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BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY PATTERNS OF BLOODSTREAM INFECTIONS

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ABSTRACT

Bloodstream infections are a significant cause of morbidity and mortality worldwide, with a growing concern over antimicrobial resistance. Understanding the bacteriological profile and antibiotic susceptibility patterns of these infections is essential for effective clinical management and therapy. This study aims to investigate the microorganisms responsible for BSIs and their resistance patterns to commonly used antibiotics. The objective of our study was to present the prevalence of different pathogens isolated from blood cultures, highlighting most common organisms causing BSIs with demographic factors and comorbidities that influence bacteriological profile and to evaluate the susceptibility patterns of isolate organisms to various antibiotics used. This cross-sectional study was conducted at the Microbiology Lab of Railway General Hospital, Rawalpindi, from September to December 2024. A total of 136 blood culture specimens were analyzed using aseptic techniques for sample collection. Blood was inoculated into Brain Heart Infusion broth and incubated under aerobic and anaerobic conditions for up to 7 days. Gram staining was performed to classify isolates as Gram-positive or Gram-negative. Biochemical tests that includes catalase, coagulase, oxidase, API, and triple sugar iron, were used for bacterial identification. Antibiotic susceptibility testing was conducted using the Kirby-Bauer disk diffusion method to determine sensitivity, resistance, and multidrug resistance patterns. *Staphylococcus aureus* emerged as the most dominant organism with 41.2% occurrence which is gram positive. *Escherichia coli* was identified to be the second most prevalent organism in our study with 211.8% which is gram negative. While other bacterial strains isolated were *Acinetobacter baumannii* occurring as the third most frequent organism with 10.3% among bloodstream infected patients, *Pseudomonas aeruginosa 7.4* % *Klebsiella pneumonia* 8.1%, *Salmonella typhi 5.8% are gram negative bacteria while gram positive bacteria are Enterococcus faecalis 4.4%, Staphylococcus epidermis 1.5% and Streptococcus spp.* 2.2% were bacteria our study patients which were infected with blood stream infection. Antibiotic susceptibility patterns observed among all the seven organisms discovered that isolated of gram positive species both *Staphylococcus aureus* and *Enterococcus faecalis* showed high sensitivity rates against linezolid and chloramphenicol (92.3% and 83.3% respectively) and showed high resistance against erythromycin and ampicillin (72.7%, 80% respectively). Similarly, gram negative isolates *Escherichia coli* showed high resistance against cephalexin 61.5% and great sensitivity against meropenem 91.7%. *Klebsiella pneumoniae* showed high sensitivity for meropenem 83.3%, and resistant to cephalexin 88.9%. Ciprofloxacin was greatly effective for both *Acinetobacter baumannii* 84.6% and *Pseudomonas aeruginosa* 66.7% and *Salmonella typhi* were sensitive to sulfamethoxazole 71.9% for bloodstream infectious patients. Our study findings shows that the gram positive bacteria *Staphylococcus* aureus as the most prevalent pathogen among BSIs patients while in gram negative *Escherichia coli* was highest pathogen along with the antibiotic susceptibility patterns observed emphasizes the requirement to design awareness programs with the purpose to reduce risks of antibiotic resistance.

1. Introduction

Bloodstream Infections (BSI) refers to infectious diseases that are characterized by the presence of live bacteria in the bloodstream [1]. These microorganisms either cause or have caused an inflammatory response that is reflected in changes to hemodynamic, laboratory, and clinical parameters [2]. These infections are of blood caused by blood-borne pathogens [3]. It is referred to as bacteremia, blood poisoning, or septicemia. Serious medical diseases known as BSIs happen when pathogens mostly bacteria enter the bloodstream and circulate throughout the body [4]. It happens when a bacterial infection gets into the bloodstream from anywhere in the body, like the lungs, intestines, urine, or skin. If germs enter the bloodstream, the immune system might not be able to handle the invasion, and bloodstream infection symptoms could appear [5].

