

Common Bacterial Causes of Lower Respiratory Tract Infection Other than Acid Fast Bacilli in Erbil City

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Abstract:

Background and objectives: Lower respiratory tract infection (LRTI) is one of the major causes of morbidity and mortality in young children and elderly. The most important lower respiratory infection is pneumonia, the fourth leading cause of death. Most cases of bronchitis are of viral etiology.

Most common lower respiratory infections are acute bronchitis, chronic bronchitis, and pneumonia; the common causative agents are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Enterococcus spp*, *Klebsiella pneumoniae*.

Aims of the study was to find the common bacterial causes of lower respiratory tract other than acid fast bacilli in Erbil city and to determine if there is any relation between the causative agents with gender of the patients, also to determine the antibacterial susceptibility profile of the bacteria that isolated from patients with lower respiratory tract infection.

Method: 250 sputum samples collected from patients suffering from lower respiratory tract infection attending the Microbiology Laboratory of Rezgary Hospital, Raparin Hospital and Par Hospital within period of 6 months (from August 2016 to February 2017). A questionnaire form sheet prepared for each patient who includes the following information: Patient name, age, gender, residence, symptoms, Drug history, past medical history and antimicrobial susceptibility done for each pathogen either by vitek or disk susceptibility tests.

Result: From 250 patients only 142 patients showed positive growth, 100 (70.4%) were males and 42(29.6%) were females. Lower respiratory tract infection was mostly seen in age group of (41-50) years. The age range in this study varied between six months and 97 years with mean age (47 ± 25.23) years. All together 10 different species of bacteria were identified, majority of which were gram negative (89.42%). The gram-negative bacteria were: *Klebsiella pneumoniae* (30.29%), *Acinetobacter baumannii* (28.9%), *Pseudomonas aeruginosa* (11.9%), *Escherichia coli* (8.45%), *Pseudomonas oryzae* (4.94%), *Serratia marcescens* (2.82%) and *Proteus mirabilis* (2.12%) isolated from sputum samples. The gram-positive bacteria were: *Staphylococcus aureus* (7.04%), *Streptococcus pneumoniae* (2.12%) and *Streptococcus oralis* (1.42%) isolated from sputum samples. On performing antimicrobial susceptibility testing, in gram-positive bacteria, they were resistant to Amoxicillin and Penicillin while most of them were sensitive to Tetracycline. While in gram negative bacteria, they were resistant to Amoxicillin and Ampicillin and most of them were sensitive to Amikacin.

Conclusion: Most of the isolated bacteria were gram negative which was (89.44%) while (10.56%) were gram positive. The prevalence of lower respiratory tract infection caused by bacterial infection is higher in males than females. Most of the gram positive and gram negative were resistant to most of the common antibiotics that used by the patients. Varieties of pathogens are responsible for lower respiratory tract infection and antimicrobial resistance has become significant public health problem.

Keywords: Respiratory tract infection, Gram positive bacteria, Gram negative bacteria.

Introduction:

Lower respiratory tract infections (LRTI) include infection of trachea, bronchi and lungs. It usually occurs when infecting organisms reach the airway of pulmonary parenchyma by passing the mechanical and other nonspecific barriers of the upper respiratory tract. Infection may result from inhalation of infectious aerosols, aspiration of oral or gastric contents or by heterogeneous spread ⁽¹⁾.

Most common lower respiratory infections are acute bronchitis, chronic bronchitis, and pneumonia; the common causative agents are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Enterococcus spp*, *Klebsiella pneumoniae* ⁽²⁾.

Symptoms include coughing up mucus, wheezing, shortness of breath, and chest discomfort. Bronchitis is divided into two types: acute and chronic ⁽³⁾.

Chronic bronchitis affects people of all ages but is more prevalent in people over 45 years of age. As opposed to acute bronchitis chronic bronchitis results from inhalation of respiratory tract irritants, the most common being cigarette smoke, air pollution, chemical fumes, fungal spores, dust, and other environmental irritants ⁽⁴⁾.

Acute bronchitis is approximately (90%) are viral in origin and (10%) bacterial. The most common cause of acute and chronic bronchitis in the pediatric population is: viral infections (Adenovirus, Influenza Virus, Parainfluenza Virus, Respiratory Syncytial Virus, Rhinovirus, Coxsackie Virus, Herpes Simplex Virus) ⁽⁵⁾.

Secondary bacterial infections are also part of an acute respiratory infection (extremely rare in nonsmokers without cystic fibrosis). The most common bacterial pathogen that causes lower

respiratory tract infections in children of all age groups is *Streptococcus pneumoniae*. *Moraxella catarrhalis* and *Haemophilus influenzae* ⁽⁶⁾.

A chronic or recurrent insult to the airway epithelium, such as recurrent aspiration or repeated viral infection may contribute to chronic bronchitis in childhood. Thus, it may be caused by repeated attacks of acute bronchitis, which can weaken and irritate bronchial airways with time. Following damage to the airway lining, chronic infection by commonly isolated airway organisms may occur industrial pollution is a common cause; however, the chief reason is heavy long term exposure to cigarette smoke ⁽⁷⁾.

