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Rasheed & Al-Khafaji

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ANTIBIOTICS SUSCEPTIBILITY PATTERN OF COMMON PATHOGENIC BACTERIAL STRAINS ISOLATED FROM PATIENTS WITH LOWER RESPIRATORY TRACT INFECTION (LRTI)

Sama Kamal Rasheed[1]**,*   ***Ahmed Salim Kadhim Al-Khafaji[1,]
[1] Department Biology, College of Science, University of Baghdad, Baghdad, Iraq. sama.kamal9977@gmail.com
2Department Biology, College of Science, University of Baghdad, Baghdad, Iraq. khafaji@sc.uobaghdad.edu.iq

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ABSTRACT

Lower respiratory tract infections LRTIs are quickly becoming the most prevalent infectious disorders affecting people. This investigation focused on characterizing the current shift in the bacterial strains causing the infections of respiratory tract among patients and their antimicrobial sensitivity pattern since antibiotic resistance has developed in all major pathogens.

In the microbiology lab of the Department of Biology Sciences / University of Baghdad, a cross- sectional research using non-probability sequential sampling method was carried out. Respiratory sputum samples taken from individuals with lower respiratory tract infections and collected 149 bacterial isolates. *M. catarrhalis*, *S. pneumonia* and *H. influenzae* were the bacterial pathogens diagnosed by VITEK 2 system and then gathered for further investigation. Frequencies along with percentages were calculated for categorical parameters including microorganism, age and gender. Continuous data like age was presented as mean ± standard deviation SD. We used chi-square test for data analysis the value of Chi Square was deemed significant when the p value was P<0.05 . The pathogen that was identified most often was *M. catarrhalis* 60.4 percent, or 90 patients, followed by *H. influenza* 28.1 %, or 42 patients and *S. pneumonia* 11.4 %, or 17 patients. Levofloxacin had a greater sensitivity to *S. pneumoniae* n=17, 11.4%. Meropenem 42 28.2% was more effective against *H. influenza*. The *M. catarrhalis* pattern showed a 57% sensitivity to Co-amoxiclav, a 49% sensitivity to Ceftriaxone, and a 34.9% sensitivity to Erythromycin susceptibility.

***M. catarrhalis*, *H. influenzae* and *S. pneumoniae* were the most frequently isolated bacteria from LRTIs. We found that the *M. catarrhalis* strain was highly resistant to moxifloxacin 49.7% and co-trimaxazole 53.7%. Co-amoxiclav resistance in *S. pneumoniae* was 8.1%, while Moxifloxacin resistance in *H. influenzae* was 5.4%.**

Keywords: Lower Respiratory Tract Infection, Antibiotics Sensitivity, *Streptococcus pneumoniae* and *Moraxella catarrhalis*.

نمط الحساسية للمضادات الحيوية من السلالات البكتيرية الممرضة الشائعة المعزولة من المرضى المصابين بعدوى الجهاز التنفسي السفلي(LRTI)

سما كمال رشيد[1]، احمد سالم كاظم الخفاجي[2]
[1]قسم علوم الحياة، كلية العلوم، جامعة بغداد، بغداد، العراق، sama.kamal9977@gmail.com
2 قسم علوم الحياة، كلية العلوم، جامعة بغداد، بغداد، العراق، khafaji@sc.uobaghdad.edu.iq

الخلاصة

بتسارع مضطرد أصبحت التهابات الجهاز التنفسي السفلي LRTIs من أكثر الاضطرابات المعدية التي تصيب الناس انتشارًا. ركزت هذه الدراسة على توصيف التحول الحالي في السلالات البكتيرية المسببة لالتهابات الجهاز التنفسي بين المرضى ونمط الحساسية لمضادات الميكروبات منذ أن تطورت مقاومة المضادات الحيوية في جميع مسببات الأمراض الرئيسية.

في مختبر الأحياء الدقيقة التابع لقسم علوم الأحياء/ جامعة بغداد، تم إجراء بحث مقطعي باستخدام طريقة أخذ العينات المتسلسلة غير الاحتمالية. عينات البلغم التنفسي المأخوذة من الأفراد المصابين بعدوى الجهاز التنفسي السفلي وتم جمع 149 عزلة بكتيرية. *M. catarrhalis, H. influenzae ,S. pneumoniae* كانت من اهم العوامل الممرضة التي تم جمعها عند الاستقصاء عنها وتشخيصها باستخدام جهاز VITEK 2. تم حساب التكرارات مع النسب المئوية لمؤشرات الفئات بما في ذلك الكائنات الحية الدقيقة والعمر والجنس. تم تقديم البيانات المستمرة مثل العمر بحساب المتوسط الحسابي للقيم مع + انحرافها المعياري SD+ عن المتوسط. استخدمنا اختبار chi-square لتحليل البيانات، واعتبرت قيمة Chi Square مهمة عندما كانت قيمة P<0.05 .