Worldwide, BSIs are among the most prevalent infections linked to healthcare. In the developed world's United States and Europe, bloodstream infections can make up as much as 9%–11% of hospital-acquired infections, in low and middle-income nations, however, the prevalence can reach up to 19% [6]. The USA had a 16% decline in the prevalence of BIs between 2011 and 2015, primarily as a result of lower rates of SSIs and urinary tract infections. From roughly 4.5–5% in the past, it is now predicted that one in 31 (3%) hospitalized patients in the USA suffers at least one BSI. A public health concern, bloodstream infections (BSI) are thought to be responsible for 150,000 deaths in Europe each year [7]. BSIs still result in an estimated 250,000 fatalities annually in North America and Europe combined [8]. The population under study, prevalence rates in Pakistan have been reported to range from 8.4% to 13.1 [9].

Inappropriate hand hygiene, failing to isolate high-risk patients and the careless use of antibiotics are some of the causes of these infections. In the United States, the Centers for Disease Control and Prevention (CDC) highlights ventilator-associated pneumonia, central line-associated bloodstream infections, and catheter-associated urinary tract infections as prevalent forms of bloodstream infections [10].

The three most significant and prevalent gram-positive bacteria species that can enter the bloodstream are *Enterococcus, Streptococcus,* and *Staphylococcus*. In hospital environments, the most frequent causes of *Staphylococcus aureus* bacteremia include urinary tract catheters, intravenous catheters, and surgical operations [11]. The World Health Organization (WHO) has identified the emergence of resistance to several antimicrobial drugs in pathogenic bacteria as a concern to public health [12]. Gram-positive bacteria account for about half of all bloodstream infections at several institutions [13]. *Staphylococcus* bacteria are not the only microorganisms contributing to the rising incidence of Gram-positive infections, *Enterococcus* species also play a role in rising incidence [14].

The most common cause of *E.coli* bacteremia is a urinary tract infection. *Pseudomonas aeruginosa, Klebsiella pneumoniae*, and *Proteus mirabilis* are additional microorganisms that can result in community-acquired bacteremia. Gram-negative bacteria are highly resistant to antibiotics, which makes them one of the biggest threats to global public health [15]. Gram-negative bacteria are extremely capable of infecting people and can spread to nearly every organ system in the body [16]. *E. coli, Salmonella, Shigella,* and other *Enterobacteriaceae* bacteria that cause gastroenteritis. These bacteria harm millions of people globally and are linked to poor sanitation [17].

Understanding the antibiotic susceptibility pattern and bacteriological profile is crucial for determining the best course of treatment for bloodstream infections, ensuring that the medicines being supplied work, and preventing the spread of antibiotic-resistant bacteria [18]. It is necessary to select the appropriate antibiotic for empirical therapy. It is imperative to continuously study the microbiology of bloodstream infection (BSI) bacteria and their drug susceptibility patterns. Appropriate direction for empirical antibiotic treatment methods and infection prevention programs is made possible by this observation [19]. The antibiotic susceptibility patterns of bloodstream infections (BSIs) are increasingly important for determining the most effective treatments. Research shows that BSIs in different regions are typically caused by a variety of bacterial pathogens, including both Gram-positive and Gram-negative organisms [20].

Regarding antibiotic susceptibility, various pathogens demonstrate differing levels of resistance. For instance, *Staphylococcus aureus* generally remains highly susceptible to Vancomycin, but resistance is increasingly noted in certain strains, particularly those resistant to methicillin (MRSA). In contrast, Gram-negative bacteria like *Klebsiella spp*. exhibit varying levels of susceptibility to antibiotics like Meropenem, with some strains showing resistance.

Proper use of antibiotics and prompt, accurate diagnosis of bacterial infections are essential components of appropriate care. Early infection detection and susceptibility evaluation are essential for optimizing treatment outcomes. Blood culture has long been recognized as the gold standard for certain detection of bacterial and fungal illnesses worldwide. Furthermore, systematic surveillance tracks the emergence of multi-drug-resistant organisms in hospital settings in an era where drug resistance is rapidly expanding globally, especially since the supply of antibiotics is nearly depleted. Understanding the pattern of antibiotic susceptibility of isolated strains at a tertiary care hospital is the aim of the current study.

