRODUCTION

Lower respiratory tract infections (LRTIs) constitute one of the most common human infectious diseases globally.[1] These infections occur below the level of the larynx, and include tracheitis, bronchitis, bronchiectasis, abscess and pneumonia.[2] They have been found to be responsible for 4.4% of all hospital admissions and 6% of all consultations with general practitioners.[3] The infection is considered as one of the major public health problems and a leading cause of morbidity and mortality in both adults and children worldwide. Lower respiratory tract infections account for between 3-5% of deaths in adults, especially beyond the age of 60 years.[4, 5] Approximately 7 million people die yearly as a direct consequence of acute and chronic respiratory infections.[6] In Nigeria, they are notably major cause of morbidity. [7] The aetiologic agents of LRTIs differ from place to place and therefore, the susceptibility profile of the organisms will also vary between geographical locations.[6] Previous studies in Nigeria have revealed somewhat different patterns of aetiologic agents and susceptibility, with Klebsiella pneumoniae, Pseudomonas aeruginosa, Streptococcus pneumoniae, Staphylococcus aureus, Haemophilus Influenzae and Escherichia coli being the most predominant bacteria isolated from patients with LRTIs.[8, 9] Since clinical determination of the causative organism of LRTIs is impossible, and antimicrobial therapies are frequently empirical and presumptive, knowledge of etiological agents of LRTIs and their sensitivities to locally available drugs in any environment is

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therefore, of immense importance in the selection and use of antimicrobial agents in the management of these infections.[10] There is lack of data on the profile of bacterial isolates from sputum samples of patients with suspected LRTIs in this environment, hence the study.

MATERIALS AND METHODS

This was a retrospective study conducted at the National Hospital Abuja, a 200-bed tertiary health facility located in Federal Capital Territory (FCT) of Nigeria. It serves the FCT residents and patients referred from other parts of the country. It has well-equipped wards and outpatient departments for various clinical specialties. The Medical Microbiology laboratory record of processed sputum samples of patients with suspected LRTIs from 1st January, 2016 to 1st December, 2016 were extracted and evaluated. In our facility, sputum samples collected using a well-labelled, sterile, leak-proof and wide-mouthed container with tight fitting cover are usually processed as soon as they are received.

The sputum samples are evaluated for quality based on Gram's staining detection of more than 25 white blood cells and less than [10] epthelial cells per low power field of microscope as indicative of true infection.[11,12] The sputum samples are then inoculated onto blood agar, chocolate agar, and MacConkey agar plates respectively. Chocolate agar plates are incubated at 37°C for 24 hours under 10% CO2 in a candle jar, while blood agar and MacConkey agar plates are incubated at 37°C for 24 hours under aerobic condition. Isolates recovered are identified using standard bacteriological methods.[13,14] The isolates are subsequently subjected to antimicrobial susceptibility testing using the modified Kirby-Bauer techique and results interpreted according to the Clinical Laboratory Standard Institute guideline.[15]

RESULTS

Out of a total of six hundred and thirteen patients' sputum samples received and processed, 89 (14.5%) yielded growth of clinically significant bacteria. Seventy-two (80.9%) of the bacterial isolates were Gram negative, while 17 (19.1%) were Gram positive. Forty-seven (52.8%) of the bacterial isolates were Klebsiella pneumonia, 14 (15.7%) Pseudomonas aeruginosa, 12 (13.5%) Staphylococcus aureus, 7 (7.9%) Escherichia coli, 5 (5.6%) Enterococcus spp, and 4 (4.5%) Proteus spp (Figure 1). Fifty (56.1%) of the bacterial isolates were from males, while 39 (43.9%) were from females (Table 1). Fifty-six (62.9%) of the isolated bacterial pathogens were from inpatients, while 33 (37.1%) were from outpatients (Table 1). Three (3.4%) of the bacterial isolates were from patients aged < 10 years, 3 (3.4%) from 10-20 years, 23 (25.8%) from 21-40 years, 18 (20.2%) from 41-60 years, 14 (15.7%) from > 60 years, and 28 (31.5%) from unspecified age of adult patients (Table 1).

The sensitivity of Klebsiella pneumonia to Amikacin, Imipenem, Meropenem, Ofloxacin, Ciprofloxacin and Gentamycin was 100%, 83.3%, 80.0%, 75.0%, 66.7% and 66.7% respectively. Pseudomonas aeruginosa was 100% susceptible to Amikacin, Imipenem, Meropenem and ciprofloxacin respectively. The sensitivity was, however, 90% to Levofloxacin, and 87.5% to Gentamycin. The sensitivity of Staphylococcus aureus to Meropenem, Ciprofloxacin and Gentamycin was 100% respectively, but was 90% and 67.5% to Clindamycin and Amikacin respectively. Escherichia coli was 100% sensitive to Meropenem, 66.7% respectively to Amikacin, Augmentin and Ceftazidime, and 50% and 40% respectively to Gentamycin and Levofloxacin. Enterococcus spp was 100% sensitive to Augmentin and Gentamycin respectively, but 60% to Cefuroxime .The sensitivity of Proteus spp to Gentamycin, Levofloxacin, Augmentin, Cefuroxime and Cefotaxime was 100% respectively (Table 2).

