

Bacterial isolates of the respiratory tract infection and their current sensitivity pattern among patients attending Aminu Kano Teaching Hospital Kano-Nigeria

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ABSTRACT

The study was carried out to isolate and identify the common Bacteria causing respiratory tract infections among patients attending Aminu Kano Teaching Hospital between August and October, 2011, and the current sensitivity patterns of the isolated bacteria to common commercially antibiotic prepared disc. Forty three (43) bacterial pathogens were isolated from two hundred (200) samples collected. *Streptococcus pneumoniae* (25.6%) has the highest percentage of occurrence, followed by *Klebsiella pneumoniae* (20.9%), *Escherichia coli* (20.9%) and *Staphylococcus aureus*, (16.3%) respectively. Others include *Proteus species* (4.7%), *Pseudomonas aeruginosa* (4.7%), *Haemophilus influenzae* (4.7%) and *Serratia species* (2.3%) as well. Age ranges 20 – 29 and 30 – 39 have the highest percentage of pathogens isolated. The sensitivity patterns of the isolated bacteria to commercially antibiotic prepared disc indicated that drugs likes Ceftriaxone, Ceftazidime, Ciprofloxacin, Ofloxacin, Gentamicin and Chloramphenicol shows activity on all the pathogens isolated.

Keywords: Isolate, Bacteria, Respiratory tract infections, sensitivity, antibiotic.

INTRODUCTION

Respiratory tract is the part of the human system that plays a vital role in breathing processes. In human, the respiratory system can be subdivided into an Upper respiratory tract and a Lower respiratory tract based on anatomical features (Perkin, 2003). The respiratory tract is constantly exposed to microbes due to the extensive surface area, for instance, the lungs have an exposed internal surface area of approximately 500m² (Underwood, 1992). Respiratory tract infections are the most frequently reported of all human infections. Some of these infections are most times mild, transient lasting and sometimes self-limiting. Due to this, many infected persons tend to disregard them (Ndip *et al.*, 2008). However, respiratory infections are a common and important cause of morbidity and mortality worldwide. For instance, in USA alone, over 62 million persons suffer from cold annually (National Institute of Allergy and Infectious Diseases, 2010), while in the United Kingdom,

about 8 million persons are infected by some forms of chronic lung diseases which now kills one in every five persons (British Lung Foundation, 2010). In Canada, respiratory disease is accountable for over 16% of deaths and 10% of hospitalizations (Public Health Agency of Canada, 2011). In most developed countries, particularly African countries, the situation is more complicated and management is often difficult due to the problem associated with the identification of the etiological agents and administration of appropriate treatment in cases requiring antibiotic therapy (Alter *et al.*, 2011). Acute lower respiratory tract infection is a common cause of hospital admission in Nigeria; however no comprehensive study on the prevalence of pneumonia in adults is readily available. Among patients attending a TB clinic in South Western Nigeria, 6.4% had *Streptococcal* pneumonia (Agwu *et al.*, 2006). Few studies have also investigated the aetiology of pneumonia in Nigerian adults. A study of

74 patients with pneumonia in Zaria, Northern Nigeria, however, showed that 50% had positive pneumococcal polysaccharide antigen and 16.2% had *Mycoplasma pneumoniae* (Macfarlane *et al.*, 1979). In a prospective cohort study in Ilorin, the rate of acute respiratory infection was three episodes per child per year with pneumonia being responsible for 1.3 episodes per child per year (Fabule *et al.*, 1994). In another hospital-based study in Ibadan, 28.4% of children admitted to the hospital with acute lower respiratory tract infection had acute bronchitis with respiratory syncytial virus being the most common viral etiologic agent (Johnson *et al.*, 1996). There are scanty data on the bacterial aetiology of pneumonia in Nigerian children. There is a seasonal variation in acute respiratory infections in Nigerian children with more episodes occurring during the rainy season (Fabule *et al.*, 1994; Johnson *et al.*, 1996). Pneumonia is also associated with measles infection, and this has been recognized as the major cause of death from measles in sub-Saharan Africa (De Buse *et al.*, 1969; Morton and Mee, 1986). Lower respiratory tract infections place a considerable strain on the health budget and are generally more serious than upper respiratory infections. Since 1993 there has been a slight reduction in the total number of deaths from lower respiratory tract infection. However, in 2002, they were still the leading cause of deaths among all infectious diseases and they accounted for 3.9 million deaths worldwide and 6.9% of all deaths that year (WHO, 2004).