The purpose of this research is to identify the various microbe species that cause bloodstream infections and the patterns of antibiotic susceptibility. Understanding the many types of bacteria that cause bloodstream infections, and their patterns of antibiotic sensitivity is essential to improving patient outcomes. The results of this research can be used to inform public health campaigns, treatment strategies that are effective, and a decline in the incidence of drug-resistant diseases. By identifying common pathogens and their resistance profiles, it helps to better control infections and adapts medication regimens.

2. Methodology:

A descriptive cross-sectional study conducted from September to December 2024 at Microbiology Laboratory, Railway General Hospital, Rawalpindi. 136 blood culture samples were included. Patients with confirmed bloodstream infections, ensuring that they have not received antibiotic treatment for at least two weeks prior to the study. Additionally, there must be a sufficient blood sample available to allow for bacterial profiling and antimicrobial susceptibility test. Individuals of any age are eligible for participation in the study, provided they meet these conditions. Aseptic venipuncture was performed; 10–15 mL blood for adults or 2 mL for children was inoculated into BHI broth and incubated at 37℃ for up to 7 days. Gram staining was done to differentiate between gram positive and negative organisms. Growth-positive samples were sub-cultured on Blood agar, MacConkey,s agar, and Chocolate agar. Catalase, Coagulase, Oxidase, Indole, Urease and TSI were performed biochemically to confirm the pathogens. Kirby–Bauer disk diffusion method was done on Mueller–Hinton agar following CLSI 2024 guidelines. The measured zones of inhibition in (mm) were compared to a standard chart provided by organizations such as the Clinical and Laboratory Standards Institute (CLSI) to determine whether the bacteria are Sensitive, Intermediate, or Resistant.

3. Results

Table 1: Demographic and clinical characteristics of the study participants, including Age, Comorbidities, Symptoms and Length of Hospital stay

Parameters	Frequency (N)	Percentage (%)
Age (Years)		
0-10	57	41.9
11-20	12	8.8
21-30	10	7.4
31-40	7	5.1
41-50	9	6.6
51-60	8	5.9
61-70	15	11.0
71-80	14	10.3
81-90	3	2.2
91-100	1	0.7
Gender		

Male	61	44.9
Female	75	55.1
Comorbidities		
Diabetes Mellitus	5	3.7
Gall Bladder Stone	4	2.9
Thalassemia	6	4.4
Cardiovascular Disease (Angina)	7	5.1
Sepsis	26	19.1
Chronic Liver Disease	6	4.4
Lung Disease (Pulmonary Fibrosis)	25	18.4
Gut Disease (Acute Gastroenteritis)	24	17.6
None	22	16.2
Joint and Muscle Disease (Arthritis)	2	1.5
Viral Disease (Hepatitis C)	3	2.2
Brain Disease (Hypoxic Ischemic Encephalopathy)	6	4.4
Symptoms		
Fever	83	61.0
Vomiting	22	16.2
Diarrhea	14	10.3
Respiratory distress	46	33.8
Body pain	44	32.4
Length of Hospital Stay (Days)		

0-5	83	61.0
6-10	35	25.7
11-15	10	7.4
16-20	5	3.7
21-25	3	2.2

Table 1 shows that the age of patients (in years) having the BSIs. Out of our total collected samples N=136 the patients between the age of 0-10 years have N=57 (41.9%) have the highest percentage of BSIs infection, 11-20 years N=12 (8.8%) have second highest percentage, 21-30 years N=10 (7.4%) of patients, then 31-40 years N=7 (5.1%) patients , 41-50 years N=9 (6.6%) patients, 51-60 years N=8 (5.9%) having the BSIs infection, 61-70 years N=15 (11.0%) patients, 71-80 years N=14 (10.3%) patients, 81-90 years N=3 (2.2%) patients, and then 91-100 years N=1(0.7%). having least number of patients having the bloodstream infection.

