Iraqi JMS

Published by Al-Nahrain College of Medicine
ISSN 1681-6579
Email: iraqijms@colmed-alnahrain.edu.iq
http://www.colmed-nahrain.edu.iq/

The Pattern of Bacterial Pathogens & their Antibiotics Sensitivity among Patients with Respiratory Tract Infections

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Abstract

Background Knowing the bacterial pathogens and their antibiotic sensitivity is an important way of establishing a suitable guideline of treatment of infection.

Objectives To isolate bacterial pathogens from patients with respiratory tract infections (RTI), and to determine the antibiotic sensitivity of isolates.

Methods Sputum specimens were collected from 145 patients with RTI admitted to Al-Kindy Teaching Hospital from March 2011 to January 2012. Out of these, 88 (60.7%) patients (age rang 17-59 years) had an established bacterial etiology, and of these, 57 (64.8%) were males and 31 (35.2%) females. All isolates were diagnosed according to bacteriological and biochemical standard methods. For identified of antimicrobial susceptibility used from Kirby Bauer method according to (NCCLS).

Results *Klebsiella* species and *Pseudomonas aeruginosa* were the most common isolates among the Gram negative pathogens (26.2% and 11.7% respectively), followed by *Escherichia coli* and *Proteus* species, while *Streptococcus pneumonia* was the most common isolate among the Gram positive organisms, identified in (15.2%) followed by *Staphylococcus aureus* and Streptococcus pyogenes. High rates of resistance to Amoxicillin and Cephalothin were demonstrated by all bacteria, whereas most isolates were found to be highly sensitive to Amikacin, Ciprofloxacin and Tobramycin. In contrast, Cefotaxim, Tetracyciln, Gentamycin and Erythromicin were less effect against most of isolates.

Conclusions *Klebsiella* spp. was the most common pathogens, whereas *Streptococcus pneumonia* which ranks as second common pathogens from patients with RTI in the present study. Amikacin, Ciprofloxacin and Tobramycin were the most effect antibiotics in *vitro* against tested bacteria. Conversely, no or less effect of other antibiotic agents was obtained making them not to be considered the drugs of choice in treatment of patients with RTI.

Keywords Bacterial pathogens, Antibiotics resistance, Patients RTIs.

Introduction

Respiratory tract infection (RTI) is defined as any infectious disease of the upper or lower respiratory tract. Upper respiratory tract infections (URTIs) include the common cold, laryngitis, pharyngitis/tonsillitis, acute rhinitis, acute rhinosinusitis and acute otitis media. Lower respiratory tract infections (LRTIs) include acute bronchitis, bronchiolitis, pneumonia and tracheitis [1]. The Centers for Disease Control and Prevention (CDC), World Health Organization (WHO) and Institute of Medicine have identified antimicrobial resistance as a major public health threat [2-4]. Antibiotic is credited with dramatic reduction in the morbidity and mortality associated with many bacterial infections, its abuse has resulted in the rapid emergence of resistant strains that reduce the effectiveness of many antibiotics [5].

Antibiotics are commonly prescribed for RTIs in adults and children in primary care. General Practice Consultation Rates (GPCR) in England and Wales show that a quarter of the population will visit their GPCR because of an RTI each year [6]. Therapy for community acquired respiratory tract infections is often empirical. However, increasing antibiotic resistance in frequently isolated respiratory tract pathogens complicated the selection process of antimicrobial agents [7]. Pharmaco-economic analyses have confirmed that bacteriologically more effective antibiotics can reduce overall management costs. Particularly with respect to consequential morbidity and hospital admission. Application of these principles would positively benefit therapeutic outcomes, resistance avoidance and management costs and will more accurately guide antibiotic choices by individuals, formulary, and guideline committees [8].

Methods

Sputum specimens were collected from 145 patients with RTI admitted to Al-Kindy Teaching Hospital from March 2011 to January 2012. Out of these, 88 (60.7%) patients (age rang 17-59 years) had an established bacterial etiology, and of these, 57 (64.8%) were males and 31 (35.2%) females.

The sputum samples were collected in sterile universal plastic containers and sent to the Diagnostic Microbiology Laboratory of Al-Kindy Teaching Hospital were analyzed. All isolates were diagnosed according to well-known established bacteriological methods [9]. Biochemical identification of bacterial species was performed by standard methods [10].

Antimicrobial susceptibility test: The isolates were subjected to susceptibility testing to the commonly used antimicrobial agents by Kirby - Bauer method according to criteria of National Committee for Clinical Laboratory Standard (NCCLS) [11], and their results of zone growth inhibition were compared to that in table 1.