اظهرت نتائج الدراسة وجود بكتريا *M.catarrhalis* بنسبة 60.4% من اصل 90 مريضا عند تشخيصها، تلتها بكتريا *H. influenzae* 28,1٪، 42 مريضاً و *S. pneumoniae* 11,4٪، بعدد 17 مريضاً. كان لدى Levofloxacin حساسية أكبر *S. pneumoniae* مريض17 ، 11,4٪ . كان42 Meropenem 28,2% أكثر فعالية ضد *H. influenzae*. أظهر نمط *M. catarrhalis* حساسية57٪ تجاه Co-amoxiclav، وحساسية 49٪ لـ Ceftriaxone، وحساسية 34.9٪ لقابلية Erythromycin .

وجدنا أن *M.catarrhalis* كانت شديدة المقاومة لـ moxifloxacin 49.7٪ وco-trimaxazole 53.7٪ . كانت مقاومة Co-amoxiclav في *S.pneumoniae* هي8,1٪، بينما كانت مقاومة Moxifloxacin في *H.influenza* 5,4٪.

الكلمات المفتاحية: عدوى الجهاز التنفسي السفلي ، حساسية المضادات الحيوية ، *S.pneumoniae* ، *M.catarrhalis*.

INTRODUCTION

Primary examples of Lower Respiratory Tract Infection (LRTIs) include acute exacerbations of preexisting pneumonia and chronic bronchitis. Geographical location, age distribution and other risk variables like hospitalization all contribute to the etiology of LRTIs. Incidences of community acquired LRTIs and nosocomial have increased, mirroring the growth of other incapacitating illnesses such as respiratory system impairment (COPD and asthma), chronic kidney disease and diabetes (**Sharma & Singh., 2012**) (**Chang *et al.*, 2009**). Community-acquired LRTIs are caused by *Streptococcus pneumoniae*, *Moraxella catarrhalis*, *Haemophilus influenzae*, and *Staphylococcus aureus*, whereas nosocomial LRTIs are caused by Gram-negative organisms (*Klebsiella* spp., *Acinetobacter* spp., *Pseudomonas* and *Escherichia coli*,). Atypical pneumonias may also be caused by other pathogens, such as *Mycoplasma pneumoniae* and *Chlamydia*. Although antibiotics are often used to treat LRTIs, they are not effective against viruses. New infections and forms of resistance to standard treatments need a shift in both the antibiotics used and the approach used to treat them. *M. catarrhalis*, *H. influenzae*, and several Gram-negative bacilli are among the LRTI pathogens that have become resistant to first-line treatment because they produce β-lactamase (**Guthrie., 2021**).

The clinical features of these infections demand the use of empirical antibiotic therapy prior to learning the etiology and susceptibility patterns of the causative bacteria (**Metersky *et al.*, 2012**). Clinical efficacy of -lactam medicines has been hampered significantly, by the widely usage of extended-spectrum - carbapenems and β-lactamases. The use of antibiotics on an impromptu basis is likely to blame for this pattern of resistance (**Aslan & Akova., 2019**) (**Paterson & Bonomo., 2005**). Emergence of multi-resistant bacteria such carbapenemase, *Klebsiella pneumoniae* and *H. influenzae* β--lactamase further complicates the issue (**Aslan & Akova., 2019**). To prevent the spread of antimicrobial resistance and cut down on overall treatment expenses, it is important to choose the antimicrobial therapy for bacterial LRTIs based on an understanding of their etiology and the antimicrobial susceptibility pattern. The purpose of this research was to determine the frequency of common LRTI-causing microbes are and how they respond to different classes of antibiotics (**Llor & Bjerrum., 2014**). The rise of multidrug-resistant pneumococcal bacteria and resistance to penicillin has become a worldwide health crisis. Antibiotic-resistant pneumococci have been on the rise since the late 1980s and are now considered a pandemic threat. Pneumococci that are resistant to the antibiotic penicillin are widely distributed different regions of the world (**Appelbaum.,1987**). Resistance to penicillin in the United States rose from 5 percent to 6.6 percent between 1991 and 1992, with only 1.3% of isolates showing Minimum inhibitory concentrations (MICs) of $\geq$2.0 ug/ml (**Appelbaum., 1992**). Widespread and intensive monitoring is required everywhere, even in countries where resistance is relatively rare, since resistant pneumococci may move from country to country (**Dowson *et al.*, 1994**).