This table also shows the gender distribution of patients having BSIs, out of our total collected samples N=136, the female patients included in our study were N=75 (55.1%) and male were N=61 (44.9%). From our sample size and data collection its shows that female have more frequency of bloodstream infections then male.

According to our data, out of our total samples N=136 it was noticed that about N=26 (19.1%) of BSIs patients having sepsis as a comorbidities, N= 25 (18.4%) lung disease (Pulmonary Fibrosis) , N=24 (17.6) patients having Gut disease (Acute Gastroenteritis) ,then N=22 (16.2%) patients do not have any type of Comorbidities, cardiovascular disease (Angina) N=7 (5.1%), brain disease (Hypoxic Ischemic Encephalopathy), N=6 (4.4%), thalassemia N=6 (4.4%), chronic liver disease N=6 (4.4%),then Diabetes Mellitus N=5 (3.7%), gall bladder Stone N=4(2.9%), viral disease (hepatitis C) N=3 (2.2%) ,then least number of patients have the joint and muscle disease (Arthritis) N=2 (1.5%). In terms of length of hospital stay of our study participants, N=83 (61.0%) majority number of patient stay in hospital for 1 to 5 days, N=35 (25.7%) patients stay in hospital for 6 to 10 days, N= 10 (7.4%) patient stay in hospital for 11 to 15 days, N=5 (3.7%) patients stay in hospital for 16 to 20 days, then least N=3 (2.2%) patients stay in hospital for 21 to 25 days patients having bloodstream infection.

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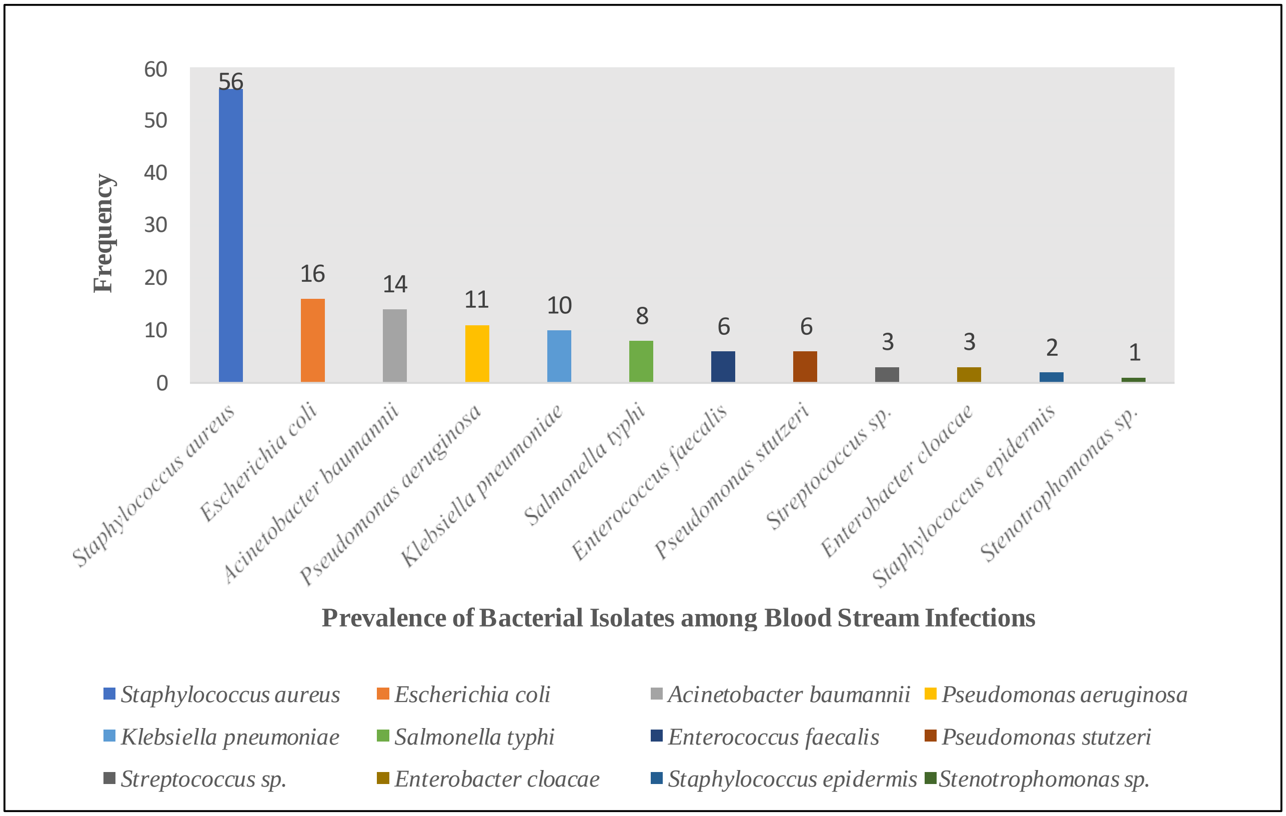

