Razi International Medical Journal

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RESEARCH ARTICLE

Sensitivity Pattern in Children Respiratory Bacterial Infections:
Respiratory bacterial infections in children and sensitivity of antibiotics

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ARTICLE INFO

Open Access

Received: 2023-08-11
Accepted: 2024-11-29
Published: 2024-11-30

Keywords:
Gram-negative bacteria
Gram-positive bacteria
Respiratory infections
Antibiotic resistance
Acinetobacter baumannii
Streptococcus pneumoniae
Pneumonia
Antibiogram
Seasonal variation

ABSTRACT

Background: Bacterial respiratory infections are a major health concern, especially in underdeveloped and developing countries. This study aims to evaluate the prevalence of Gram-negative and Gram-positive bacteria in respiratory infections and assess the efficacy of antibiotics.
Methods: A prospective, observational study was conducted from July 2010 to July 2011. Patients with respiratory infections were categorized by age, bacterial pathogen, disease type, and season of infection. Diagnostic methods, including throat swabs, blood cultures, and antibiograms, were used to identify pathogens and determine antibiotic resistance profiles. The infection rate was calculated using standard epidemiological formulas.
Results: Gram-negative bacteria accounted for 84.7% of infections, with Acinetobacter baumannii (26.4%) being the most common pathogen. Gram-positive infections, primarily caused by Streptococcus pneumoniae (77%), were also prevalent. The highest infection rates were observed in the spring, particularly among children under one year and those aged 1-6 years. Pneumonia was the most common diagnosis (43.5%). Ampicillin resistance was widespread, but Acinetobacter baumannii, E. coli, and Klebsiella pneumoniae showed sensitivity to Sulbactam, Cefoperazone, and Piperacillin/Tazobactam.
Conclusion: Acinetobacter baumannii was the predominant cause of respiratory infections, especially in young children and during spring. Ampicillin resistance was common, but Sulbactam, Cefoperazone, and Piperacillin/Tazobactam were more effective. These findings highlight the importance of targeted antibiotic therapy, particularly for Gram-negative bacterial infections.

Introduction

Bacteria are a large group of prokaryotic microorganisms, typically measuring just a few micrometers in length. They exhibit various shapes, including rods, spirals, and spheres, and are ubiquitous in nature, thriving in environments such as soil, acidic hot springs, radioactive waste, water, and the bodies

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Cite this article as Sensitivity Pattern in Children Respiratory Bacterial Infections: Respiratory bacterial infections in children and sensitivity of antibiotics. *Razi International Medical Journal, 4(2).* DOI: 10.56101/rimj.v4i2.161

of plants and animals, including humans (1-2). In fact, a single gram of soil or fresh water can contain millions of bacterial cells (3). The scientific study of bacteria is called bacteriology, a subfield of microbiology (4).

Bacteria can be classified into two categories based on their effects on humans: beneficial and pathogenic. Pathogenic bacteria are responsible for numerous infectious diseases, many of which affect the respiratory system, including pneumonia, otitis media, sinusitis, pulmonary tuberculosis, tonsillitis, and epiglottitis (5-6). Among the most common bacterial pathogens are Gram-positive bacteria such as Streptococcus pneumoniae, and Gram-negative bacteria such as Escherichia coli, Klebsiella pneumoniae, Haemophilus influenzae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Haemophilus para-influenzae (7-9).

Broad-spectrum antibiotics are those that act against a wide range of bacteria, including both Gram-positive and Gram-negative species, while narrow-spectrum antibiotics target specific bacterial types. Examples of broad-spectrum antibiotics include chloramphenicol, tetracycline, and fosfomycin, while narrow-spectrum antibiotics include penicillin and vancomycin (10-11).

In this study, we aim to determine the rates of Gram-negative and Gram-positive bacterial infections in the respiratory ward of Dalian Children's Hospital, considering factors such as bacterial species, respiratory diseases, patient age, and seasonal variations. Additionally, we seek to assess the spectrum of action of commonly used antibiotics in the hospital's respiratory ward through antibiogram testing (12).

Materials and Methods

Study area and population

This study was conducted at Dalian Children's Hospital, a teaching hospital located in the center of Dalian City, Liaoning Province, China. The hospital serves as a regional center for the treatment, prevention, and care of children under 18 years of age in South Liaoning Province. The hospital has 400 beds and 32 departments, providing care to approximately 1.7 million children annually. The study aimed to evaluate the rate of Gram-negative and Gram-positive bacterial infections in the respiratory ward and assess the sensitivity and resistance of various antibiotics against these pathogens.

The study population consisted of children under the age of 15 years who were admitted to the respiratory ward of Dalian Children's Hospital between June 2010 and June 2011. A total of 1,310 children were admitted to the ward during the study period. Of these, 255 children were diagnosed with bacterial respiratory infections, including 216 infected by Gram-negative bacteria and 39 by Gram-positive bacteria.

Study Design

This was a prospective, observational study designed to assess the prevalence of Gram-negative and Gram-positive bacterial infections, their antibiotic resistance profiles, and the distribution of these infections across different ages, respiratory diseases, and seasons. The study was carried out over a one-year period from June 2010 to June 2011.

Samples Collection

Convenience sampling was used to select patients admitted to the respiratory ward with confirmed or suspected bacterial respiratory infections. Children presenting with the following diagnoses were included in the study: Asthmatic Bronchitis, Pneumonia, Bronchial Asthma, Bronchiolitis, Interstitial Pneumonia, Laryngitis, Pharyngitis, Bronchitis Obliterans, Pleuritis, Tonsillitis, and Chronic Cough.

Throat swab cultures were obtained from all patients for microbiological analysis, and relevant clinical data were recorded, including the patient's name, age, sex, diagnosis, pathogen identified, and admission date.

Sample Size

Out of the 1,310 children admitted to the respiratory ward, 255 were diagnosed with bacterial infections. The sample consisted of 255 children, with 216 infected by Gram-negative bacteria and 39 infected by Gram-positive bacteria. These children were the focus of the study's analysis.

Sample Collection

Throat swabs were collected from each patient for microbial analysis. The process involved instructing the patient to tilt their head back and open their mouth as wide as possible. A sterile swab was used to collect samples from the back of the throat, around the tonsils, and from any red areas or sores. Alternatively, throat washouts were performed, where the patient gargled a small amount of saltwater and then spat it into a clean container to obtain a larger sample.

The collected samples were then labeled with patient information and sent to the laboratory for bacterial culture and sensitivity testing.

Microbial methods

1. *Throat Swab Culture:*

The throat swabs were cultured in a laboratory to isolate bacterial pathogens. The bacteria were then identified using standard microbiological techniques.

2. *Antibiogram:*

An antibiogram was performed to assess the bacterial resistance and sensitivity profiles to various antibiotics. After culturing the bacteria, an agar plate was prepared with small tablets containing different antibiotics. The cultured bacteria were inoculated onto the agar plate. If bacteria were susceptible to a particular antibiotic, a clear zone of inhibition (a "halo") formed around the antibiotic disc, indicating that the bacteria could not grow in that area. The plates were incubated at 37°C for 24 hours, and the results were recorded by observing the zone of inhibition.