Pneumococcal infections are often treated using data from the past and research conducted on completely susceptible strains of the bacteria. However, significant consequences for therapy are at stake due to the rise of penicillin resistance and resistance to other antimicrobials. Serious systemic infections such as meningitis caused by pneumococcal strains with decreased penicillin sensitivity are commonly treated with ceftriaxone and cefotaxime alone or in combination with vancomycin (**Dowson *et al.*,1994**). Critically sick patients in underdeveloped nations are particularly vulnerable to (RTIs), which are spread via the air or by personal contact and are considered one of the world's most serious infectious diseases (**Mannur *et al.*, 2015**). Coughing, dyspnea, wheezing, expectoration, and/or chest discomfort often lasting 1–3 weeks are all signs of a lower respiratory tract infection (LRTI). Acute form of LRTIs may nor may involve lungs, including but not limited to: bronchiolitis, acute bronchitis, community-acquired pneumonia (CAP) either with radiological examinations or without radiological evidence and acute exacerbation of chronic obstructive pulmonary disease (**Mannur *et al*., 2015**). In both first- world and third-world countries, LRTIs are a leading cause of death and disability. After ischemic heart disease and cerebrovascular illness, it is the third greatest cause of mortality worldwide (**Regasa, 2014**).

Several factors, such as characteristics of the high-risk population, inappropriate antibiotic therapy, immunosuppressive drugs, quality of the available health care facilities, distribution of causative agents as well as prevalence of antimicrobial resistance (**Paterson & Bonomo., 2005**), can affect the incidence and associated mortality due to LRTI. One of the current public health challenges of the 21st century is antimicrobial resistance, which makes it harder to treat and prevent a wide variety of bacterial infections. Over the course of many decades, antibiotic usage has increased drastically, and the extensive use of these medications has greatly aided the emergence of antibiotic-resistant bacteria (**Okesola & Ige., 2008**). The aims of the study were to assess the frequency of different pathogen strains of lower respiratory tract infections and to determine the frequency of Moraxella catarrhalis in the pathogenicity of lower respiratory tract infections.

MATERIALS AND METHODS

Laboratory culture data from tertiary care institutions in Baghdad, Iraq, was used in a descriptive cross-sectional analysis to estimate antibiotic susceptibility patterns in lower respiratory infection. Data from the labs of 79 male and 70 female patients diagnosed with LRTIs at tertiary care facilities in Baghdad, Iraq, were analyzed. The 6-months' time frame, from September 2021 to February 2022, was used for retrieval of information, classification of data according to research inclusion and exclusion criteria, and documentation. All medical records of patients who were potentially eligible and who had been diagnosed with a lower respiratory tract infection (LRTI) were reviewed in order to obtain laboratory results.

The culture sensitivity reports were included using a sampling approach that was convenient at the time and the laboratory data were accessed. The demographic information gathered included age, gender, and antibiotic susceptibility patterns. Gram's staining was utilized to divide bacteria into gram-negative and gram-positive strains (**Rodloff *et al*., 2008**) .

Bacterial isolates were cultured from sputum taken from individuals with LRTI. Patients between the ages of 32 and 82 years were isolated after 48 h. Ventilator-associated pneumonia and other cases of healthcare-associated pneumonia were disqualified. Bacterial identification and antibiotic susceptibility testing were conducted according to protocols developed by the Clinical Laboratory Standard Institute (CLSI). Exclusion requirements were strappingly satisfied. The institution's ethics board provided written approval. Patients' informed consent was also collected.

Information such as patient age, gender, specimen collection location, and visit type was recorded. Sheep blood agar (SBA), Mac Conkey agar and chocolate agar were used to inoculate the samples. These media plates underwent normal process streaking using a sterile wire loop. Colonies formed on the culture plates after being cultured at 35^{o}C in ambient atmosphere" for 24 h. Standard methods were used to identify the organisms produced and assess their antibiotic susceptibility depending on Clinical Laboratory Standard Institute (CLSI) (**Shen &Sergi., 2023**) (**Weinstein & Lewis., 2020**).