Figure 1. Prevalence of Bacterial Isolates among Bloodstream Infections (BSIs)

This study of 136 patients with Bloodstream infections were collected and analyzed, 12 microorganisms are observed that are causing the bloodstream infection. Among them *Staphylococcus aureus* N=56 (41.2%) have the highest percentage that is responsible for causing BSIs infection, followed by N= 16 (11.8%) *Escherichia coli* was second highest in causing infecton, then N=1(0.7%) *Stenotrophomonas sp*. have the least infection rate that cause BSIs infection.

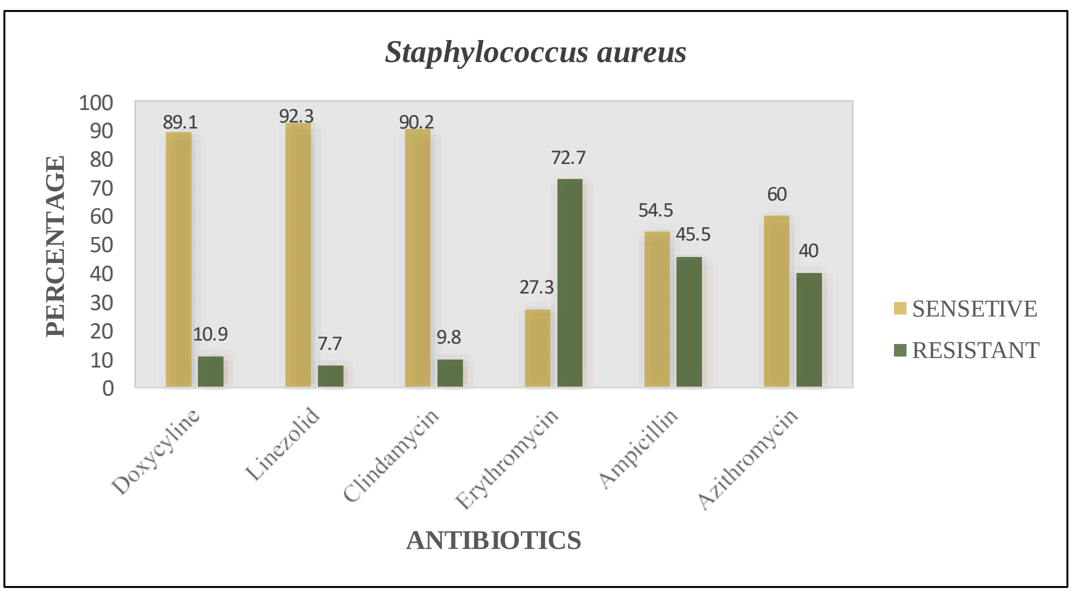

Figure 2. Antibiotic susceptibility pattern of *Staphylococcus aureus* isolates among Bloodstream Infections (BSIs)