Figure1: Bar Chart showing the frequency (No) and percentage of the various bacterial isolates from LRTIs

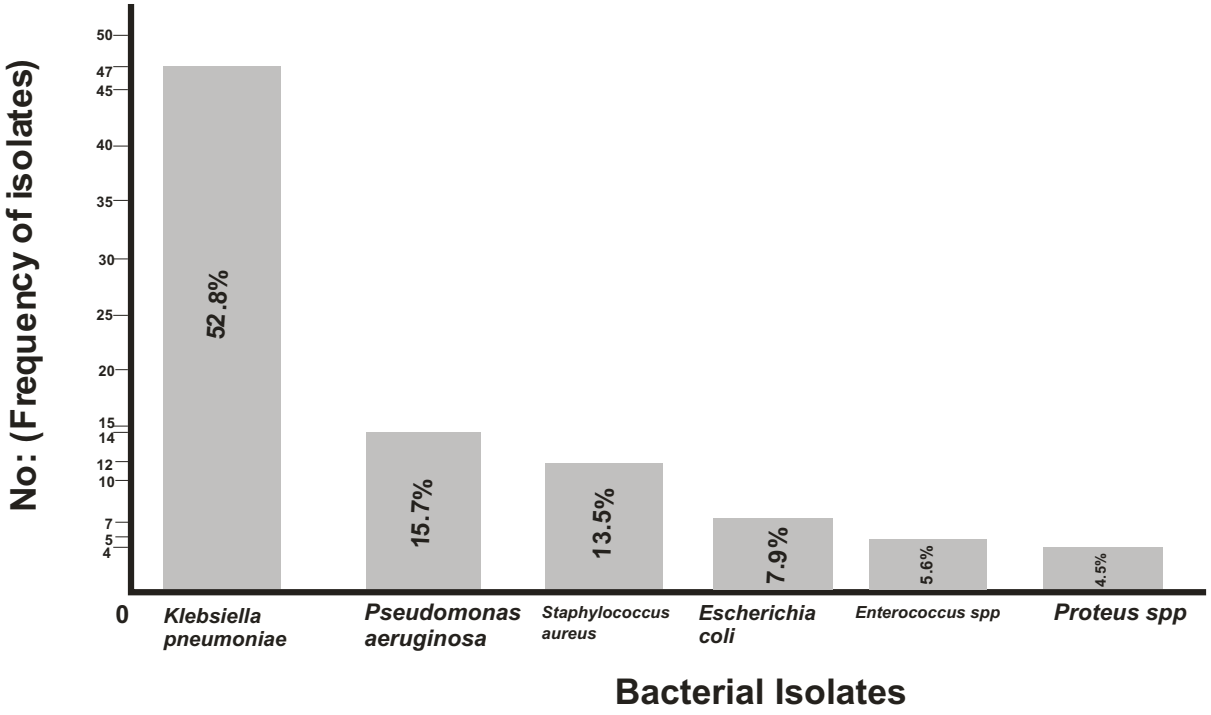

Table 1: Showing the distribution of lower respiratory tract infections (lrtis) by age, gender and source

Age (years)	**No. (%)**
<10	3 (3.4)
10-20	3 (3.4)
21-40	23 (25.8)
41-60	18 (20.2)
>60	14 (15.7)
Unspecified	28 (31.5)
Total	**89 (100)**
Gender	**No.(%)**
Male	50 (56.1)
Female	39 (43.9)
Total	**89 (100)**
Source	**No. (%)**
Outpatients	33 (37.1)
Inpatients	56 (62.9)
Total	**89 (100)**

Key: No.= Number of cases of LRTIs, %=percentage of LRTIs

Table 2: Showing the antibiotic susceptibility pattern of the isolates

Antibiotics	Isolates											
	K. pneumoniae		*P. aeruginosa*		*S. aureus*		*E. coli*		*Enterococcus spp*		*Proteus spp*	
	T	%S	T	%S	T	%S	T	%S	T	%S	T	%S
Gentamycin	42	66.7	8	87.5	1	100	6	50.0	1	100	4	100
Levofloxacin	38	63.2	10	90.0	8	50.0	5	40.0	3	33.3	4	100
Ciprofloxacin	6	66.7	1	100	3	100	3	33.3	-	-	-	-
Amikacin	19	100	11	100	3	66.7	7	28.6	-	-	-	-
Cefuroxime	41	34.1	2	0.0	12	58.3	4	25.0	5	60.0	4	100
Cefotaxime	37	40.5	5	0.0	-	-	1	0.0	-	-	4	100
Ceftriazone	3	66.7	1	0.0	1	0.0	6	66.7	1	0.0	-	-
Augmentin	16	25.0	-	-	8	62.5	-	-	2	100	3	3
Imipenem	6	83.3	6	100	-	-	-	-	-	-	-	-
Ofloxacin	4	75.0	3	33.3	-	-	-	-	-	-	-	-
Meropenem	10	80.0	2	100	2	100	2	100	-	-	-	-
Ceftazidime	7	28.6	9	55.6	-	-	3	66.7	-	-	-	-
Aztreonam	1	0.0	2	50.0	-	-	1	100	-	-	-	-
Clindamycin	-	-	-	-	10	90.0	-	-	5	40.0	-	-
Erythromycin	-	-	-	-	8	62.5	-	-	4	25.0	-	-