Recurrent episodes of acute or chronic bronchitis may be associate with immunodeficiency. Studied showed that those children which had recurrent sinopulmonary infection mostly they had immunoglobulin A (IgA) and immunoglobulin G (IgG) deficiency ⁽⁸⁾.

Pneumonia is a form of acute respiratory tract infection (ARTI) that affects the lungs and has many possible causes, but the most common are bacteria and viruses. The most common pathogens are *Streptococcus pneumoniae*, *Haemophilus influenzae* and respiratory syncytial virus (RSV) in children under five years in the developing world ⁽⁹⁾.

The populations most at risk for pneumonia are children under five years, people aged 65 or over, and people with pre-existing health problems ⁽¹⁰⁾.

Aims of the study were:

To find the common bacterial causes of lower respiratory tract other than acid fast bacilli in Erbil city and to determine the antibacterial susceptibility profile of

the bacteria that isolated from patients with lower respiratory tract infection.

Materials and Methods:

Study population:

The study population, were the patients who attended the Rizgary, Raparin Teaching Hospital and Par Private Hospital either as inpatient or outpatient during the period (August 2016 to February 2017) with symptoms suggestive of lower respiratory tract infections (LRTIs). All patients had diagnosed as a case of lower respiratory tract infections by the specialist doctors included in the study. Those patients were on antibiotics in a week before the samples were excluded.

Questionnaire form sheet prepared for each patient who includes the following information: Patient name, age, gender, residence, symptoms, Drug history, past medical history.

Sample collection:

Early morning sputum samples were collected from two hundred and fifty patients (176 were males and 74 were females) patients and all patients were instructed on how to collect the sputum samples aseptically and taken to the laboratory immediately for analysis. The sputum samples were collected into well-labeled sterile, wide mouthed glass bottles with screw cap tops.

The sample either collected by the patients him or during bronchoscopy sometimes suction can also be used to collect a sputum sample, this method is often used for people who are very sick and for children.

The samples were immediately transported to the laboratory after collection and all bacterial isolates were subjected to a series of confirming tests and bacterial susceptibility were determined for each bacteria.

Microscopic Identification:

This includes shape of the cell and reaction to gram stain. Smears were prepared from isolated bacterial culture, stained with gram stain and examined under light microscope using oil immersion objective.

Cultural identification:

In order to obtain maximal yield, specimens where inoculated to several culture media after incubation overnight at 37°C, the bacterial colonies were identified on the following agars:

Blood agar, Chocolate agar, MacConkeyagar and Muller Hinton agar.

The newly redesigned colorimetric Vitek 2 compact system with updated advanced expert system (AES) was evaluated for its accuracy and rapidity to identify clinical isolates and to detect several antimicrobial resistances.

Also the antibacterial susceptibility testing of the isolates also was done by using the Kirby-Bauer disk diffusion method by using 1 ml of an 24 hours culture of each bacterium previously adjusted to turbidity Standard of 0.5 on McFarland Scale was seeded on the plates containing Mueller- Hinton agar, the plates then swabbed evenly across the surface of a Mueller Hinton agar plates and some antibiotic discs were gently and firmly placed on the agar plates, which were then left at room temperature for 1 hour and then incubated at 35 - 37°C for 24 hours and then zones of growth inhibition were then measured to the nearest millimeter and recorded, Interpretation of results was done using zone sizes, those isolates that displayed diameter of zones of inhibition in antimicrobial susceptibility test less than or equal to (6 mm) were considered resist antibiotics, while those isolates with diameter of

zones of inhibition more than or equal to 7 mm were considered susceptible (2006)⁽¹¹⁾.

Results:

From (250) patients attending the Rizgary and Raparin Teaching Hospital and Par Private Hospital with signs and symptoms of lower respiratory tract infection whom diagnosed by the specialist physician: 176 patients were males and 74 patients were females and sputum obtained from them for bacterial culture and sensitivity, 142 which represents (56.8%) showed bacterial growth, of which 127(89.44%) were gram negative while 15(10.56%) were gram positive as shown in figure (1). The mean age of the patients was (47±25.23) with maximum and minimum age (97 year, 6 months) respectively and in table (1) which show the distribution of bacterial isolates from sputum, 10 types of bacteria were isolated, out of 10 bacteria, 7 isolated species were gram negative bacilli and 3 were gram positive cocci. In gram negative, *Klebsiella pneumonia* 43(30.29%) had the highest number of isolation and *Proteus mirabilis* 3(2.12%) had the lowest number of isolate. While in the gram positive, *Staphylococcus aureus* 10(7.04%) had the highest number of isolate and *Streptococcus oralis* 2(1.42%) had lowest number.