Colonies of *H. influenzae* were identified as "Gram negative moist, rods, tiny, smooth gray colonies with absence of hemolysis, positive oxidase and catalase test. The results of oxidase test may vary in some conditions.

Satellite growth surrounding streaks of *Staphylococcus aureus* in the presence of growth factors V and X may provide a false-negative result in an oxidase test. "Gram negative cocci on gram staining, colony morphology, oxidase test, hockey puck sign, catalase test, and butyrate esterase production, and their inability to ferment sugars" are diagnostic of *M.catarrhalis*. The presence of "tiny, round, flat, and transparent colonies, with central depression (checker piece and nail head colonies), hemolysis, catalase negative and oxidase negative, absence of bile-esculin hydrolysis, lysis by bile-salts, susceptibility to optochin, and other biochemical characters" are all characteristics used to identify *S. pneumoniae*. Whereas the diagnosis of all bacterial isolates mentioned above was confirmed by using the VITEK 2 system.

Isolated bacteria and yeast were put through Kirby-Bauer disc diffusion tests for resistance on Mueller Hinton agar plates. After 24 h in the incubator, the isolated colonies were suspended in 0.5 McFarland turbidity normal saline. Mueller Hinton agar plates were prepared by streaking them with sterile swabs. The MHA plates had antimicrobial discs of varying intensities. Oxoid (UK) and Bioanalyse (Turkey) supplied the antimicrobial discs used in this study. Antimicrobials including "ampicillin (10 g), co-amoxiclav (amoxicillin/clavulanic acid 20/10 g), meropenem (10 g), levofloxacin (5 g), co-trimoxaz- ole (trimethoprim/ sulfamethoxazole 1, ceftriaxone (30 g), cefadroxil (30 g), ciprofloxacin (5 g). After inverting the plates, they were kept for 16-18 h in 37° C incubator. The sizes of the inhibitory zones were recorded after incubation.

Table (1): CLSI antibiotic breakpoints for bacterial strains susceptibility

Antibiotic concentrations in vitro	Bacterial strains	Sensitive (S)	Intermediate (I)	Resistant (R)
ampicillin (10g)	*M.catarrhalis*	-	-	–
	S.pneumoniae	–	-	–
	H.influenzae	≤ 1	2	≥ 4
co-amoxiclav (amoxicillin/clavulanicacid20/10g)	*M.catarrhalis*	≤4	-	>1
	S.pneumoniae	≤2	4	≥8
	H.influenzae	≤ 4/2	–	≥ 8/4
levofloxacin (5g)	*M.catarrhalis*	–	-	-
	S.pneumoniae	≤ 2	4	≥ 8
	H.influenzae	≤ 2	-	-
meropenem (10g)	*M.catarrhalis*	–	-	>2

	S.pneumoniae	≤ 0.25	0.5	≥ 1
	H.influenzae	≤ 0.5	–	–
co-trimoxaz- ole (trimethoprim/ sulfamethoxazole 1, ceftriaxone (30g)	*M.catarrhalis*	≥13	11–12	<15
	S.pneumoniae	≤ 0.5/9.5	1/19–2/38	≥ 4/76
	H.influenzae	≤ 0.5/9.5	1/19–2/38	≥ 4/76
cefadroxil (30g)	*M.catarrhalis*	-	-	-
	S.pneumoniae	–	-	-
	H.influenzae	≤ 0.5	–	–
ciprofloxacin (5g)	*M.catarrhalis*	≤1	-	>0.5
	S.pneumoniae	–	-	-
	H.influenzae	≤ 1	-	-

STATISTICAL ANALYSIS

The data of this research study was analysed using SPSS 21 (Statistical Package for the Social Sciences). Frequencies and percentages were computed for factors including microbial strain, gender, and antibiotic resistance. Age, and other quantitative characteristics were analysed using mean and standard deviation. A chi-square test was performed, and a significance level of p value $P<0.05$ was set.

RESULTS AND DISCUSSION

The demographic information of the individuals who took part in the research is shown in table 2. There were a total of 79 males, comprising 53% of the group, and 10 females, comprising 47%. With the average age of 52.99±12.35 years. The total number of smokers in the male population were 53 (67.1%), whereas only 5 (7.1%) of the women in the study population smoked cigarettes. It was reported that only 10 males (12.7%) were alcoholics. There were 13 (16.5%) males and 8 (11.4%) females who had a history of TB. The number of males was higher than the number of females , as shown in the table (2).