Statistical Analysis

The rate of bacterial infection was calculated using the following formula:

Rate of Infection = Number of patients with infections\Population at risk X Constant (K)

Where K was taken as 100, and the rate of infection was expressed as a percentage. The infection rates were calculated for both Gram-positive and Gram-negative bacteria, and further categorized by different respiratory diseases, bacterial species, patient age, and season of infection. Antibiotic resistance and sensitivity patterns were also analyzed. Data were organized into charts and graphs using Microsoft Excel for visual presentation.

Results

1. Rate of bacterial infections in respiratory ward

The data was collected from July -2010 to July -2011 in Dalian children hospital, in this study the total amount of patients was 1310 in which 255 (19.46%) were infected. Among these 255 infected patients 216 (84.7%) patients were infected by Gram negative and 39 (15.3%) patients were infected by Gram positive.

2. Rate of bacterial infections according to different seasons

2.1 Rate of Gram-negative bacterial infections according to different seasons

Among 216 patients, 71 in spring (33%), 45 in summer (21%), 53 in autumn (21.2%), and 47 in winter (21.2%) were infected by Gram negative Bacteria. They are having high rate of infection in spring season (33.3%). Results are shown in Table 1 & Figure 1.

Table 1. Rate of Gram-negative & Positive bacterial infections according to different seasons

Season	Number of Patients	Rate of Gram-negative Bacterial infections According to Seasons (%)	Number of Patients	Rate of Gram-Positive Bacterial infections According to Seasons (%)
Spring	71	33.3	11	28.2
Summer	45	21	10	25.6
Autumn	53	24.5	8	20.5
Winter	47	21.2	10	25.6
Total	216	100	39	100

Gram negative & positive bacterial infections according to different seasons

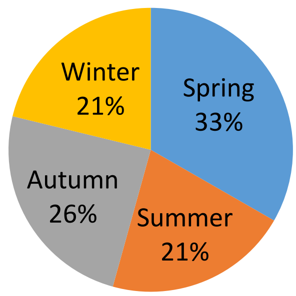

Figure 1. Pie diagram showing rate of Gram-negative bacterial infections according to different season

2.2 Rate of Gram-positive bacterial infections according to different seasons

Among 39 patients, 71 in spring (33%), 45 in summer (21%), 53 in autumn (21.2%), 47 in winter (21.2%) were infected by Gram positive bacterial infections. They are having high rate in spring season (28.2%). Results are shown in Table 1 above & Figure 2 below.

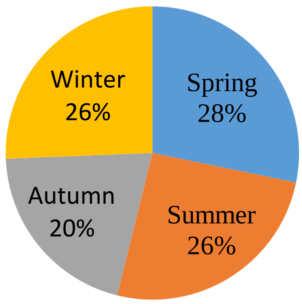

Figure 2. Pie diagram showing rate of Gram-positive bacterial infections according to different seasons

3. Rate of bacterial infections according to different ages

3.1 Rate of Gram-negative bacterial infections according to different ages

Among 216 patients 102 at age range less than 1 year (47.2%), 102 at age range from 1 to 6 years (47.2%), and 12 patients were at age range from 7 to 15 years (5.6%). Gram negative bacterial infections were at the high rate (47%) at the age range of less than 1 and 0-6 year. Table 2 & Figure 3.

Table 2. Rate of gram-negative & positive bacterial infections according to different ages

Age	Number of Patients	Rate of Gram-negative Bacterial Infections According to different Ages (%)	Number of Patients	Rate of Gram-positive Bacterial Infections According to different Ages (%)
< 1 year	102	47.2	13	33.3
1-6 years	102	47.2	24	61.6
7-15 years	12	5.6	2	5.1
Total	216	100	39	100

Gram negative & Positive bacterial infections according to different ages

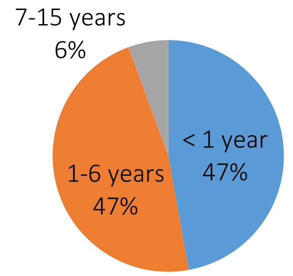

Figure 3. Pie diagram showing rate of Gram-negative bacterial infections according to different ages

3.2 Rate of Gram-positive bacterial infections according to different ages

Among 39 patients 13 patients were at age range less than 1 year (33.3%), 24 patients were at age range from 1 to 6 years (61.6%), 2 patients were at age range from 7 to 15 years (5.1%). Gram positive bacterial infections were at the high rate at the age range of 1-6 year (62%). Above Table (2) & below Figure (4).

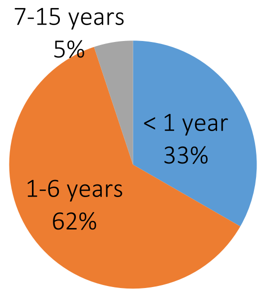

Figure 4. Pie diagram, Rate of Gram-positive bacterial infections according to different ages

4. Rate of Bacterial Infections according to different diseases

4.1 Rate of Gram-negative bacterial infections according to different diseases

Among 216 patients 94 Pneumonia (43.5%), 57 Bronchiolitis (26.4%), 21Asthmatic Bronchitis (9.7%), 20 Bronchitis (9.2%), 17 Asthma (7.9%), 5 laryngitis (2.3%), and 2 Pharyngitis (1%) patients were infected by Gram negative bacterial infections. Pneumonia (45%) is the most common disease caused by gram negative bacterial infections. Table 3 & Figure 5.

Table 3. Rate of Gram-negative & Positive bacterial infections according to different diseases

Diseases	**Number of Patients**	**Rate of Gr (-) Bacterial Infections According to different Diseases (%)**	**Diseases**	**Number of Patients**	**Rate of Gr (+) Bacterial Infections According to different Diseases (%)**
Pneumonia	94	43.5	Pneumonia	16	41
Bronchiolitis	57	26.4	Bronchiolitis	10	25.6
Asthmatic Bronchitis	21	9.7	Asthmatic Bronchitis	6	15.4
Bronchitis	20	9.2	Asthma	4	10.2
Asthma	17	7.9	Bronchitis	1	2.6
Laryngitis	5	2.3	Pharyngitis	1	2.6
Pharyngitis	2	1	Chronic Cough	1	2.6
Total	216	100	Total	39	100

Gram negative & positive bacterial infections rate according to different diseases