In this study males infection was predominant 100(70.47%) than females 42(29.53%) as shown in table (2), this table shows the highest prevalence of bacterial isolate in both male and female was *Klebsiella pneumoniae* 31(21.9%) in male and 12(8.45%) in females on other hand *Proteus mirabilis* and *Streptococcus pneumonia* 1(0.7%) which were the lowest number of isolate in males. While in female they had highest number of *Klebsiella pneumonia* 12(8.45%) and lowest number of *Staphylococcus aureus* 1(0.7%).

As shown in table (3). The highest percentage of isolated pathogens detected in the age group (41-50) and the lowest infections with LRT in the age group (21-30) years and age range in this study varied between six months and 97 years with mean age (47±25.23).

The table (4) shows the antimicrobial susceptibility of gram positive.

For *Staphylococcus aureus*, they had highest number of sensitivity to Tetracycline 7 and vancomycin and Teicoplanin and 6(40%) to gentamycin and Trimethoprim/ sulfamethaxole while it's highly resistant to (Amikacin, Ampicillin, Penicillin and Cefuroxime) as shown in table (4).

For *Streptococcus pneumonia*, they have 3(100%) of sensitivity to (Tetracycline, sulfamethaxole and Meropenem) and 3(100%) resistance to (Amoxicillin/ Clavulanic acid, Penicillin, Amoxicillin, and Cefuroxime).

For *Streptococcus oralis* had 2(100%) sensitivity to (Trimethoprim/ sulfamethaxole, Gentamycin, Meropenem, Vancomycin, Tetracycline) and 2(100%) resistant to (Cefuroxime, Ampicillin, Ciprofloxacin, Erythromycin, Penicillin, Amoxicillin).

The table (5) shows the antimicrobial susceptibility of gram negative bacteria.

For *Acinetobacter baumannii*, shows that 40(97.6%) have resistance to (Cefixim) and highly resistant to (Amikacin, Meropenem and Trimethoprim/ sulfamethaxole) while 38(92.7%) had sensitivity to (Tetracycline) and they are highly sensitive to (Cephalexin).

For *Escherchia coli*, 12(100%) had resistance to (Amoxicillin) and highly resistant to (Ampicillin, Ceftriaxone and Cefixim) while 12(100%) sensitivity to (Tetracycline) and highly sensitive to (Amikacin, Gentamycin and Meropenem).

For *Pseudomonas aeruginosa*, 17(100%) had resistance to (Trimethoprim/

sulfamethaxol) and highly resistant to (ceftriaxone, tetracycline, cefixime and amoxicillin) while its 17(100%) sensitivity to Amoxicillin/ Clavulanic acid and highly sensitive to (Amikacin, Gentamicin and Meropenem).

For *klebsiella pneumonia*, 40(93%) had resistance to Amoxicillin and highly resistant to (Ampicillin and cefotixin) and it's highly sensitive to (Amikacin and tetracycline).

For *Proteus mirabilis*, about 3(100%) had resistance to (Amoxicillin, cephalixin, Amoxicillin/ Clavulanic acid, Ceftriaxone) and highly resistant to (Ampicillin, Meropenem, Cefiximand Trimethoprim/ sulfamethaxol) and

3(100%) sensitivity to (Amikacin, Ciprofloxacin and Gentamycin).

For *Serratia marcescens* 4(100%) had resistance to (Amoxicillin) and showed high resistant to (Ampicillin, Amoxicillin/ Clavulanic acid and Cefixim) and 4(100%) sensitivity to (Teicoplanin) and showed high sensitivity to (Meropenem, Tetracycline and Cephalixin).

For *pseudomonas oryzihabitans* 7(100%) resistance to (Amoxicillin) and highly resistant to (Ciprofloxacin, Amoxicillin/ Clavulanic acid and Cephalixin) and 6(85.7%) sensitivity to (Ceftriaxone, Tetracycline, Cefixim and Trimethoprim/ sulfamethaxole).