Table (2): Demographic Characteristics of Study Participants

Gender		Frequency	Percent
Male		79	53.0
Female		70	47.0
Smoking			
Male	**Non-Smoker**	26	32.9
	Smoker	53	67.1
Female	**Non-Smoker**	65	92.9
	Smoker	5	7.1
	Alcohol Consumption		
Male	**No**	69	87.3
	Yes	10	12.7
Female	**Yes**	0	0
	No	70	100.0
	Tuberculosis History		
Male	**No**	66	83.5
	Yes	13	16.5
Female	**No**	62	88.6
	Yes	8	11.4

Our results agree with the fact that infectious illnesses affecting the lower respiratory system (LRTIs) are now among the most prevalent worldwide. Since the causative bacteria for LRTIs vary by region, the susceptibility profile will also change depending on geographical location (**Safiri *et al.*, 2023**). Therefore, our cross-sectional study confirmed that it is crucial for the selection of suitable therapy to have updated information on the microorganisms responsible for LRTIs and their sensitivity profile.

Antimicrobial resistance patterns among microorganisms isolated from patients were investigated in this study. The most often identified organism was *M. catarrhalis* (60.4 percent, or 90 patients), followed by *H. influenzae* (28.1 percent, or 42 patients), and *S. pneumoniae* (11.4 percent, or 17 patients). The most prevalent organism found to cause community-acquired lower respiratory tract infections was *M. catarrhalis*, with a frequency of 60.4% (90). The antibiotic resistance patterns shown by *H. influenzae*, *S. pneumoniae*, and *M. catarrhalis* are described in (figure 1).

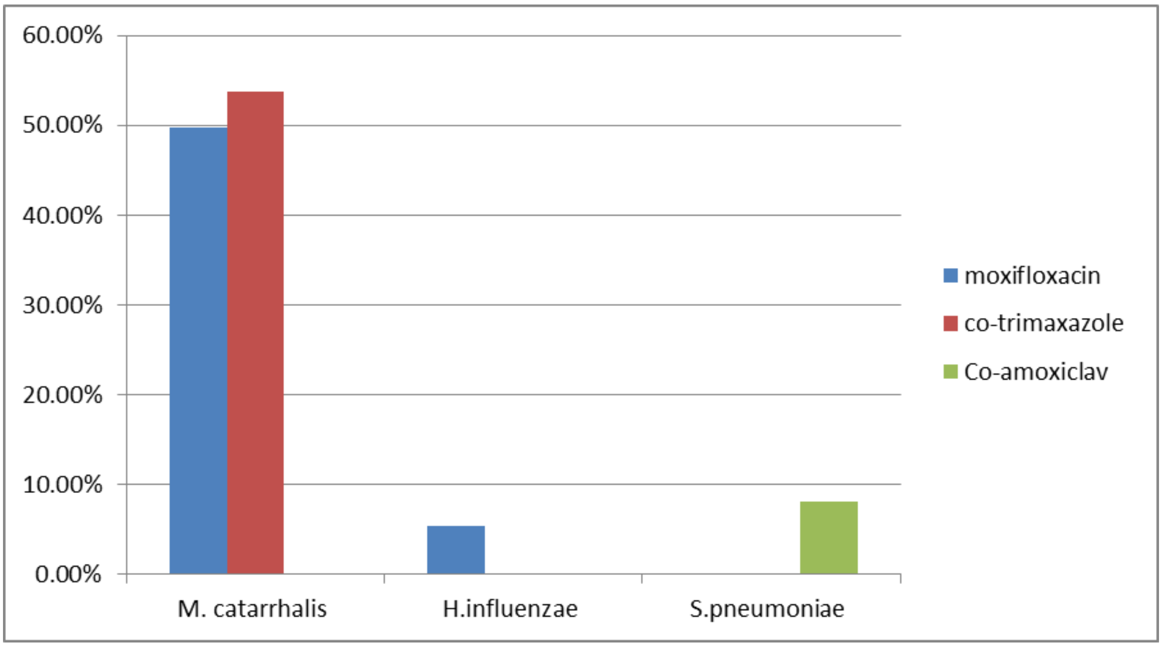

Figure (1): Antibiotic resistance patterns by the most common pathogenic strains in lower respiratory tract infections.