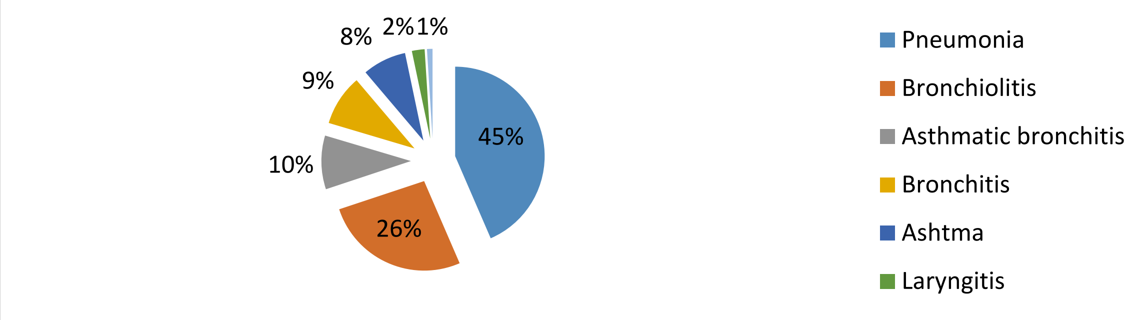

Figure 5. Pie diagram showing rate of Gram-negative bacterial infections according to different diseases

4.2 Rate of Gram-positive bacterial infections according to different diseases

Among 39 patients 16 Pneumonia (41%), 10 Bronchiolitis (25.6%), 6 Asthmatic Bronchitis (15.4%), 4 Asthma (10.2%), 1 Bronchitis (2.6%), 1 Pharyngitis (2.6%), and 1chronic cough (2.6%) patient were infected by Gram positive bacterial infections. Pneumonia (41%) is the most common disease caused by gram Positive bacterial infection. Above Table 3 above & Figure 6 below.

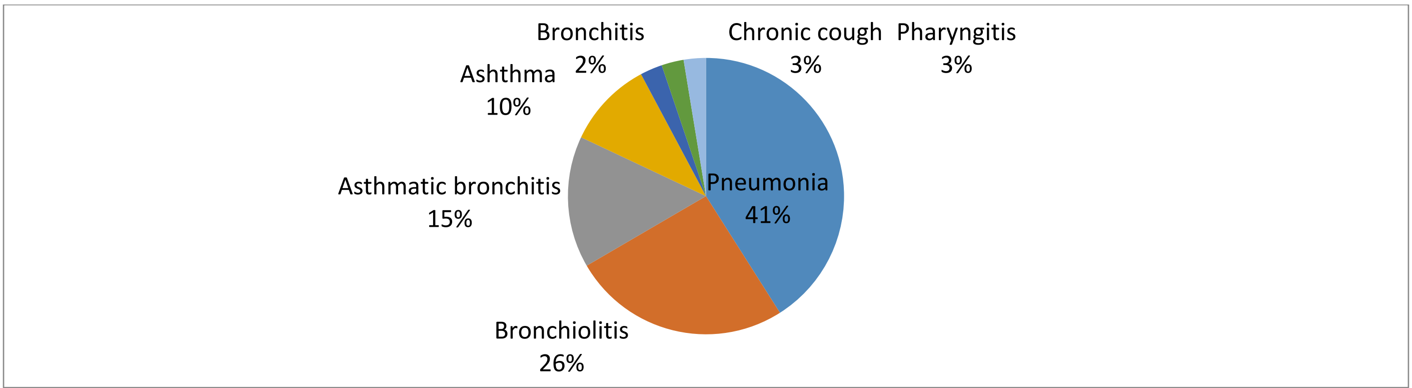

Figure 6. Pie diagram showing rate of Gram-Positive bacterial infections according to different diseases

5. Rate of Bacterial infection according to different Bacteria

5.1 Rate of Gram-negative bacterial infections according to different Bacteria

Among 216 patients 57 Acinetobacter Baumannii (26.4%), 33 H.influenza (15.2%), 29 E. Coli (13.4%), 24 Klebsiella Pneumonia (11.1%), 19 H. Para influenza (8.8%), 15 Pseudomonas Aeruginosa (6.9%), 11 Klebsiella Oxytoca (5%), 9 Enterobacter Cloacae (4.1%), 5 Chryseobacterium Indologens (2.3%), 4 Steno Trophomonas mall (1.9%), 3 Serratia Marcescens (1.4), 2 P. Fluorescens (1%), 1 Pantoea (0.5%), 1 Clostridium Perfringens (0.5%), 1 Burkholderia Cepacia (0.5%), 1 Enterobacter Sakazakii (0.5%), 1 Rhizobium Radiobacter (0.5%) patients were infected by these Bacteria. Acinetobacter Baumannii (26.4%) is the common bacteria among Gram negative. The results are shown in Table 4 & Figure 7.

Table 4. Rate of Gram-negative bacterial infections according to different Bacteria

Bacteria	**Rate of Infection (%)**	**Bacteria**	**Rate of Infection (%)**
Acinetobacter Baumannii	26.4	Steno Trophomonas mall	1.9
H. Influenza	15.2	Serratia Marcescens	1.4
E. Coli	13.4	P. Fluorescens	1
Klebsiella Pneumonia	11.1	Pantoea	0.5
H. Para Influenza	8.8	Clostridium Perferingeus	0.5
Pseudomonas Aeroginosa	6.9	Burkholderia Cepacia	0.5
Klebsiella Oxytoca	5	Enterobacter Sakazakii	0.5
Enterobacter cloacae	4.1	Rhizobium Radiobacter	0.5
Chryseobacterium Indolens	2.3		
Gram negative bacterial infections according to different Bacteria			