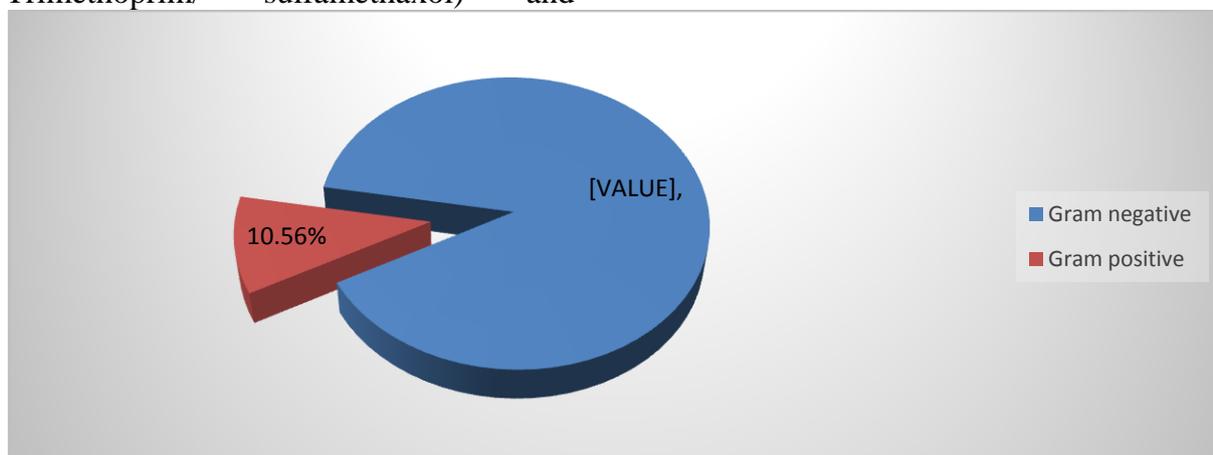


Figure (1): Distribution of microorganism isolates from 142 positive cases.

Table (1): Distribution of bacterial isolates from sputum of patient with LRTI.

Bacterial species		No. of isolates	Percentage (%)
Gram-negative bacilli	<i>klebsiella pneumonia</i>	43	30.29
	<i>Acinetobacter baumanii</i>	41	28.9
	<i>Pseudomonas aeruginosa</i>	17	11.9
	<i>Escherchia coli</i>	12	8.45
	<i>Pseudomonas oryzihabitans</i>	7	4.94
	<i>Serratia marcescens</i>	4	2.82
	<i>Proteus mirabilis</i>	3	2.12
Gram-positive cocci	<i>staphylococcus aureus</i>	10	7.04
	<i>streptococcus pneumonia</i>	3	2.12
	<i>Streptococcus oralis</i>	2	1.42
Total		142	100

Table (2): prevalence of the isolates according to gender.

	Gender				Total number and percentage of isolated	
	Male		Female			
	No	%	No.	%	No	%
<i>Klebsiella pneumoniae</i>	31	21.9	12	8.45	43	30.35
<i>Acinetobacter baumannii</i>	30	21.12	11	7.74	41	28.85
<i>Escherchia coli</i>	6	4.22	6	4.23	12	8.45
<i>Pseudomonas aeruginosa</i>	13	9.15	4	2.82	17	11.97
<i>Proteus mirabilis</i>	1	0.7	2	1.4	3	2.1
<i>Serratia marcescens</i>	4	2.82	0	0	4	2.82
<i>Pseudomonas oryzihabitans</i>	5	3.53	2	1.4	7	4.93
<i>Staphylococcus aureus</i>	9	6.33	1	0.7	10	7.03
<i>Streptococcus oralis</i>	0	0	2	1.4	2	1.4
<i>Streptococcus pneumoniae</i>	1	0.7	2	1.4	3	2.1
Total	100	70.47	42	29.53	142	100

Table (3): Effect of age on the prevalence of lower respiratory tract infection.

	Bacterial isolates										Total	
	Gram negative bacilli						Gram positive cocci					
	<i>A.baumannii</i>	<i>E. coli</i>	<i>P.aeruginosa</i>	<i>K. pneumoniae</i>	<i>P. Mirabilis</i>	<i>S.marcescens</i>	<i>P.oryzihabitans</i>	<i>S. aureus</i>	<i>S. oralis</i>	<i>S.pneumoniae</i>	Frequency	Percentage (%)
≥1-10	3	1	3	4	0	0	1	1	0	1	14	9.9
11-20	6	0	1	3	0	1	1	1	0	0	13	9.2
21-30	4	2	0	1	0	0	0	0	2	0	9	6.3
31-40	5	0	0	8	0	3	0	2	0	0	18	12.7
41-50	9	2	2	9	3	0	1	3	0	2	31	21.8
51-60	4	1	6	3	0	0	0	1	0	0	15	10.6
61-70	5	2	2	6	0	0	2	0	0	0	17	11.9
≥71	5	4	3	9	0	0	2	2	0	0	25	17.6
Total	41	12	17	43	3	4	7	10	2	3	142	100

Table (4): Antimicrobial susceptibility profiles of gram positive isolates.

Antibiotic disc used	Pathogens					
	<i>Staphylococcus aureus</i> (n=10)		<i>Streptococcus pneumoniae</i> (n=3)		<i>Streptococcus oralis</i> (n=2)	
	Sensitive No. (%)	Resistant No. (%)	Sensitive No. (%)	Resistant No. (%)	Sensitive No. (%)	Resistant No.(%)
AK	3(30)	7(70)	2(66.6)	1(33.4)	1(50)	1(50)
AM	1(10)	9(90)	1(33.40)	2 (66.6)	0	2(100)
CRO	4(40)	6(60)	1(33.4)	2(66.6)	1(50)	1(50)
CIP	4 (40)	6(60)	1(33.4)	2 (66.6)	0	2(100)
GM	6 (60)	4(40)	1(33.4)	2(66.6)	2(100)	0
MEM	5 (50)	5(50)	3(100)	0	2(100)	0
AMC	6(40)	4(40)	0	3(100)	1(50)	1(50)
CAZ	5 (50)	5 (50)	1(33.4)	2(66.6)	0	0
VA	7 (70)	3(30)	2(66.6)	1(33.4)	2(100)	0
E	5(50)	5 (50)	1(33.4)	2 (66.6)	0	2(100)
P	1(10)	9(90)	0	3(100)	0	2(100)
TE	7(70)	3(30)	3(100)	0	2(100)	0
CL	5(50)	5(50)	2(66.6)	1 (33.4)	1(50)	1(50)
AX	0	10(100)	0	3(100)	0	2(100)
OX	2(20)	8 (80)	2(66.6)	1 (33.4)	1(50)	1(50)
CXM	2(20)	8(80)	0	3(100)	0	2(100)
TEC	7(70)	3(30)	2(66.6)	1(33.4)	1(50)	1(50)
SXT	6(60)	4(40)	3(100)	0	2(100)	0