Statistics: Descriptive statistical analysis (number and percentage) were used to calculate for type of bacterial isolates and their sensitivity results.

Table 1. Zone size and their interpretation (National Committee for clinical laboratory Standard (NCCLS)

Antimicrobial agent (symbol)	Disc potency	Diameter of zone of inhibition (mm)		
		Sensitive	Intermediate	Resistant
Amikacin (AN)	30 µg	≥ 17	15-16	≤14
Amoxicillin (AMX)	10 µg	≥18	14-17	≤ 13
Ciprofloxacin (CIP)	5 µg	≥21	16-20	≤ 15
Gentamycin (GM) Tobramycin	10 µg	≥15	13-14	≤ 12
(TM)	10 µg	≥15	13-14	≤12
Cephalothin (CF)	30 µg	≥ 18	15-17	≤ 14
Cefotaxim (CTX)	30 µg	≥19	15-18	≤ 14
Tetracycline (TE)	30 µg	≥ 19	15-18	≤ 14
Erythromicin (ER)	15 µg	≥ 23	14-22	≤ 13

Results

A total of 145 patients with RTI were examined, the bacterial etiology agents were identified in 88(60.7%) patients. In our study since the number of males was higher than females (64.8%), so the number of isolates was comparatively higher in males than females.

From 88 positive cases with RTI, 103 bacterial strains were isolated. Out of these, 64 (62.1%) were Gram-negative bacilli and 39 (37.9%) were Gram-positive cocci. Indeed some sputum samples contained more than one bacterium. These results as shown in figure 1.

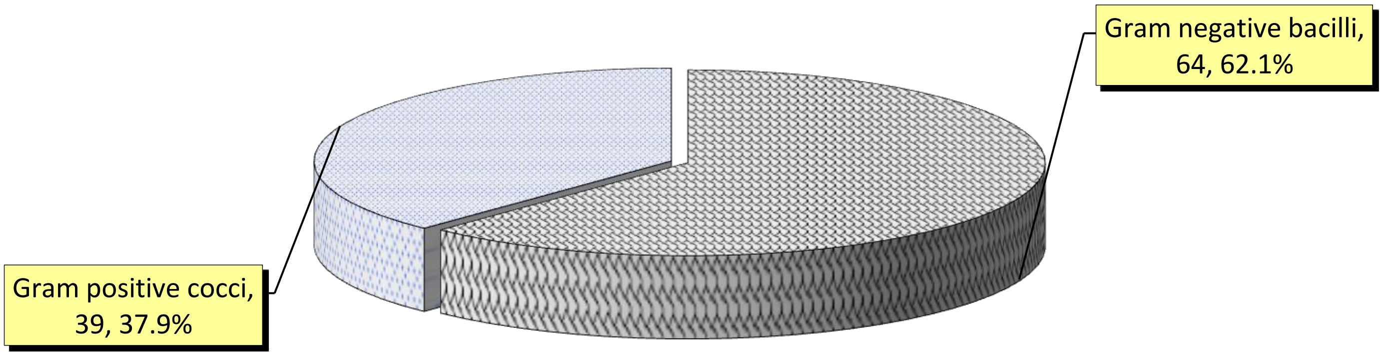

Figure 1. Distribution of the Microorganism isolates from 88 positive cases

Table 2 shows the Klebsiella species and Pseudomonas aeruginosa were the most prevalent (36.9% and 16.5% respectively) among the Gram-negative bacilli, followed by Escherichia coli (5.8%) and Proteus species (2.9%). Streptococcus pneumonia was the most prevalent among Gram-positive cocci (21.3%), followed by Staphylococcus aureus and Streptococcus pyogenes (11.7% and 4.9% respectively).

Table 2. Distribution of the Bacterial isolates from sputum of patients with RTI

Bacterial species		No. of isolates	%
Gram-negative *bacilli*	*Klebsiella species*	38	36.9
	Pseudomonas aeruginosa	17	16.5
	Escherichia coli	6	5.8
	Proteus species	3	2.9
Gram-positive *cocci*	*Streptococcus pneumonia*	22	21.3
	Staphylococcus aureus	12	11.7
	Streptococcus pyogenes	5	4.9

The drug sensitivity to bacterial pathogen isolates from patients with RTIs:

High rates of resistance to Amoxicillin and Cephalothin was demonstrated by all bacteria, whereas most isolates were found to be highly sensitive to Amikacin, Ciprofloxacin and Tobramycin. Klebsiella species showed high resistance to most of antibiotic agents except Amikacin, Ciprofloxacin and Tobramycin were the most potent activity against this strain.