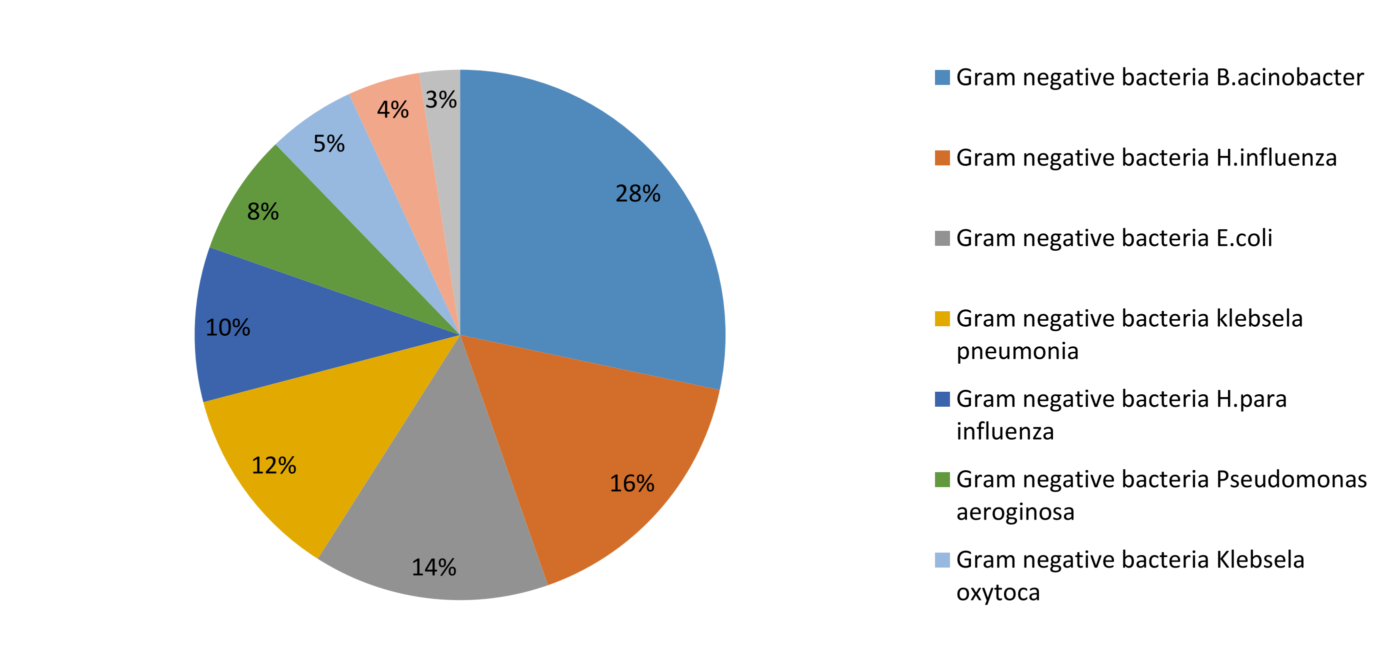

Figure 7. Rate of Gram-negative bacterial infections according to several bacteria

5.2 Rate of Gram-positive bacterial infections according to several bacteria

Among 39 patients 30 Strep Pneumonia (77%), 5 Staphylococcus Aureus (12.8%), 2 Streptococcus Sangius (5.1%), and 2 Streptococcus Mites (5.1%) patients infected by Gram positive Bacteria. Streptococcus Pneumonia (77%) is the common bacteria among Gram Positive. Table 5 & Figure 8.

Table 5. Rate of Gram-Positive bacterial infections according to several Bacteria

Bacteria	Number of Patients	Rate of Gram (+) Bacteria according to different Bacteria (%)
Strep Pneumonia	30	77
Staphylococcus Aureus	5	12.8
Streptococcus Sangius	2	5.1
Streptococcus Mites	2	5.1
Total	39	100

Gram Positive bacterial infections according to several Bacteria

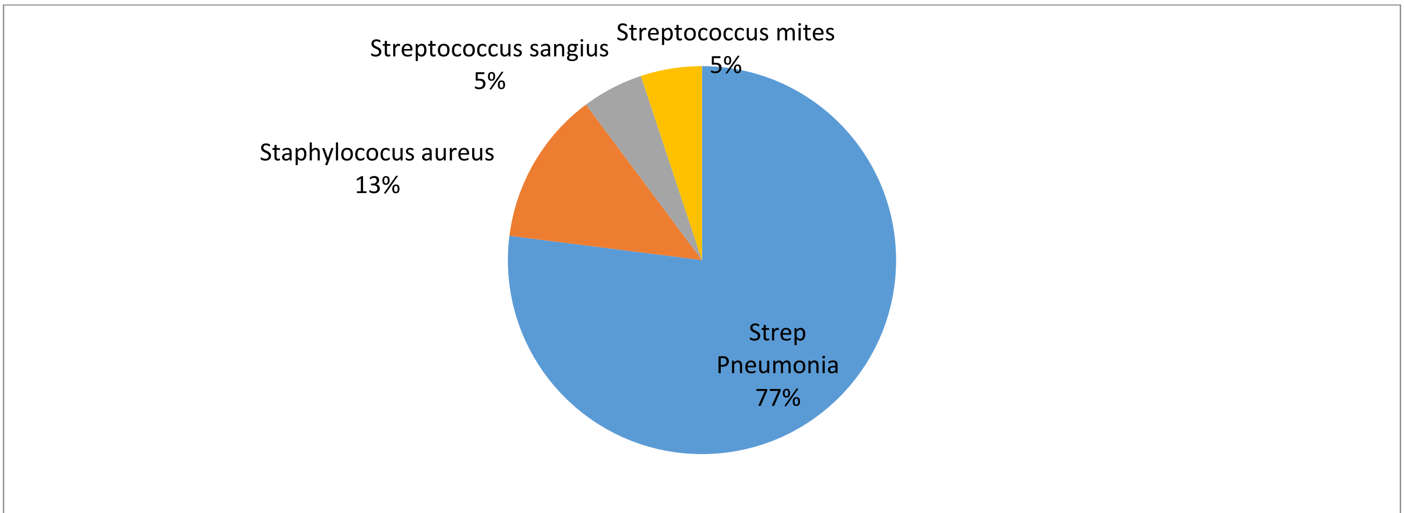

Figure 8. Pie diagram showing rate of Gram-Positive bacterial infection according to several Bacteria

6. Antibiotics sensitivity and resistance among different Bacteria

Cefuroxime, Ampicillin, Cefoperazone, Fosfomycin, Clavulanic acid + Amoxicillin, Sulbactam Cefoperazone, Piperacillin/Tazobactam, Cefepime, and Imipenem were used for H Para Influenza, Baumannii Acinetobacter, E Coli, E Coli (ESBLS), Klebsiella Pneumonia and Klebsiella Pneumonia (ESBLS) in respiratory ward.

6.1 Acinetobacter Baumannii

Imipenem (100%), Sulbactam Cefoperazone (97.6), Piperacillin/Tazobactam (95%), Cefepime (90%), Cefoperazone (75.6%), Cefuroxime (68.2%), Clavulanic acid +Amoxicillin (66%), Fosfomycin (44%) and Ampicillin (29.2%) were used for Baumannii Acinetobacter. Imipenem (100%) was the most sensitive and Ampicillin (70.8%) was the most resistance antibiotics among 41 patients infected by Baumannii Acinetobacter. Imipenem (100%) is the most sensitive and Ampicillin (70.8) is the most resistance antibiotics against Acinetobacter Baumannii. Table 6 Figure 9.