AK=Amikacin, AM=Ampicillin, CRO=Ceftriaxone, CIP=Ciprofloxacin, GM=Gentamycin, MEM=Meropenem, AMC=Amoxicillin/Clavulanic acid, VA=Vancomycin, E=Erythromycin, P=Penicillin, TE=Tetracycline, CFM=Cefixim, CL=Cephalexin, AX=Amoxicillin, OX=Oxacillin, CXM=Cefuroxime, TEC=Teicoplanin, SXT=Trimethoprim/sulfamethaxole

Table (5): Antimicrobial susceptibility profiles of gram negative isolates.

Antibiotics	A. baumannii (n=41)		E. coli (n=12)		P. aeruginosa (n=17)		K. pneumonia (n=43)		P. Mirabilis (n=3)		S. marcescens (n=4)		P. oryzihabitans (n=7)	
	R No. (%)	S No. (%)	R No. (%)	S No. (%)	R No. (%)	S No. (%)	R No. (%)	S No. (%)	R No. (%)	S No. (%)	R No. (%)	S No. (%)	R No. (%)	S No. (%)
AK	34 (82.9)	7 (17.1)	1 (8.3)	11 (91.7)	5 (29.4)	12 (70.6)	12 (27.9)	31 (72.1)	0	3 (100)	2 (50)	2 (50)	4 (57.1)	3 (42.8)
AM	35 (85.4)	6 (14.6)	10 (83.3)	2 (16.7)	10 (58.8)	6 (35.2)	36 (83.7)	7 (16.3)	2 (66.6)	1 (33.4)	3 (75)	1 (25)	2 (28.5)	5 (71.4)
CRO	40 (97.6)	1 (2.4)	8 (66.6)	4 (33.4)	1 (4.2)	3 (17.7)	27 (62.8)	16 (37.2)	3 (100)	0	2 (50)	2 (50)	1 (14.3)	6 (85.7)
CIP	38 (92.6)	3 (7.4)	6 (50)	6 (50)	8 (47.1)	9 (52.9)	19 (44.1)	24 (55.9)	0	3 (100)	2 (50)	2 (50)	5 (71.5)	2 (28.5)
GM	23 (55.1)	18 (43.9)	1 (8.3)	11 (91.7)	5 (29.4)	12 (70.6)	11 (25.5)	32 (74.5)	0	3 (100)	2 (50)	2 (50)	2 (28.5)	5 (71.4)
MEM	37 (90.2)	4 (9.9)	3 (25)	9 (75)	5 (29.4)	12 (70.6)	18 (41.8)	25 (58.2)	2 (66.6)	1 (33.4)	1 (25)	3 (75)	3 (42.9)	4 (57.1)
AMC	33 (80.4)	8 (19.6)	5 (41.6)	7 (58.4)	0	17 (100)	21 (48.8)	22 (51.2)	3 (100)	0	3 (75)	1 (25)	5 (71.5)	2 (28.5)
TE	3 (7.3)	38 (92.7)	0	12 (100)	14 (82.3)	3 (17.6)	7 (16.3)	36 (83.7)	1 (33.4)	2 (66.6)	1 (25)	3 (75)	1 (14.2)	6 (85.7)
CFM	40 (97.5)	1 (2.5)	8 (66.6)	4 (33.4)	1 (4.2)	2 (11.7)	12 (27.9)	31 (72.1)	2 (66.6)	1 (33.4)	3 (75)	1 (25)	1 (14.2)	6 (85.7)
CL	8 (19.6)	33 (80.4)	11 (91.7)	1 (8.3)	14 (82.3)	3 (17.6)	11 (25.6)	32 (74.4)	3 (100)	0	1 (25)	3 (75)	5 (71.5)	2 (28.5)
AX	39 (95.1)	2 (4.9)	12 (100)	0	15 (88.3)	2 (11.7)	40 (93)	3 (7)	3 (100)	0	4 (100)	0	7 (100)	0
SXT	36 (87.8)	5 (12.2)	7 (58.3)	5 (41.7)	17 (100)	0	21 (48.8)	22 (51.2)	2 (66.6)	1 (33.4)	2 (50)	2 (50)	1 (14.2)	6 (85.5)

S: Sensitive R: Resistant

Some figures for the isolated bacteria



Figure (2): Colony of *Staphylococcus aureus* on blood agar.