Key: T=Total no tested, %S= percentage sensitive, K. pneumoniae= Klebsiellapneumoniae, P. aeruginosa= Pseudomonas aeruginosa, S. aureus= Staphylococcus aureus, E. coli= Escherichia coli, Enterococcus spp= Enterococcus species, Proteus spp= Proteus species

DISCUSSION

The prevalence of bacterial isolates of LRTIs in this study was 14.5%. This finding is similar to those of earlier studies in Ilorin, Benin and Kano with prevalence of 15.53%, 18.91% and 21.5% respectively.[16,17,18] The observation in this study disagrees with the higher prevalence of 47.2% and 55% recorded in other studies done in Benin and Ilesha respectively.[7,9] The low prevalence in this study might be due to prior antibiotics intake by patients, occurrence of atypical bacteria, viral agents or other aetiologic agents.

The higher prevalence of Gram negative bacteria against Gram positives (80.9% vs 19.1%) recorded in this work agrees with the reports of studies in Ibadan and Nepal.[8, 19] In other studies however, higher prevalence of Gram positive bacteria was reported.[9,20]

Klebsiella pneumonia (52.8%) was the most prevalent bacterial cause of LRTIs in this study followed by P. aeruginosa (13.5%). This finding is in agreement with previous studies in Ibadan and Ilorin.[8,16] Other studies that also reported Klebsiella pneumonia as the most common isolates have either Staphylococcus aureus or Streptococcus pneumoniae as the next most prevalent bacteria.[7, 21] In contrast, however, Studies done in Pakistan and Iran reported Pseudomonas aeruginosa followed by Streptococcus pneumoniae as the most prevalent bacterial agents of LRTIs.[22,23] Variation in the geographical locations may account for the different pattern of aetiologic agents of the infections noted. No reasonable explanation can be offered for the inability to isolate Streptococcus pneumonia in this study. It may be that the methodology was not good enough for its isolation in this study.

There was an observed higher prevalence of LRTIs in males than in females (56.1% vs 43.9%) in this study. Previous studies have recorded similar findings.[8,9,10,16,18] In contrast to finding in this research, few studies have reported higher prevalence of LRTIs in females than in males, while in another study there was no significant difference between male and female with LRTIs.[7, 17, 24] The reason for the observed higher male prevalence in this study might be due to compromise in local immunity in the respiratory tract as a result of smoking, use of tobacco, alcohol consumption.

In this study, age group 21-40 years had the highest number of cases of LRTIs followed by age group 41-60 years, showing that young adults and the elderly were most at risk of the infection. This finding is similar to the report of a study conducted in Ibadan.[8] It is however in disagreement with findings in other studies in which different age groups accounted for the highest cases recorded.[9,19]

In this study, Klebsiella pneumonia was highly sensitivity to Amikacin (100%), Imipenem (83.3%), Meropenem (80%), Ofloxacin (75.0%), but moderately high sensitive to Ciprofloxacin (66.7%) and Gentamycin (66.7%), Ceftriazone (66.7%). Previous studies have similarly reported high susceptibility to ciprofloxacin, gentamycin and ofloxacin.[10,17,19]

Pseudomonas aeruginosa showed excellent sensitivity to Amikacin (100%), Imipenem (100%), Meropenem (100%), ciprofloxacin (100%), Levofloxacin (90%) and Gentamycin (87.5%). This is supported by similar report in other studies.[19, 21] Staphylococcus aureus showed excellent sensitivity to Meropenem, Ciprofloxacin, Gentamycin and Clindamycin respectively, but was moderately sensitive to Amikacin. This is similar to findings in previous studies[7, 8, 25]. Escherichia coli was highly sensitive to Meropenem, but moderately sensitive to Amikacin, Augmentin and Ceftazidime. This is contrary to findings in another study in which Augmentin and aminoglycoside were highly resistant.[8]

Excellent sensitivity to Augmentin and Gentamycin was observed for Enterococcus spp, but it was found to be moderately sensitive to Cefuroxime. Similar pattern has previously been documented.[9,19]. Proteus spp was highly susceptible to Gentamycin, Levofloxacin, Augmentin, Cefuroxime and Cefotaxime. This is supported by the findings in a study done in Ibadan and Kano where the sensitivity to gentamycin and fluoroquinolones were high.[8,18]

CONCLUSION

Klebsiella pneumoniae was the most predominant bacterial aetiologic agent of LRTIs in this study. This pathogenwas generally highly susceptible to amikacin, carbapenems, fluoroquinolones and gentamycin. This finding is heart-warming as it offers clinician a range of good choice of antibiotics for emperic treatment of this infection. To prolong the usage life span of these antibiotics, it is recommended that antibiotic stewardship programme be instituted along with trend monitoring of the antibiotic resistance of this organism isolated from LRTIs.

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