Both moxifloxacin (49.7% resistance) and co-trimaxazole (53.7% resistance) had higher resistance on the *M. catarrhalis* strain that we tested. The percentage of *S. pneumoniae* resistant to co-amoxiclav was 8.1%, whereas the percentage of *H.influenzae* resistant to moxifloxacin was 5.4%.

It was shown that the male and female groups that were affected by LRTI had distinct differences in the frequency pattern of pathogen strains. *M. catarrhalis* was found at a higher frequency in both groups, reaching a maximum of 50 and 40 frequencies in males and females respectively. On the other hand, the frequency of *H. influenza* was 16 in the male population and 26 in the female population correspondingly. In comparison to the other two strains, *S. pneumoniae* was the one that appeared less often. We identified a statistically significant difference between the male and female groups when we used the chi-square test to compare the frequency of these pathogen strains. The p-value for this finding was 0.021 as shown in table 3.

Table (3): Comparison of LRTI Pathogen Strains in Male and Female Participants

	Pathogen Strain			**Total**	**p-value**
	Moraxella catarrhalis	**Haemophilus influenza**	**Streptococcus pneumoniae**		
Male	50	16	13	79	0.021
Female	40	26	4	70	
	90	42	17	149	

After classifying the ages of the people who participated in our research into the various age groups, we analyzed the variance in the frequency pattern of the three types of strains that were seen among our study population. It was shown that individuals between the ages of 46 and 60 had a significantly greater incidence of both *M. catarrhalis* (n=55) and *H. influenzae* (n=23). *S .pneumoniae* was shown to be more prevalent in individuals between the ages of 60 and 80. When we compared the prevalence of LRTI pathogens using the chi-square test, we discovered that there was a significant difference between them. The p-value that was computed was P<0.01 as shown in the table (4).

Table (4): Comparison of Age Distribution and Frequency of LRTI Pathogen Strains in Recruited Samples

Age Category (Years)	**Pathogen Strain**			**Total**	**p-value**
	Moraxella catarrhalis	**Haemophilus influenzae**	**Streptococcus pneumoniae**		
30-40	4	19	0	23	<0.01
40-60	55	23	6	84	
60-80	29	0	11	40	
>80	2	0	0	2	

As per our study findings, patients with LRTIs were reportedly had *M. catarrhalis* isolated from their respiratory tracts. Nonetheless, *S. aureus* was shown to be the most common bacterium in Pakistan, with *S. pneumoniae* coming in second (**Khawaja *et al.* ,2013**). Another research done in Pakistan found that *H. influenza* and *S. pneumoniae* were the leading causes of LRTI, whereas *M. catarrhalis* categorized in sixth position. *M. catarrhalis* has emerged as a pathogen in the past 20-30 years and is currently thought to be a root cause of upper respiratory tract infections in adults .and even in healthy children (**Abdullah *et al.*, 2013**).

All of the *S. pneumoniae* strains that were isolated in our study exhibited variable susceptibility to vancomycin and it was confirmed by multiple studies which reported similar findings regarding the inconsistent sensitivity of *S. pneumoniae* strains to vancomycin. Multiple studies from different parts of the world confirmed similar findings (**Rao *et al.*, 2013**) (**Knobbe *et al.*, 2020**). Resistance to penicillin is especially major concern in *S. pneumoniae*. In one study, researchers found out that only 1% of *S. pneumoniae* were resistant to penicillin (**Knobbe *et al.*, 2020**). Antimicrobial susceptibility pattern of S. pneumonia isolated from CAP patients were assessed in a Greek study from the early 1990s. While only 14% of participants in that study showed resistance to penicillin (**Maraki & Papadakis., 2014**). Nevertheless, our study findings reported 47% (12) resistance to penicillin.