Figure (3): colony of *Proteus mirabilis* on MacConkey agar.

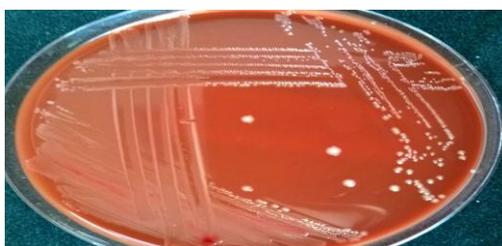


Figure (4): *Acinetobacter baumannii* colony on Chocolate agar.

Discussion:

From (250) patients complaining from lower respiratory tract infection whom diagnosed by the specialist physician: 176 patients were males and 74 patients were females and sputum obtained from them for bacterial culture and sensitivity, 142 which represents (56.8%) showed bacterial growth, of which 127(89.44%) were gram negative while 15(10.56%) were positive.

The result of this study is almost similar to study by (Khan *et al*)⁽¹²⁾ who reported (49.3%) and (Tamang *et al*)⁽¹³⁾ who revealed (50.4%) and with (Amutha *et al*)⁽¹⁴⁾ who reported (51%) while in a study done in Nigeria by (Okesola and Ige)⁽¹⁵⁾. Their results showed that (26.3%) were culture positive which is lower than that reported in the present study.

The current study showed a high percentage of Gram-negative bacteria (89.44%) among patients with LRTIs. This finding was higher than that reported by (Schneeberger *et al.*)⁽¹⁶⁾ (8%), while it was similar to that reported by (Okesola and Ige)⁽¹⁵⁾ 13(93%).

The National Nosocomial Infections Surveillance (NNIS) of the center for disease control of USA reports (60%) of nosocomial pneumonias to be caused by aerobic GNB. We found GNB to be the predominant organism (96.04%) with low isolation of *S. aureus*. These results were similar to those obtained by (Kumari, *et al*)⁽¹⁷⁾, (Okesola and Ige)⁽¹⁵⁾ and (Goel, *et al.*)⁽¹⁸⁾ who found that GNB isolated was (92.2%, 93% and 97.4%) respectively.

The result of this study found that *Klebsiella pneumonia* was demonstrated in 43(30.29%) and it was the most predominant pathogen isolated in samples and this was in agreement with study which done in Ibadan, Nigeria by (Okesola and Ige)⁽¹⁵⁾ who demonstrated that the major single pathogens causing LRTI are *Klebsiella* species (38%) and (Egbe, *etal*)⁽¹⁹⁾ who revealed that *Klebsiella pneumonia* was the most predominant isolate causing LRTI.

The incidence of *E.coli* was positive in 12 (8.45%) of samples and this result was in agreement with the results of (taura, *et al*)⁽²⁰⁾ which reported 9(6%)

and lower than the result reported by (Khan, et al)⁽¹²⁾ which was 15(26.79%). The *Acinetobacreaumanaii* isolated in 41(28.9%) of samples and this was in agreement with a study done by (Villers, et al)⁽²¹⁾ which revealed *Acinetobacreaumanaii* in (26.7%) of sputum samples in patients with LRTI.

Pseudomonas aeruginosa isolated in 17(11.9%) of samples and this result in agreement with (Okesola and Ige)⁽¹⁵⁾ which reported (16.7%) of the isolated samples and it's lower than reported by (Saxena, et al)⁽²²⁾ which isolated (29.6%) of samples and this result was higher than reported by (Taura, et al)⁽²⁰⁾ which was (4.7%).

Pseudomonas oryzihabitans isolated in 7(4.94%) of samples and this result was higher than recorded by (Afifi, et al)⁽²³⁾ which was 1(0.8%) of samples.

Serratia marcescens was isolated in 4(2.82%) of isolated samples and this is in agreement with a study done by (Taura, et al)⁽²⁰⁾ who reported (2.3%) of isolated samples.

While growth of *Staph. aureus* was isolated in 10(7.04%) of samples and this in agreement with a study done by (Egbagbe, et al)⁽²⁴⁾ were isolation in 6(10.2%) of sample and (Shah, et al)⁽²⁵⁾ were reported *Staphylococcus aureus* in (5.9%) of samples also (Amutha, et al)⁽¹⁴⁾ who revealed that *Staphylococcus aureus* found to be accusative agent of lower respiratory tract infection in 22(5%) patients.

The isolation of *Streptococcus pneumonia* detected in 3(2.12%) of samples and this was in agreement with a study done by (Egbe, et al)⁽¹⁹⁾ which revealed 6(1.97) of the samples and is lower than that reported by (EL-Mahmood, et al)⁽²⁶⁾ which was (21.6%). *Streptococcus oralis* detected in 2(1.41%) of samples and this result was

similar to a study done by (Keith, et al)⁽²⁷⁾ who detected this pathogen in 33(4%) of patient with LRTI.