Staphylococcus aureus showed high resistance rates against azithromycin 72.7% and 45.5% from ampicilin but linezolid showed high effectiveness 92.3%, and clindamycin have effectivesness 90.2% against *Staphylococcus aureus*, having the low resistant rate linezolid 7.7% and clindamycin 9.8%. doxycycline having the effective against bacteria is 89.1% with little resistant rate of 10.9%, azithromycin has high sensitivity of 60% then resistance 40% against the *Staphylococcus aureus infection.*

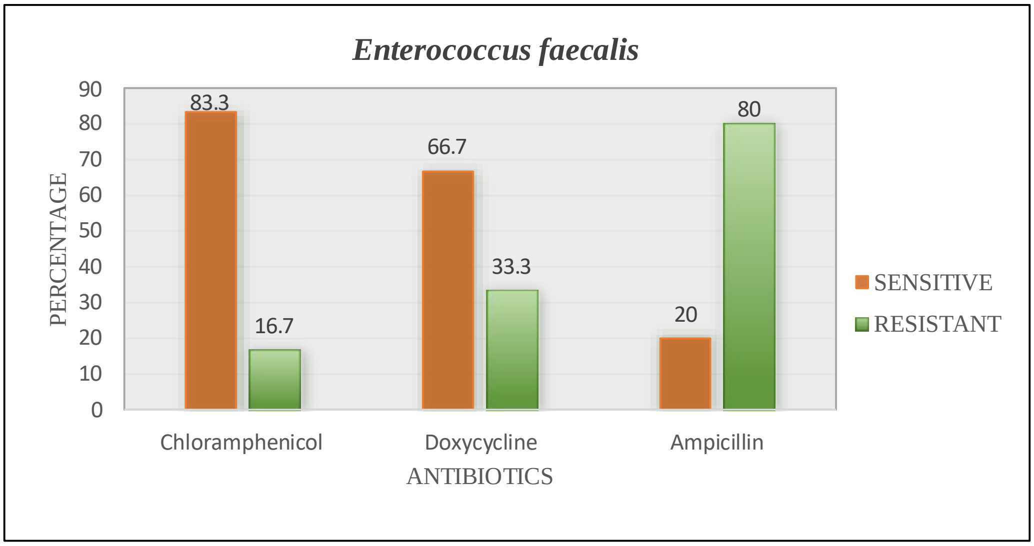

Figure 3. Antibiotic susceptibility pattern of *Enterococcus faecalis* isolates among Bloodstream Infections (BSIs)

In this graph, the antibiotic susceptibility profile of *Enterococcus faecalis* isolates. Chloramphenicol appears to be the most sensitive occurring up to 83.3%, with the lowest resistance rate of 16.7%. This suggests that Chloramphenicol could be effective treatment option for *Enterococcus faecalis* infections, especially in cases of multidrug resistance. Among the tested antibiotics, Ampicillin has the highest resistance rate of 80% of isolates being resistant. This indicates a major challenge in treating *Enterococcus faecalis* infections with this antibiotic. Doxycyclin has the sensitivity of about 66.7% which is also effective in treating the infection casued by the bacteria *Enterococcus faecalis* with low resistant rate of 33.3%.