S. pneumoniae drug resistance profiles differ greatly across nations. Ceftriaxone resistance in *S. pneumoniae* ranged from 0% in Greece (**Maraki & Papadakis.,2014**) whereas it was reportedly 30% in south India in a study conducted in 2013 (**Rao *et al.*, 2013**). We found widespread resistance to Co-amoxiclav (8.1%), ampicillin (6.7%, n=10) and ceftriaxone (6.7%, n=10), whereas only low levels of resistance to these drugs were reported in multiple studies.
Based on the results of the current investigation, it is believed that *H. influenzae* is surprisingly sensitive to a wide variety of antibiotics. Meropenem (28.2%), ampicillin (27.5%), ceftriaxone (27.5%), cefixime (26.8%), moxifloxacin (24.2%) and co-trimaxazole showed (20.1%), higher sensitivities against *H. influenzae*. The results are consistent with those of previous research done in various regions of the world (**Maraki & Papadakis., 2014**) (**Santella *et al.*, 2021**). However, a study done in Kuala Lumpur found that cotrimoxazole resistance was present in 26% of the cases. When comparing our findings to those from Ethiopia, where sixty-six percent of the isolates were reportedly resistant to cotrimoxazole antibiotic, but then dramatic decline in cotrimoxazole resistance among *H. influenzae*. Resistance to fluoroquinolones in *H. influenzae* has been discovered less frequently in South Asian countries (**Ansarie & Kasmani.,2015**). However, we have found that 24.2 percent of *H. influenzae* isolates are resistant to the fluoroquinolone drug i.e. moxifloxacin.

In recent years, *M. catarrhalis* has become increasingly recognized as a major pathogen responsible for LRTI. 90% of *M. catarrhalis* isolates are ampicillin-resistant because they produce β-beta lactamase enzyme. *M. catarrhalis* strain was highly resistant to Moxifloxacin (49.7%) and co-trimaxazole (53.7%). Co-amoxiclav resistance in *S. pneumoniae* was 8.1%, while Moxifloxacin resistance in *H. influenzae* was 5.4%.

As a result, amoxicillin-clavulanate and other beta-lactam/beta-lactamase inhibitor combinations have been considered as first-line therapy for *M. catarrhalis* infections (**Bandet *et al.*, 2014**). Similar to previous investigations (**Tamang *et al.*, 2005**), all *M.catarrhalis* isolates showed a 100% sensitivity to amoxicillin/clavulanate and ceftriaxone. Ramana and colleagues 30 found the same degree of sensitivity to amoxicillin/clavulanate. The current study found that moxifloxacin resistance was highest (49.7%), followed by co-trimaxazole (53.7%).

Over the last two to three decades, *M. catarrhalis* has become an influential pathogen. In fact, this seems to be a rise in the prevalence of strains that produce β-lactamase, which might have major implications for the treatment of infections. The British and American Thoracic Societies recommend amoxicillin or a macrolide as the first line of antibiotic therapy for outpatients. Respiratory fluoroquinolones or β-lactam with macrolide should be used to treat individuals who do not require critical care (**Knobbe *et al.*, 2020**).

Patients with critical health conditions should take clarithromycin or another respiratory fluoroquinolone in addition to a β-lactam (**Knobbe *et al.*, 2020**). The local resistance pattern should also be documented, as this data might help in guiding the choice of a suitable first course of antibiotic treatment. Continuous surveillance at both the local and national levels is still necessary to detect any ancillary changes in the frequency of pathogens and to observe drift in their sensitivity pattern, despite the fact that antibiotic susceptibility pattern and prevalence of these bacteria vary from nations to nations. This information could aid medical professionals in making informed decisions about antimicrobial therapy for the treatment of LRTI. In addition, it has the potential to reduce antimicrobial resistance in both natural environments and clinical settings.

Both the Council for Appropriate and Rational Antibiotic Therapy and the World Health Organization criteria stress the importance of selecting the most effective drug but within shorter period of time. Less drug exposure, fewer side effects, more time saved, better compliance, and lower healthcare costs are all possible advantages of a shorter course with higher dose therapy (**Spellberg & Rice., 2019**).

CONCLUSION

The trend of susceptibility of lower respiratory tract pathogenic strains shows that *M.catarrhalis* is the most common bacterial agent of LRTIs, followed by *H.influenzae* and *S.pneumoniae*. The most often isolated bacteria from lower respiratory tract infections were *M.catarrhalis*, *H. influenzae*, and *S.pneumoniae*. Both moxifloxacin and co-trimaxazole had higher resistance on the *M. catarrhalis* strain that we tested. The percentage of *S.pneumoniae* resistant to co-amoxiclav was higher than the percentage of *H. influenzae* resistant to moxifloxacin. Therefore, careful administration of antimicrobial medicines will lessen the burden of antibiotic resistance, allowing for appropriate patient management and reducing the morbidity as well as mortality caused by LRTIs.

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