Klebsiella pneumonia detected in 43(26.3%) of samples and had the highest number of isolation and *streptococcus oralis* 2(1.42%) had lowest number of isolate.

In this study male infection was predominant 100(70.47%) than females 42(29.53%) and also shows the highest prevalence of bacterial isolate in both male and female was *Klebsiella pnunioniae* 31(21.9%) in male and 12(8.45%) in females and the result of this study was in agreement with a study done by (Amutha, et al) in which the LRTI was higher in males than females⁽¹⁴⁾.

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 (Taura, et al)⁽²⁰⁾ and females since were less mobile, they must have experienced less exposure to respiratory risk factors (Doddannavar)⁽²⁸⁾.

This is consistent with other studies conducted by (Panda, et al)⁽²⁹⁾ 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 contradict the data obtained by (El- Mahmood, et al)⁽²⁶⁾, in which out of (232) total isolates, 114(49.1%) were from males while 118 (50.9%) from females.

The highest percentage of isolated pathogens detected in the age group (41-50) years and this is agreed with the (Amutha, et al)⁽¹⁴⁾ who reported the same finding and (Okesola and Ige)⁽¹⁵⁾

which reported the highest percentage in the age group (41-60) years while (Taura, et al) ⁽²⁰⁾ reported the higher percentage of pathogens growth in age group (20-29) and (30-39) years and also (Saxena, et al) ⁽²²⁾ reported highest percentage of bacterial growth in those under 59 years age.

For *Staphylococcus aureus*, they had highest number of sensitivity to Tetracycline 7 and vancomycin and Teicoplanin and 6(40%) to gentamycin and Trimethoprim/ sulfamethaxole while it's highly resistant to (Amikacin, Ampicillin, Penicillin and Cefuroxime). In a study done by (taura, et al) ⁽²⁰⁾ the increased resistance was observed for penicillin in *S. aureus* (92.86%) and *S. aureus* was found to be only moderately sensitive to ceftazidime, ciproflaxacin and at the same time shows resistance to some antibiotics which are augmentin, amoxicillin, erythromycin, tetracycline, gentamycin, cotrimoxazole.

In another study done by (Egbagbe, et al) ⁽²⁴⁾ observed that *Staphylococcus aureus* accounted for (8%) of total isolates and was over (83%) susceptible to amoxicillin/ clavulanate, ceftriazone and (60%) susceptible to ceftazidime, ciprofloxacin, and gentamycin. It was however, (100%) resistant to Cotrimoxazole, tetracycline, cloxacillin and amoxicillin.

For *Streptococcus pneumoniae*, they have 3(100%) of sensitivity to (Tetracycline, sulfamethaxole and Meropenem) and 3(100%) resistance to (Amoxicillin/ Clavulanic acid, Penicillin, Amoxicillin, and Cefuroxime).

The result of our study was not in agreement with a study done by (Zafar, et al) ⁽³⁰⁾ observed that none of the isolate of *S.pneumoniae* was resistant to Beta lactams; ampicillin, amoxicillin,

amoxiclave, cephalosporin and cefixime.

The study done by (Manikandan and Amsath) ⁽³¹⁾ revealed that *S. pneumoniae* was susceptible to (98%) Amikacin, (88%) Cefotaxime, (82%) Ciprofloxacin, (77%) Ceftriaxone, (66.3%) Amoxicillin, (66.3%) Ofloxacin, (59.6%) Erythromycin, (55%) Cefuroxime, (39.3%) Gentamycin and (28%) Ampicillin.

For *Streptococcus orallishad* 2(100%) sensitivity to (Trimethoprim/ sulfamethaxole, Gentamycin, Meropenem, Vancomycin, Tetracycline) and 2(100%) resistant to (Cefuroxime, Ampicillin, Ciprofloxacin, Erythromycin, Penicillin, Amoxicillin).

In a study done by (Keith, et al) ⁽²⁷⁾ found that of the (35) *S. oralis* isolates, none was resistant to penicillin and vancomycin while 21(60%) were resistant to erythromycin, 27(77%) were resistant to tetracycline, and 4(11%) were resistant to Trimethoprim, *streptococcus orallis* is resistant to pencilin G.

On the other hand gram negative bacteria: for *Acinetobacter baumannii*, about 40(97.6%) had resistance to (Ceftriaxone, Cefixim) and highly resistant to (Amikacin, Meropenem and Trimethoprim/ sulfamethaxole) while 38(92.7%) had sensitivity to (Tetracycline) and they are highly sensitive to (Cephalexin).

In a study done by (Shrestha, et al) ⁽³²⁾ *Acinetobacter spp* exhibited (100%) resistance to Ceftaxidime and (75%) resistant to ampicillin and highly resistant to Ceftriaxone.