Upper respiratory tract infections (URIs) are mostly caused by viruses. Group A beta hemolytic *Streptococci* (GABHS) cause 5% to 10% of cases of pharyngitis in adults (Nichol *et al.*, 2005). Other less common causes of bacterial pharyngitis include group C beta hemolytic *Streptococci*, *Corynebacterium diphtheriae*, *Neisseria gonorrhoeae*, *Chlamydia pneumoniae*, and *Mycoplasma pneumoniae* (McGinn and Ahlawa, 2003). *Streptococcus pneumoniae*, *Haemophilus influenzae* are the most common organisms that causes bacterial super infection of viral acute sinusitis and less than 10% of cases of acute tracheobronchitis are caused by *Bordetella pertussis*, *Bordetella parapertussis* or *Mycoplasma pneumoniae*. Thus transmission occurs more commonly in crowded conditions. Respiratory tract infections (RTIs) are usually treated with antibiotics, and in most cases, there is need to start treatment before the final laboratory results are available. But of recent, empiric treatment has been complicated by the emergence of antimicrobial resistance among the principal pathogens and a definitive bacteriological diagnosis and susceptibility testing would, therefore, be required for effective management (Aydemir *et al.*, 2006; Sahm *et al.*, 2008). In the last three decades, there have been a lot of reports in the scientific literature on the inappropriate use of antimicrobial agents and the spread of bacterial resistance among microorganisms causing respiratory tract infections (Tenever and McGowan, 1996; Hryniewicz *et al.*, 2001; Kurutepe *et al.*,

2005). Nevertheless, the choice for antimicrobial therapy is usually straight forward when the etiologic agents and their susceptibility patterns are known (Zafar *et al.*, 2008). In Nigeria, just as in the other parts of the developing countries, most RTIs are treated empirically, possibly because of higher cost of laboratory services where available. The emergence of antibiotic resistance in the management of RTIs is a serious public health issue, particularly in the developing world apart from high level of poverty, ignorance and poor hygienic practices; there is also high prevalence of fake and spurious drugs of questionable quality in circulation. Antibiotic resistance often leads to therapeutic failures of empirical therapy, which is why knowledge of etiological agents of RTIs and their sensitivities to available drugs is of immense importance to the selection and use of antimicrobial agents and to the development of appropriate prescribing policies (El-Astal, 2004). This study was conducted to determine the microbial agents of human respiratory tract infections and the susceptibility patterns of bacterial isolates.

MATERIALS AND METHODS

Study Area

The research was carried out at Aminu Kano Teaching Hospital, Kano Nigeria. The population studied, was a heterogeneous population of different age group, ethnicity and educational status. Biodata and other information were collected via the counselors after obtaining informed consent from each patient with the assurance that all information obtained would be treated confidentially.

Sample Collection

Early morning sputum specimens "before eating" were aseptically collected in to sterile containers from 200 patients attending Aminu Kano Teaching hospital, between August and November, 2011. These samples were then transported to the laboratory for analysis (Cheesbrough, 2005).

Sample Processing

The samples collected were aseptically inoculated on to the surface of prepared blood and chocolate (heated blood) agar plates by picking the sample using sterilize wire loop and then swabbing on the surface of the agar. The blood agar plates were then incubated aerobically in an incubator at 35°C for 18-24hours while the chocolate agar plates were incubated in a carbon dioxide enriched environment using anaerobic jar at 35°C also for 18-24hours. After incubation, the plates were observed for the following morphological characteristics; growth of the

pathogens, size of colony, shape of colony, elevation, odour, pigmentation, haemolysis and swarming movement. Gram reaction was carried out in order to differentiate the bacteria into gram –positive and gram –negative and also to identify the shape of the organisms (Cheesbrough, 2005; Tortora, 2004).

Identification of Bacteria

In order to identify the microorganisms, the isolates were subjected to various biochemical tests. Motility-indole-ornithine medium was used to detect motility, indole, and ornithine production (Macfaddin, 1980). Catalase test was carried out to differentiate between *Streptococcus* and *Staphylococcus* species (Cappuccino, 2002). Other biochemical reactions such as Voges-proskauer, methyl red, triple sugar iron agar, Kovac's oxidase, coagulase, urease tests were used to identify and differentiate the organisms (APHA, 1999; Cheesbrough, 2000; Cheesbrough, 2005).