Table 6. Antibiotics resistance and sensitivity against Acinetobacter Baumannii

	Acinetobacter Baumannii			
	Sensitive		**Resistance**	
	N	**Percentage**	**N**	**Percentage**
Imipenem	41	100	0	0
Sulbactam Cefoperazone	40	97.6	1	2.4
Piperacillin and Tazobactam	39	95	2	5
Cefepime	37	90	4	10
Cefoperazone	31	75.6	10	24.4
Cefuroxime	28	68.2	13	31.8
Clavulanic Acid +Amoxicillin	27	66	14	34
Fosfomycin	18	44	23	56
Ampicillin	12	29.2	29	70.8

Antibiotics resistance and sensitivity against Acinetobacter Baumannii

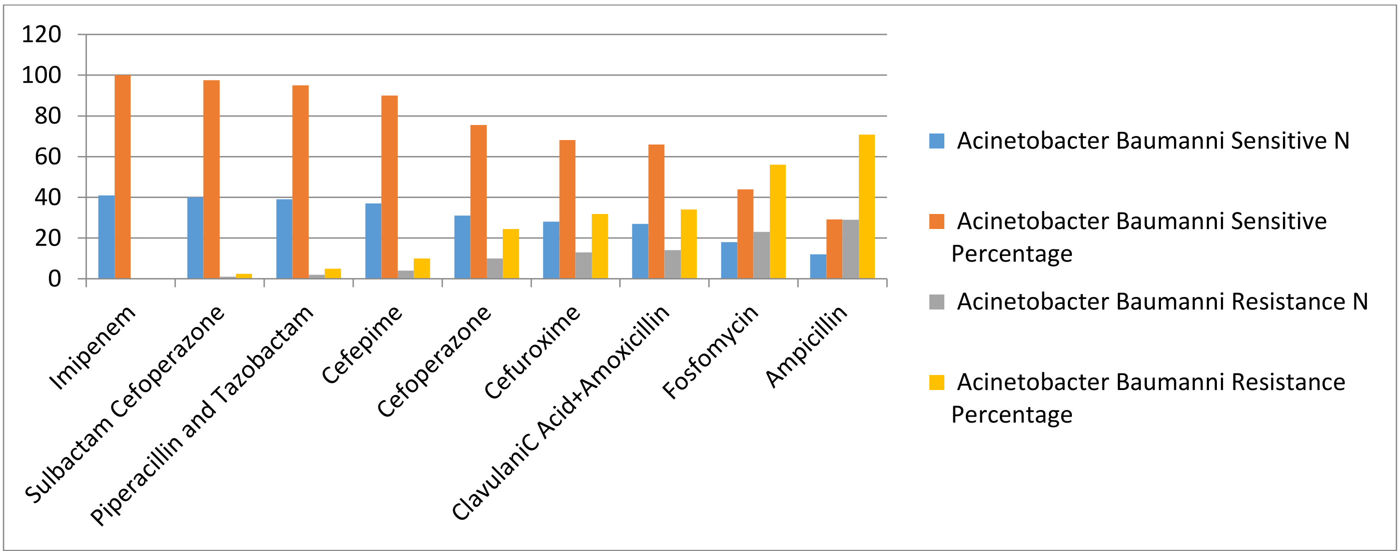

Figure 9. Antibiotics resistance and sensitivity against Acinetobacter Baumannii

6.2 H Para Influenza

Cefuroxime (85%), Ampicillin (86.5%), Cefoperazone (86.5%), Imipenem (88%), Clavulanic acid/Amoxicillin (88%), Cefepime (90%), Sulbactam Cefoperazone (91.5), Piperacillin/Tazobactam (93%), and Fosfomycin (93%) were used for H Para Influenza Treatment. Fosfomycin (85%) was the most sensitive and Cefuroxime (85%) was the most resistance antibiotic among 59 patients infected by H Para Influenza. Table 7 Figure 10.

Table 7. Antibiotics resistance and sensitivity against H. Para Influenza

	H. Para Influenza			
	Sensitive		Resistance	
	N	Percentage (%)	N	Percentage (%)
Cefuroxime	50	85	9	15
Ampicillin	51	86.5	8	13.5
Cefoperazone	51	86.5	8	13.5
Imipenem	52	88	7	12
Clavulanic Acid + Amoxicillin	52	88	7	12
Cefepime	53	90	6	10
Sulbactam Cefoperazone	54	91.5	5	8.5
Piperacillin and Tazobactam	55	93	4	7
Fosfomycin	55	93	4	7

Antibiotics resistance and sensitivity against H. Para Influenza

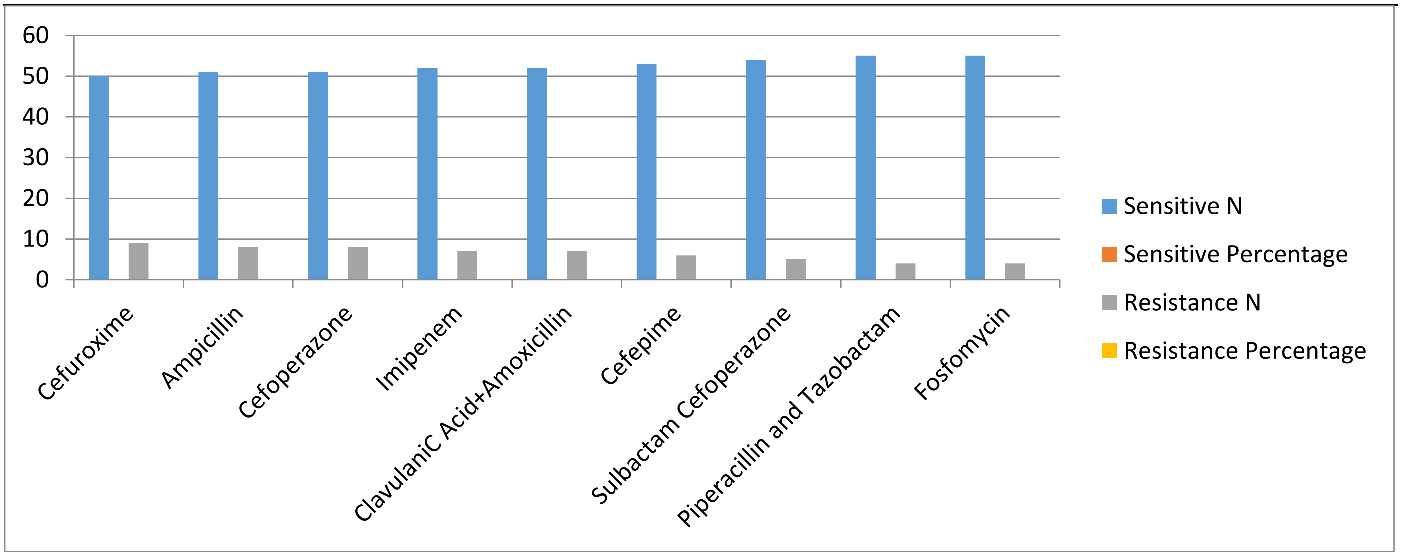

Figure 10. Antibiotics resistance and sensitivity against H Para Influenza

6.3 E. coli/ESBLS

Ampicillin (22%), Cefuroxime (53%), Cefoperazone (58.5%), Cefepime (58.5%), Clavulanic acid+ Amoxicillin (78%), Fosfomycin (89%), Piperacillin/Tazobactam (89%), Sulbactam Cefoperazone (92%), and Imipenem (100%) were used for E. coli / ESBLS Treatment. Imipenem (100%) was the most sensitive and Ampicillin (22%) was the most resistance antibiotic among 36 patients infected by E. Coli/ESBLS.Table 8 Figure 11.