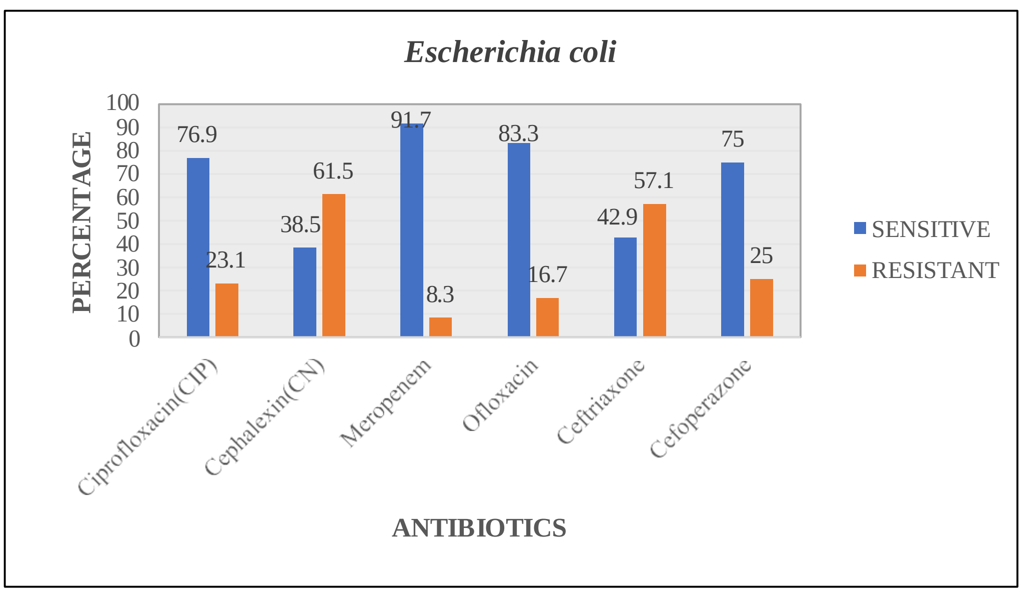

Figure 4. Antibiotic susceptibility pattern of *Escherichia coli* isolates among Bloodstream Infections (BSIs)

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This chart shows the antibiotic susceptibility profile of *Escherichia coli* isolates. Meropenem appears to be the most sensitive occurring up to 91.7%, with the lowest resistance rate of 8.3%. This suggests that Meropenem could be a potential treatment option for *E.coli* infections, especially in cases of multidrug resistance. Among the tested antibiotics, Cephalexin (CN) stands out with the highest resistance rate, with 76.9% of isolates being resistant. This indicates a significant challenge in treating E. coli infections with this antibiotic. Ciprofloxacin also exhibits substantial resistance (61.5%). While Meropenem, Ofloxacin, Ceftriaxone, and Cefoperazone demonstrate lower resistance rates, the presence of any resistance emphasizes the importance of careful antibiotic selection.

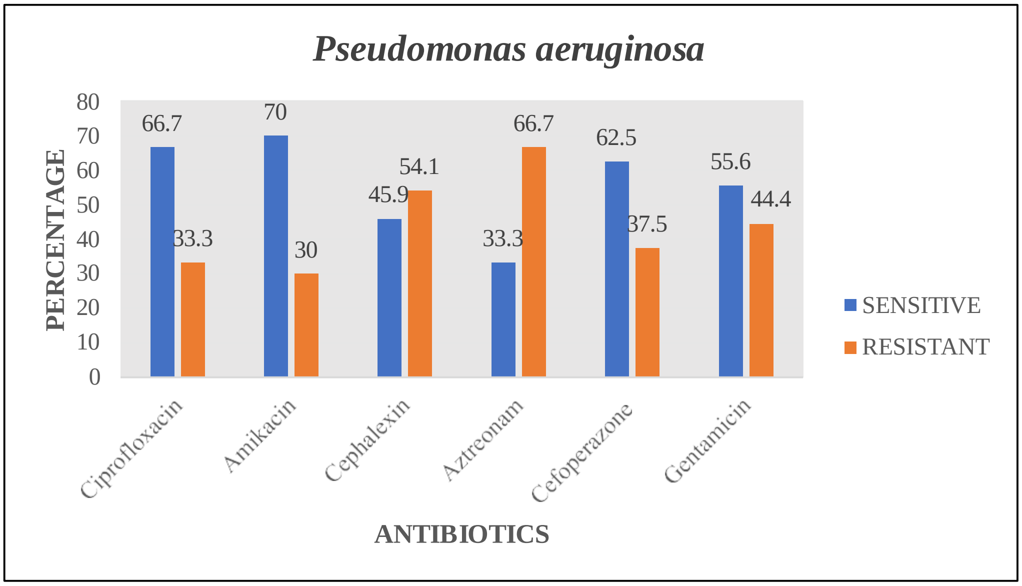

Figure 5. Antibiotic susceptibility pattern of *Pseudomonas aeruginosa* isolates among Bloodstream Infections (BSIs)