Sensitivity Screening

The isolates were aseptically subcultured by streaking onto prepared nutrient agar plates. Then using sterile forcep, standard antibiotic discs were placed on the surface of the inoculated agar plates. These were then incubated at 37°C for 24 hours. After 24 hours, the plates were observed for the zones of inhibition. Sensitivity of the isolates were determined by measuring the diameter of each zone of inhibition around each disc and the values obtained were compared with the standard chart provided (Cheesbrough, 2005).

RESULTS

The results of the study are presented in the tables below

DISCUSSION

A total of 200 patients were screened for having respiratory tract infections. Of these, 43 bacteria species were obtained. The bacteria isolated from the samples included *S. pneumoniae* 11(25.6%), *K. pneumoniae* 9(20.9%), *E. coli* 9(20.9%), *S. aureus* 7(16.3%), *Proteus* species 2(4.7%), *H. influenzae* 2(4.7%), *P. aeruginosa* 2(4.7%) and *Serratia* species 1(2.3%). These findings were in agreement with the works of El-Mahmood *et al.*, 2010 in Yola, Okesola and Oni, 2009; Nwanze *et al.*, 2007 in Ibadan and Lagos. In terms of frequency of occurrence, the results were in accordance with those conducted in other countries such as Cameroun (Ndip *et al.*, 2008), South Africa (Liebowitz *et al.*, 2003), China (Wang *et al.*, 2001), Japan (Watanabe *et al.*, 1995), Israel

(Turner and Dagan, 2001) and Turkey (Aydemir *et al.*, 2006). On the other hand, the results disagree with study conducted by Richard *et al.*, 2000, in which Nosocomial infections in combined medical surgical intensive care units in the United State; where *Staphylococcus aureus* was the most frequently reported isolate (17%) followed by *Pseudomonas aeruginosa* (15.66%) and then by *Enterobacter species* (10.9%) and *Klebsiella pneumoniae* (7.0%).

The occurrence of bacterial pathogens varies with age, in that, age group ranging from 20-29 years reported the highest number of occurrence 10 (23.5%) followed by 30-39 years 8 (18.6%). The least age group in terms of occurrence, were within the ranges of between 60-69 years in which out of 18 patients examined, only 2 (4.7%) reported the occurrence and also between 70-79 years whose reported 2 (4.7%) out of 11 patients examined. This might be probably due to the fact that, most of the people in these age groups in this community are more exposed to agents responsible for causing respiratory tract infections than the elderly ones. The high prevalence of pathogens reported among patients ranging 20-29 and 30-39 years in this study, did not agree with the findings of Panda *et al.*, 2012, in which they recorded higher occurrence of *K. pneumoniae* among patients ranging from 51-60 and 60-70 years.

Sex-related occurrence of pathogens reveals that, male subjects reported higher number of pathogens compared to their counterpart (females). This is due to more prevalent associated risk factors (e.g. smoking and chronic alcoholism) of respiratory infections in males than females. This is consistent with other studies conducted by Panda *et al.*, 2012 whose reported that, out of the 101 isolated organisms, 64 (63.4%) were from males while 37 (36.6%) were from females. However, these results contradicts the data obtained by El-Mahmood *et al.*, 2010, in which in a similar study, out of 232 total isolates, 114 (49.1%) were from males while 118 (50.9%) from females.

The results from table 4 show that, *S. pneumoniae* was highly sensitive to ceftazidime, ciproflaxacin, and rocephine but moderately sensitive to augmentin, amoxicillin and gentamycin. On the other hand, *S. aureus* was found to be only moderately sensitive to chloramphenicol, ceftazidime, ciproflaxacin and rocephine and at the same time shows resistance to the remaining seven antibiotics which are augmentin, amoxicillin, erythromycin, tetracycline, gentamycin, cotrimoxazole and pefloxacin. In a similar study in Vietnam, some 90% of *S. aureus* were resistant to at least one antibiotic (Larsson *et al.*, 2000). This organism was found to be β -lactamase producer. The incidence of bacterial resistance mediated by β -lactamases has been reported in several African countries including Nigeria and South Africa (Zeba, 2005; Onanuga *et al.*, 2005; Nwanze *et al.*, 2007). The clinical relevance of these enzymes is due to

Table 1. Bacterial Pathogens isolated from the respiratory tract of patients.