Table 8. Antibiotics resistance and sensitivity against E. coli / ESBLS

	E. coli /ESBLS			
	Sensitive		Resistance	
	N	Percentage (%)	N	Percentage (%)
Ampicillin	8	22	28	78
Cefuroxime	19	53	17	47
Cefoperazone	21	58.5	15	41.5
Cefepime	21	58.5	15	41.5
Clavulanic Acid+Amoxicillin	28	78	8	22
Fosfomycin	32	89	4	11
Piperacillin and Tazobactam	32	89	4	11
Sulbactam Cefoperazone	33	92	3	8
Imipenem	36	100	0	0

Antibiotics resistance and sensitivity against E. coli / ESBLS

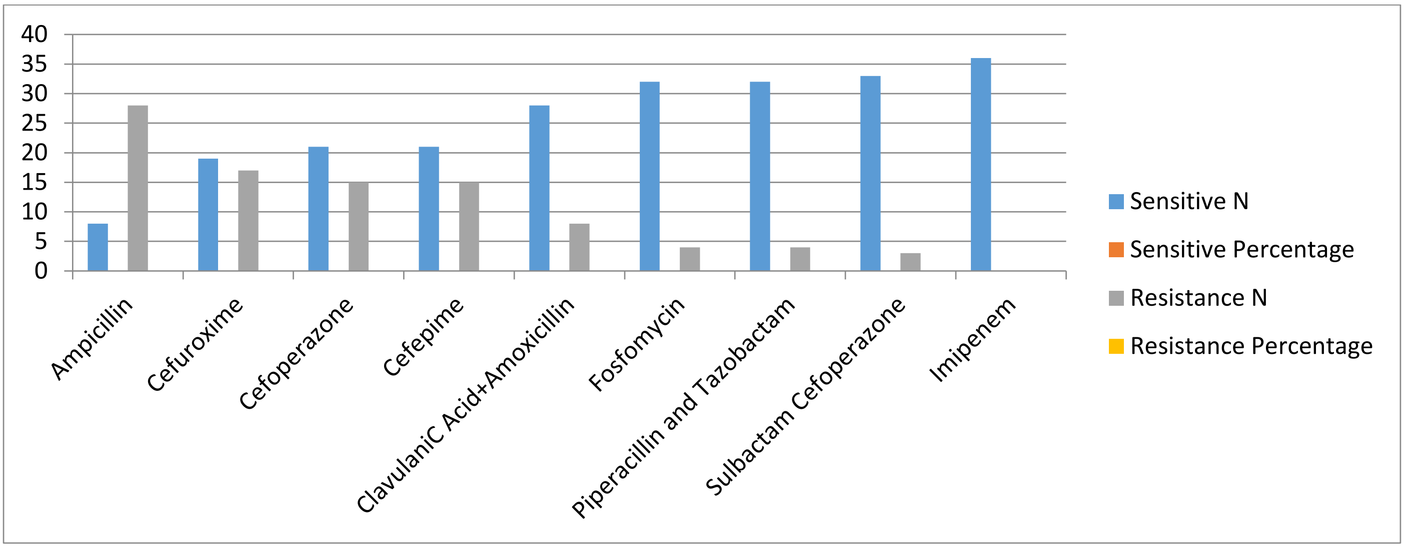

Figure 11. Antibiotics resistance and sensitivity against E. coli / ESBLS

6.4 Klebsiella Pneumonia/ESBLS

Ampicillin (4%), Cefuroxime (72%), Cefepime (72%), Cefuroxime (72%), Clavulanic acid/Amoxicillin (76%), Fosfomycin (76%), Sulbactam Cefoperazone (92%) Piperacillin/Tazobactam (96%) and Imipenem (96%) were used for Klebsiella Pneumonia/ESBLS Treatment. Imipenem (96%) was the most sensitive and Ampicillin (4%) was the most resistance antibiotic among 25 patients infected by Klebsiella Pneumonia/ESBLS.Table 9 Figure 12.

Table 9. Antibiotics resistance and sensitivity against Klebsiella Pneumonia/ESBLS

	Klebsiella Pneumonia/ESBLS			
	Sensitive		Resistance	
	N	Percentage (%)	N	Percentage (%)
Ampicillin	1	4	24	96
Cefoperazone	18	72	7	28
Cefepime	18	72	7	28
Cefuroxime	18	72	7	28
Clavulanic Acid + Amoxicillin	19	76	6	24
Fosfomycin	19	76	6	24
Sulbactam Cefoperazone	23	92	2	8
Piperacillin and Tazobactam	24	96	1	4
Imipenem	24	96	1	4

Antibiotics resistance and sensitivity against Klebsiella Pneumonia/ESBLS

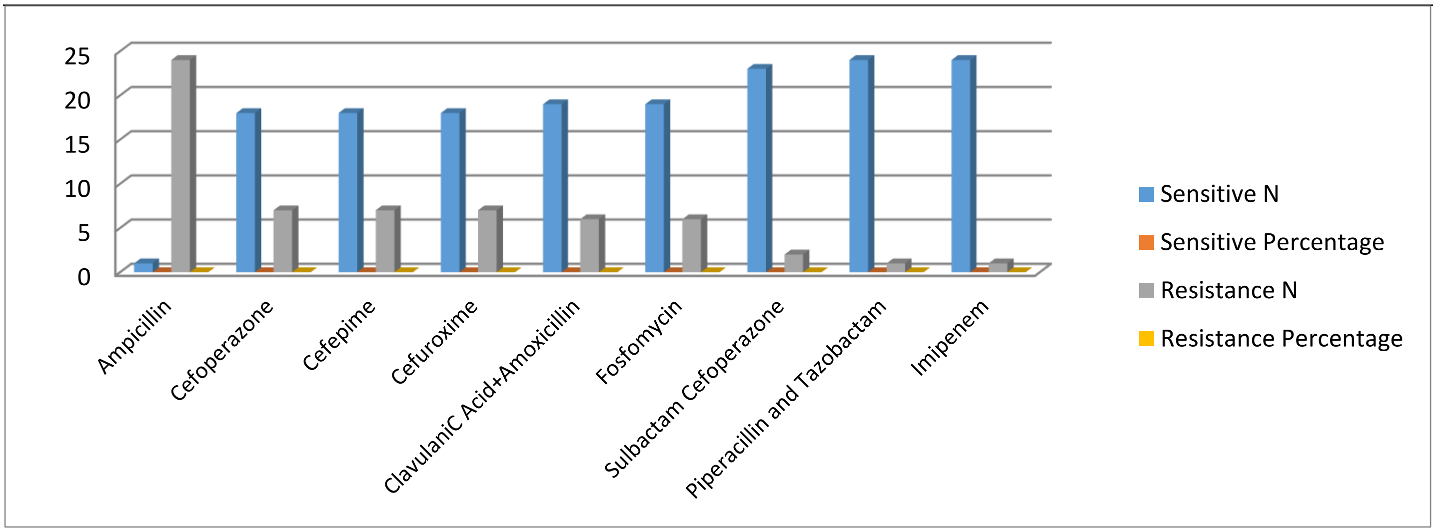

Figure 12. Antibiotics resistance and sensitivity against Klebsiella Pneumonia/ESBLS

6.5 E. coli/E Coli ESBLS

Imipenem, Cefepime, Piperacillin/Tazobactam, Sulbactam Cefoperazone and Cefoperazone (100%), Fosfomycin (90%), Clavulanic Acid+ Amoxicillin (85%), Cefuroxime (85%), and Ampicillin (40%) were Sensitive to E.coli, Meanwhile Imipenem (100%), Cefepime (6%), Piperacillin/Tazobactam (75%), Sulbactam Cefoperazone (81%), Cefoperazone (6%), Fosfomycin (87.5%), Clavulanic Acid+ Amoxicillin (69%), Cefuroxime (13%), and Ampicillin (0%) sensitive to E.coli ESBLS. Imipenem (100%) was the most sensitive Antibiotic in both E. coli and E. coli ESBLS Treatment. And Ampicillin (40%) sensitive in E. coli but (100%) resistance to E. coli ESBLS Treatment. Table 10. Figure 13.