*Streptococcus pneumonia*e, showed moderate to high resistance against Cephalothin, Tetracycline and Erythromicin, while good effect to other antibiotic agents, which were used in this study. *Pseudomonas aeruginosa*, *Streptococcus* pyogenes and *Escherichia coli* isolates exhibited strong resistance to most tested antibiotic types except Amikacin, Ciprofloxacin and Tobramycin revealed good efficacy.

Most of isolates showed good susceptibility to Cefotaxim and Gentamicin except Klebsiella species (18.4%) and Escherichia coli (33.3%) which were poor efficacy to these antibiotics agents. Majority of isolates were highly resistance to Tetracycline and Erythromicin except Proteus species and Staphylococusaureus showed fully sensitive to these antibiotic agents. These results, as presented in figures (2-8).

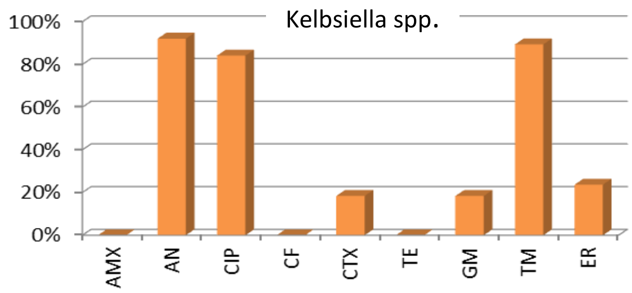

Figure 2. Susceptibility of Klebsiella *species* to antibiotics

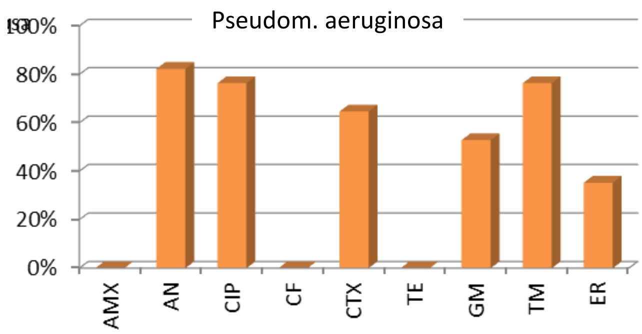

Figure 3: Susceptibility of *Pseudomonas aeruginosa* to antibiotics

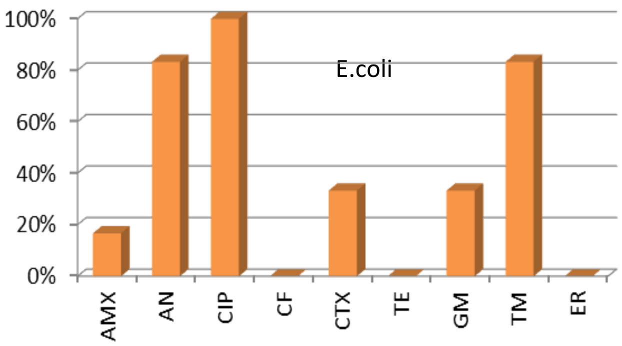

Figure 4. Susceptibility of E.coli *to* antibiotics

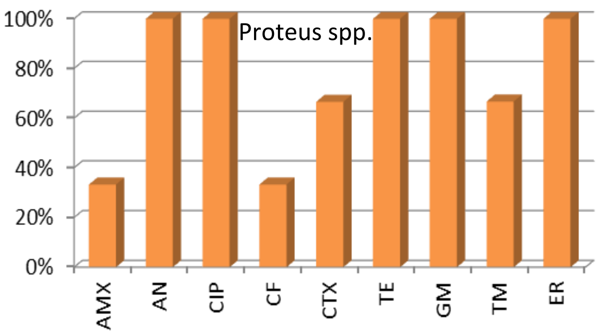

Figure 5. Susceptibility of *Proteus species* to antibiotics

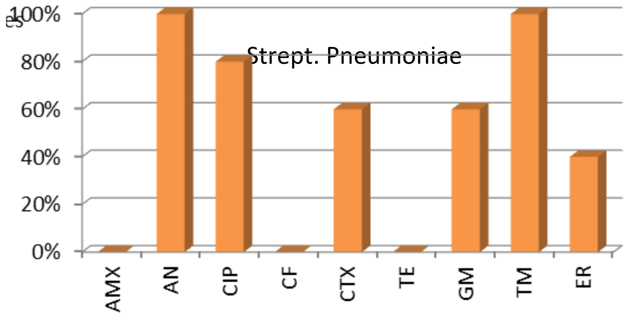

Figure 6: Susceptibility of *Streptococcus* pneumoniae *to* antibiotics

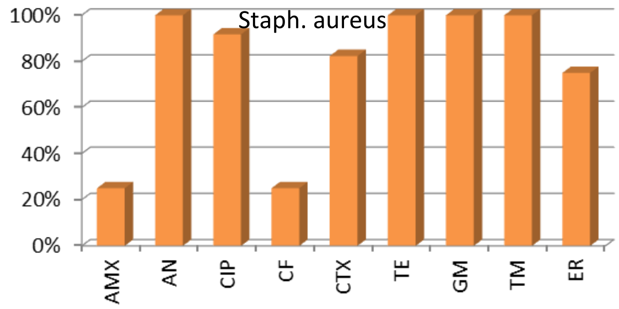

Figure 7. Susceptibility of *Staphylococcus aureus* to antibiotics

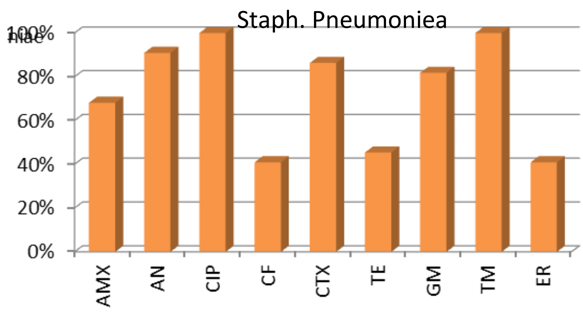

Figure 8: Susceptibility of Streptococcus pyogenes to antibiotics

Discussion

The current study showed a high percentage of Gram-negative bacteria (62.1%) among patients with RTIs. This finding was higher than that reported by Schneeberger *et al.* [12] (8%), while it was lower than that reported by Okesola and Ige [13], (93%). These differences in these results may be due to the same patients were under antimicrobial treatment at the time of specimens collection.

It is clear from this work that the *Klebsiella* species and *Pseudomonas aeruginosa* were the most prevalent among the Gram negative pathogens (36.9% and 16.5% respectively), followed by *Escherichia coli* (5.8%) and *Proteus* species (2.9%). *Streptococcus pneumonia* was the most prevalent among the Gram-positive organisms identified in (21.3%) followed by *Staphylococcus aureus* and *Streptococcus pyogenes* (11.7 % and 4.9% respectively). These results are approximately in agreement with Okesola and Ige, [13] but it was different with the finding reported by other researchers ([14,15]).