S/N	Pathogens Isolated	No. of Isolates	% of Occurrence
1	<i>Streptococcus pneumoniae</i>	11	25.6
2	<i>Klebsiella pneumoniae</i>	9	20.9
3	<i>Escherichia coli</i>	9	20.9
4	<i>Staphylococcus aureus</i>	7	16.3
5	<i>Proteus species</i>	2	4.7
6	<i>Haemophilus influenzae</i>	2	4.7
7	<i>Pseudomonas aeruginosa</i>	2	4.7
8	<i>Serratia species</i>	1	2.3
	Total	43	100

Table 2. Occurrence of bacterial pathogens from patients in relation to age.

Age	No. of patients examined	Patients with pathogens	Patients without Pathogens
0 – 9	17	5 (11.6%)	12 (7.4%)
10 – 19	27	6 (13.9%)	21 (13.4%)
20 – 29	41	10 (23.5%)	31 (19.8%)
30 – 39	44	8 (18.6%)	36 (22.9%)
40 – 49	25	6 (13.9%)	19 (12.1%)
50 – 59	17	4 (9.3%)	13 (8.3%)
60 – 69	18	2 (4.7%)	16 (10.2%)
70 – 79	11	2 (4.7%)	9 (5.7%)
Total	200	43 (100%)	157 (100%)

Table 3. Occurrence of bacterial pathogens isolated from patients in relation to sex.

Sex	No. of patients examined	Patients with pathogens	Patients without pathogens
Female	99(49.5%)	20(46.5%)	79(50.3%)
Male	101(50.5%)	23(53.5%)	78(49.7%)
Total	200(100%)	43(100%)	157(100%)

Table 4. Sensitivity patterns of the gram positive bacteria isolates of the respiratory tracts infections.

Bacterial isolates	AUG	AMX	ERY	TET	GEN	COT	PFX	CHC	CFZ	CIP	RCP
<i>S. pneumoniae</i>	++	++	-	-	++	-	-	++	+++	+++	+++
<i>S. aureus</i>	-	-	-	-	-	-	-	++	++	++	++

Key: AUG = Augmentin, AMX = Amoxicillin, ERY = Erythromycin, TET = Tetracycline, GEN = Gentamycin, COT = Cotrimoxazole, PFX=Pefloxacin, CHC= Chloramphenicol, CFZ=ceftazidine, CIP =Ciproflaxacin, RCP=Rocephine, + = sensitive/effective, - = resistance, ++ = moderately sensitive/effective, +++= highly sensitive/effective

Table 5. Sensitivity patterns of gram negative bacterial isolates of the respiratory tracts infections.

Bacterial isolates	AMX	COT	NIT	GEN	PFX	NAL	TET	AUG	CFZ	CIP	RCP
<i>P. aeruginosa</i>	-	-	-	-	++	-	-	-	++	++	++
<i>E. coli</i>	+	+++	-	+	++	-	++	+	+++	+++	+++
<i>K. pneumoniae</i>	-	-	-	++	+++	-	-	+	++	++	+++
<i>Proteus species</i>	-	++	-	+++	++	-	-	+	++	++	+++
<i>H. influenzae</i>	++	-	-	++	++	-	-	++	++	++	+++
<i>Serratia species</i>	-	-	+	++	++	+	-	++	++	++	+++

Key: NIT = Nitrofurantoin, NAL = Nalidixic acid.

their ability of causing therapeutic failures.

In the present study, most of the isolates in table 5 were sensitive to gentamycin, pefloxacin, augmentin, ceftazidime, ciproplaxacin and rocephine but resistant to cotrimoxazole, nitrofurantoin, nalidixic acid and tetracycline. These are supported by the findings of El-Mahmood *et al.*, 2010, whose also reported in a similar study that, the isolates were sensitive to ciproplaxacin and also most were not or poorly sensitive to cotrimoxazole, nitrofurantoin, nalidixic acid and tetracycline. In a related study conducted in Algeria, susceptibility to cotrimoxazole was particularly low (Ramdani-Bougessa and Rahal, 2003).

CONCLUSION

Even though, the results obtained in this study indicated that some of the antibiotics used to treat respiratory tract infections in this community are still effective, but still there is danger of drug resistance which need to be tackled.

RECOMMENDATIONS

Since there were cases of resistance especially with *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*, therefore antimicrobial susceptibility test should be encouraged on routine basis so as to figure out the best antibiotic for treatment of respiratory infections. Extensive use and misuse of antimicrobial drugs should be avoided; this will reduce the emergence of drugs resistance. New generation antibiotic especially third and fourth generation should be used in the treatment of respiratory tract infections.

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