Table 10. Antibiotics resistance and sensitivity against E. coli and E.Coli ESBLS

	E. Coli		E. Coli （ESBLS+）	
	Resistance	**Sensitive**	**Resistance**	**Sensitive**
Imipenem	0	100	0	100
Cefepime	0	100	94	6
Piperacillin and Tazobactam	0	100	25	75
Sulbactam Cefoperazone	0	100	19	81
Cefoperazone	0	100	94	6
Fosfomycin	10	90	12.5	87.5
Clavulanic Acid + Amoxicillin	15	85	31	69
Cefuroxime	15	85	87	13
Ampicillin	60	40	100	0

Antibiotics resistance and sensitivity against E. coli and E. coli ESBLS

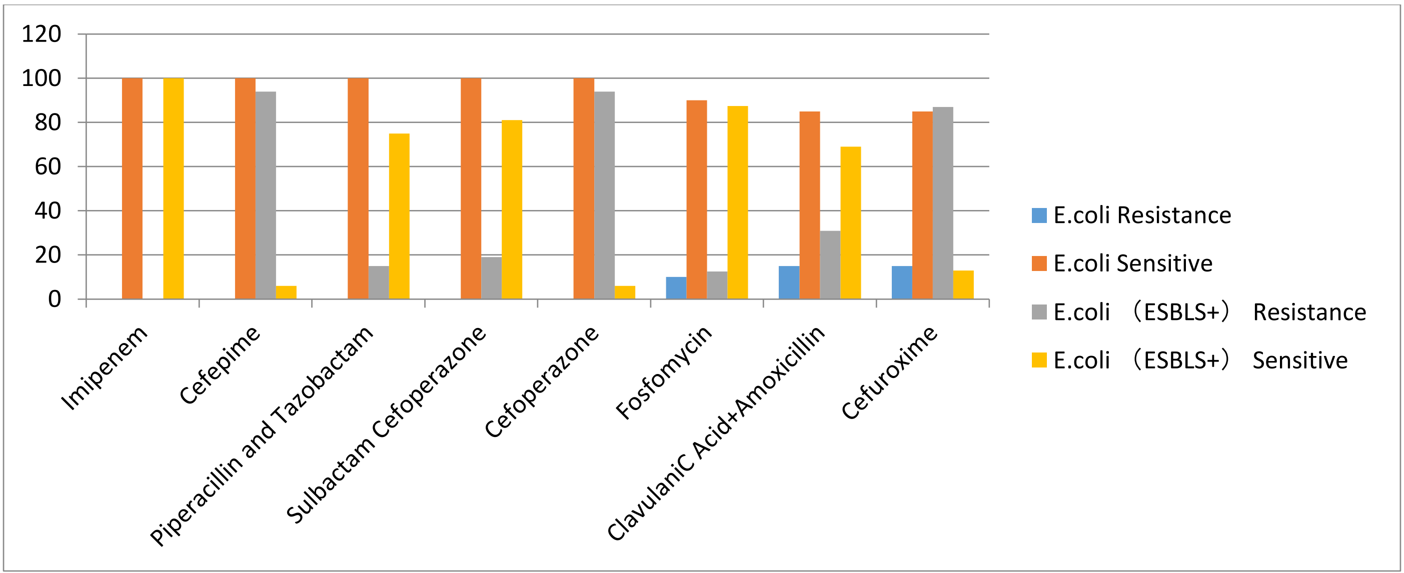

Figure 13. Antibiotics resistance and sensitivity against E. coli and E. coli ESBLS

6.6 Klebsiella Pneumonia/Klebsiella (ESBLS)

Ampicillin and Cefoperazone (100%), Clavulanic Acid + Amoxicillin (80%), Cefuroxime (80%), Cefepime (80%), Fosfomycin (40%), Imipenem (0%), Piperacillin/Tazobactam (0%), and Sulbactam Cefoperazone (0%) were resistance to E.coli ESBLS, Meanwhile Ampicillin (95%), Cefoperazone (10%), Clavulanic Acid+ Amoxicillin (10%), Cefuroxime (15%), Cefepime (15%), Fosfomycin (20%), Piperacillin/Tazobactam (5%), Sulbactam Cefoperazone (10%), and Imipenem (5%) resistance to Klebsiella Pneumonia . Ampicillin (100%) was the most resistance Antibiotic in both Klebsiella Pneumonia and Klebsiella (ESBLS) Treatment. The most sensitive antibiotic was Imipenem (100%) in Klebsiella (ESBLS) and (95%) in Klebsiella. Table 11 Figure 14.

Table 11. Antibiotics resistance and sensitivity against Klebsiella Pneumonia and Klebsiella (ESBLS)

	Klebsiella Pneumonia		Klebsiella （ESBLS+）	
	Resistance	Sensitive	Resistance	Sensitive
Ampicillin	95	5	100	0
Cefoperazone	10	90	100	0
Clavulanic Acid + Amoxicillin	10	90	80	20
Cefuroxime	15	85	80	20
Cefepime	15	85	80	20
Fosfomycin	20	80	40	60
Piperacillin and Tazobactam	5	95	0	100
Sulbactam Cefoperazone	10	90	0	100
Imipenem	5	95	0	100

Antibiotics resistance and sensitivity against Klebsiella Pneumonia and Klebsiella (ESBLS)