High rates of resistance to AMX and CF were demonstrated by all bacteria, while most isolates were found to be highly susceptible to AN, CIP and TM. In contrast, (CTX, TE, GM and ER) were less effect against most of frequently isolates. Antimicrobial resistance by respiratory tract infections has increased worldwide due to excessive use of antimicrobial agents. However, increasing antibiotic resistance in frequently isolated respiratory tract pathogens complicated the selection process of antimicrobial agents [(7,8)]. *Klebsiella* species being the high resistance to most of antibiotic agents except AN, CIP and TM were the most potent activity against this strain. This finding is different with respect to what was mentioned by most previous studies [(13,16)]. *Streptococcus pneumoniae* showed moderate to high resistance against CF, TE and ER, while good effect to other antibiotic agents, which were used in this study. These results are approximately in agreement with other research [(13)]. TE showed the poor efficacy against *Streptococcus pneumonia* (45.4%). This result was higher than that reported by author [(17)], while it was lower than that reported by other [(18)].

Pseudomonas aeruginosa isolates showed complete resistance to each of AMX, CF and TE. This finding was in consistent with study of Levy [(19)],who proved that some strains of *Pseudomonas aeruginosa* were resistant to most every antibiotic now available. *Pseudomonas aeruginosa* also, showed low resistance to GM, CTX, CIP and TM. These results were in disagreement with reported by many other studies [(17,20,21)]. AN showed the most potent activity against *Pseudomonas aeruginosa* (82.3%). This result was compatible with other reported [(20)], while lower prevalent of resistant (10%) to this agent was proved by [(21)].

Based on the findings of our study, we conclude that Klebsiella species and *Streptococcus pneumonia*e can be considered an important etiology agent of respiratory tract infections, having a high rate of drug resistance. AN, CIP and TM were the most effect antibiotics in *vitro* against tested bacteria. Conversely, no or less effect of other antibiotic agents which were used in this study thus should not be considered the drugs of choice in the treatment of patients with RTI in our study.

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Received 31st Jan: 2012: Accepted 12th Sept. 2012.