One of the most interesting features of *A. baumannii* is the ease by which it can acquire resistance to various antibiotics. Resistance of this organism can affect practically any drugs used in

clinical practice, as a result of the rapid acquisition of resistance genes to different and multiple classes of antibiotics, several drugs have already been eliminated from treatment options for *A. baumannii* infections such as penicillins, cephalosporins, aminoglycosides, quinolones and tetracyclines⁽³³⁾.

For *Escherichia coli*, about 12(100%) had resistance to (Amoxicillin) and highly resistant to (ampicillin, Ceftriaxone and Cefixim) while 12(100%) sensitivity to (Tetracycline) and highly sensitive to (amikacin, Gentamycin and Meropenem).

In a study done by (Taura, *et al*)⁽²⁰⁾ the *E. coli* was sensitive to gentamycin, augmentin, ceftazidime, ciprofloxacin but resistant to cotrimoxazole and tetracycline and in a study done by (Egbagbe, *et al*)⁽²⁴⁾ observed that *Escherichia coli* isolates were sensitive to ceftazidime, amoxicillin/ clavulanate (augmentin) and Ciprofloxacin and completely resistant to amoxicillin.

For *Pseudomonas aeruginosa*, about 17(100%) had resistance to (Trimethoprim/ sulfamethaxol) and highly resistant to (ceftriaxone, tetracycline, cefixime and amoxicillin) while its 17(100%) sensitivity to Amoxicillin/ Clavulanic acid and highly sensitive to (Amikacin, Gentamicin and Meropenem).

In a study done in Spain by (Bouza, *et al*)⁽³⁴⁾ found that for *Pseudomonas aeruginosa* the most effective antibiotic was Meropenem and its resistance rate was (14%)⁽³⁴⁾ and this result was in agreement with our results (17.6%).

For *Klebsiella pneumoniae*, about 40(93%) had resistance to Amoxicillin and highly resistant to (Ampicillin and cefotaxime) and it's highly sensitive to (Amikacin and tetracycline).

In a study done by (Kumar)⁽³⁵⁾ reported that *K. pneumoniae* showed least resistance to amikacin and proposed that Aminoglycosides be an alternative and better treatment of *K. pneumoniae* infection and this agreed with our study which showed high sensitivity to Amikacin (72.1%) and (74.5%) resistance to ampicillin and 11(25.5%) resistance to gentamicin.

For *Proteus mirabilis*, about 3(100%) had resistance to (Amoxicillin, cephalexin, Amoxicillin/ Clavulanic acid, Ceftriaxone) and highly resistant to (Ampicillin, Meropenem, Cefixim and Trimethoprim/ sulfamethaxol) and 3(100%) sensitivity to (Amikacin, Ciprofloxacin and Gentamycin).

The result of this study agrees with the result of a study done by (Okesola and Ige)⁽¹⁵⁾ that revealed that the isolated *Proteus mirabilis* was resistant to (Amoxicillin, Amoxicillin/ Clavulanic acid and Trimethoprim/ sulfamethaxol) while it was sensitive to (Ciprofloxacin-Gentamicin)

For *Serratia marcescens* 4(100%) had resistance to (Amoxicillin) and showed high resistant to (Ampicillin, Amoxicillin/ Clavulanic acid and Cefixim) and 4(100%) sensitivity to (Teicoplanin) and highly sensitive to (Meropenem, Tetracycline and Cephalexin).

In a study done by (taura, *et al*)⁽²⁰⁾ showed that *Serratia marcescens* was resistant to (amoxicillin, Cotrimoxazole and tetracycline) and it was sensitive to (Gentamicin and Ciprofloxacin).

For *pseudomonas oryzae* 7(100%) resistance to (Amoxicillin) and highly resistant to (Ciprofloxacin, Amoxicillin/ Clavulanic acid and Cephalexin) and 6(85.7%) sensitivity to (Ceftriaxone, Tetracycline, Cefixim and Trimethoprim/ sulfamethaxole).

This study revealed that most of gram negative bacteria were resistant to amoxicillin and ampicillin while most of them were sensitive to amikacin.

Widespread use of antibiotics has undoubtedly caused the epidemics of antimicrobial resistance worldwide. Unfortunately, resistance in some species has developed to the level that no clinically available treatment is effective. The genetic characterization of antimicrobial resistance genes as well as their location and diversity is important in identifying factors involved in resistance⁽³⁶⁾.

The increasing resistance to antibiotics by respiratory pathogens has complicated the use of empirical treatment with traditional agents and a definitive bacteriological diagnosis and susceptibility testing would, therefore, be required for effective management of LRTI⁽³⁷⁾.

Conclusions:

Most of the isolated bacteria was gram negative which was (89.44%) while 15(10.56%) were gram positive and the prevalence of lower respiratory tract infection caused by bacterial infection is higher in males than females, The main age group affected by bacterial infection was in the age group (41-50) years and most of the gram positive and gram negative were resistant to most of the common antibiotics that used by the patients.

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