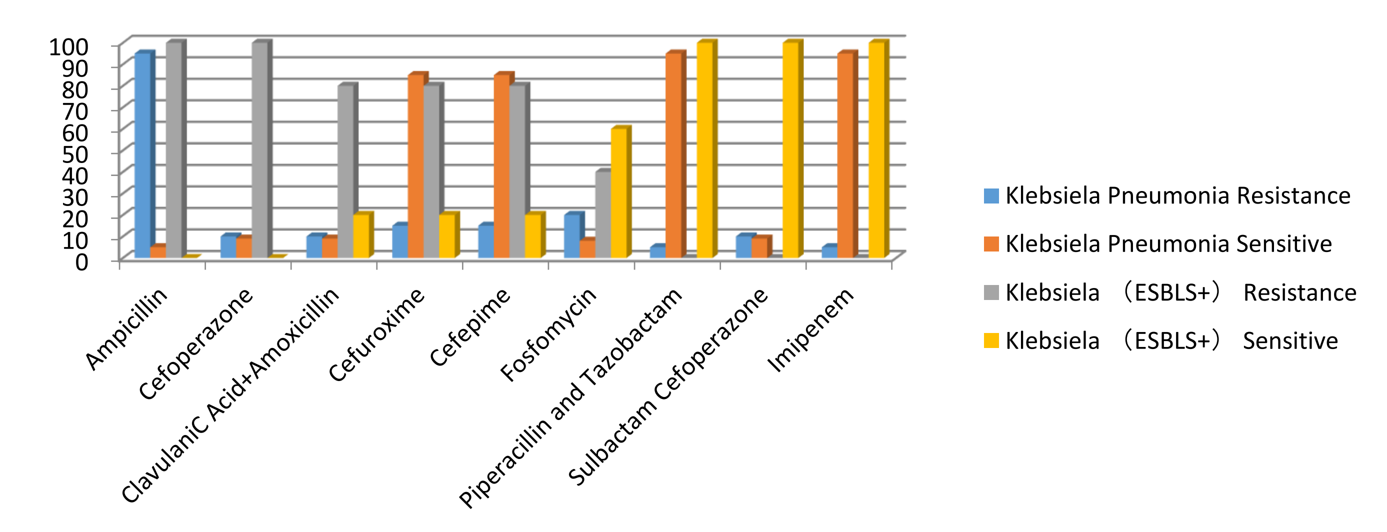

Figure 14. Antibiotics resistance and sensitivity against Klebsiella Pneumonia and Klebsiella (ESBLS)

Discussion

Bacterial resistance to antibiotics is a growing concern worldwide, particularly in the treatment of respiratory infections in children. Despite the widespread use of broad-spectrum antibiotics, the prevalence of bacterial infections and their resistance patterns continue to increase, posing significant challenges for clinicians in managing respiratory diseases.

In our study, we evaluated the rate of Gram-negative and Gram-positive bacterial infections in the respiratory ward of Dalian Children's Hospital, analyzing data according to patient age groups (<1 year, 1–6 years, 7–15 years), seasons, and types of respiratory diseases. We observed that Gram-negative bacteria were responsible for the majority of infections (84%), with Acinetobacter baumannii being the most prevalent pathogen (26.4%), followed by Haemophilus influenzae (15.2%) and Escherichia coli (13.4%). This aligns with other studies, although differences in bacterial distribution were observed due to variations in study environments and populations (1-2).

The study also revealed that Gram-positive bacteria were less common, with Streptococcus pneumoniae being the dominant pathogen (77%). These findings were partially similar to other studies but varied slightly due to the smaller proportion of Gram-positive bacterial infections in our cohort.

Regarding seasonal variations, we found that spring had the highest incidence of both Gram-negative and Gram-positive bacterial infections, consistent with other reports suggesting an increase in bacterial infections during warmer months (3-4). Interestingly, summer had the second highest rate in our study, while other studies have observed a peak in summer for certain pathogens like Pseudomonas aeruginosa and Klebsiella pneumoniae (5-6).

In terms of antibiotic resistance, our study identified Ampicillin as the most resistant antibiotic, while Sulbactam Cefoperazone, Piperacillin/Tazobactam, and Cefepime were the most effective antibiotics, exhibiting broad-spectrum activity. These findings were consistent with other studies, which also identified Carbapenems and Piperacillin-based combinations as effective treatments for resistant pathogens, especially Acinetobacter baumannii and Klebsiella pneumoniae (7-9).

Although our study provides valuable insights into the patterns of bacterial infections and antibiotic resistance, it has several limitations. The sample size was relatively small, limiting the generalizability of the results. Additionally, the study was conducted over a single year, which may not fully capture long-term trends in bacterial resistance. The comparison between Gram-negative and Gram-positive bacterial infections was also constrained by the unequal distribution of Gram-positive infections in the cohort. Finally, the study was limited by the availability of data, as we could not assess the clinical outcomes of antibiotic treatments in detail. Future studies with larger sample sizes and extended time periods are needed to confirm these findings and provide more comprehensive data on antibiotic resistance patterns.

In conclusion, this study underscores the increasing prevalence of Gram-negative bacterial infections in children's respiratory diseases, along with the rising resistance to commonly used antibiotics. By identifying the most prevalent pathogens and their resistance profiles, we hope to inform better treatment strategies and contribute to the fight against antibiotic resistance in pediatric healthcare settings.

The limitations of our study were small simple size, as we had problems in conversation with Chinese papulation and so as the Data was limited to Dalian Children hospital, which may affect our results.

Conclusion

Among Gram negative Bacteria Acinetobacter Baumannii causes most common respiratory infections in respiratory ward of Dalian children hospital. Gram negative bacterial infections were in the high rate in less than one year age and 1–6-year age where Gram positive has the highest rate in 1–6-year age. Gram negative and positive bacterial infections were in the highest rate in spring season. The common disease caused by Gram negative and positive Bacteria was Pneumonia.

The rates of Gram-negative bacterial infections caused by following bacteria from high to low rate were Acinetobacter Baumanii, H. Influenza. E. coli and Klebsiella pneumonia. H. Influenza was more sensitive compare to other bacteria. Acinetobacter Baumanii, E. coli and Klebsiella were low sensitive to common drugs such as Ampicillin (100%) resistant, but more sensitive to Sulbactam Cefoperazone and Piperacillin/Tazobactam. In respiratory ward of Dalian children hospital, the drugs which were having high enzymatic activity were used as first line drug.

Acknowledgment

I would like to warmly thank the advice and guidance of my tutor, Professor Cui Zhenze. I am also grateful from my second supervisor Dr Huang Yan's and colleagues who has been invaluable on both academic and personal level and share their great advices.

I would also like to acknowledge my fellow's postgraduate students, doctors and nurses in Respiratory department, Wu Lin Lin, Chenrong, Shuqin, in promoting stimulation and their kindness and friendship support.

Conflict of Interests

All authors express no conflict of interest in any part of the research

Fundings

This research received no external funding.

Authors Contribution

Conceptualization, methodology, software, analysis, investigation, resources, original draft preparation, review and editing, visualization and supervision, all authors have read and agreed to the published version of the manuscript.

- Author 1 [Mahboobi Ahmad Bashir]: Conceptualization, Methodology, Investigation, Resources, Data Curation, Original Draft Preparation
- Author 2 [Taren Zarghoon]: Methodology, Data Analysis, Software
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- Author 4 [Mohammadi Enayattullah]: Investigation, Methodology
- Author 5 [Rahimi Bilal]: Supervision, Review and Editing

All authors have read and agreed to the published version of the manuscript

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