Amikacin emerged as the most effective antibiotic, with a sensitivity rate of 70% and only 30% resistance, indicating its continued efficacy in combating infections caused *by Pseudomonas aeruginosa*. Ciprofloxacin and Aztreonam also demonstrated promising sensitivity levels, both at 66.7%, while resistance was observed at 33.3%. Cefozoparone exhibited a sensitivity of 62.5% and resistance of 37.5%, suggesting moderate effectiveness. Gentamicin showed slightly lower sensitivity at 55.6% and a resistance rate of 44.4%, which could limit its reliability in certain cases. Cephalexin, however, displayed an equal sensitivity and resistance rate of 50%, making it a less dependable choice for treating *Pseudomonas aeruginosa* bloodstream infections.

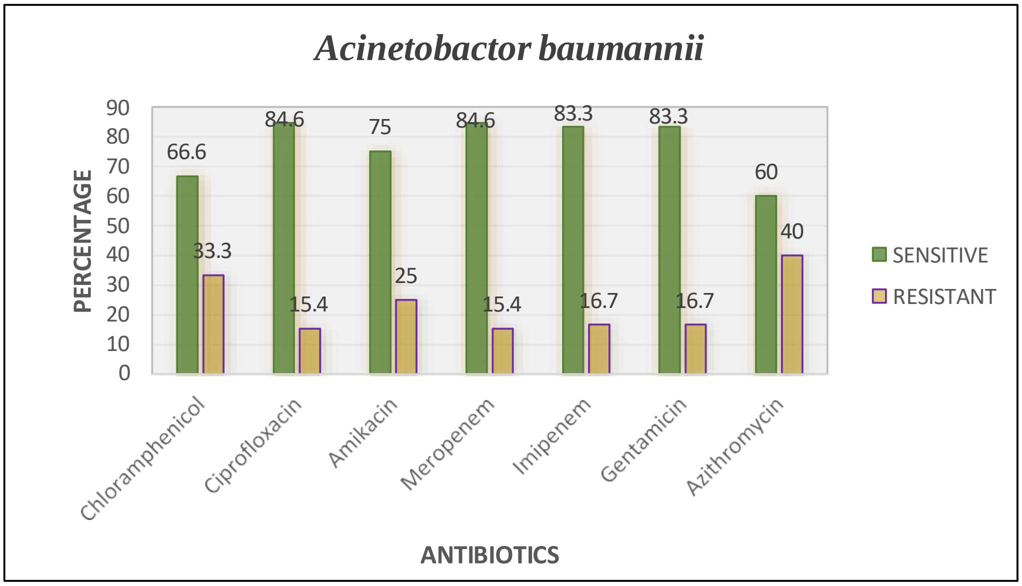

Figure 6. Antibiotic susceptibility pattern of *Acinetobacter baumannii* isolates among Bloodstream Infections (BSIs)

In this graph the antibiotic susceptibility profile of *Acinetobacter baumannii* isolates. Ciprofloxacin and Meraopenem appears to be the most sensitive occurring up to 84.6.%, with the lowest resistance rate of 15.4%. Gentamicin and Imipenem also have great sensitivity towards *Acinetobacter baumannii* the infection. This suggests that Ciprofloxacin and Meropenem could be a potential treatment option for *Acinetobacter baumannii* infections, especially in cases of multidrug resistance. Among the tested antibiotics, Azithromycin stands out with the highest resistance rate, with 40% of isolates being resistant. This indicates a challenge in treating *Acinetobacter baumannii* infections with this antibiotic. Chloramphenicol also exhibits substantial resistance of 33,3. Gentamicin and Imipenem has the resistant rate about 16.7% While Meropenem, Ciprofloxacin has the lowest resistant rate about 15.4% the presence of any resistance emphasizes the importance of careful antibiotic selection.

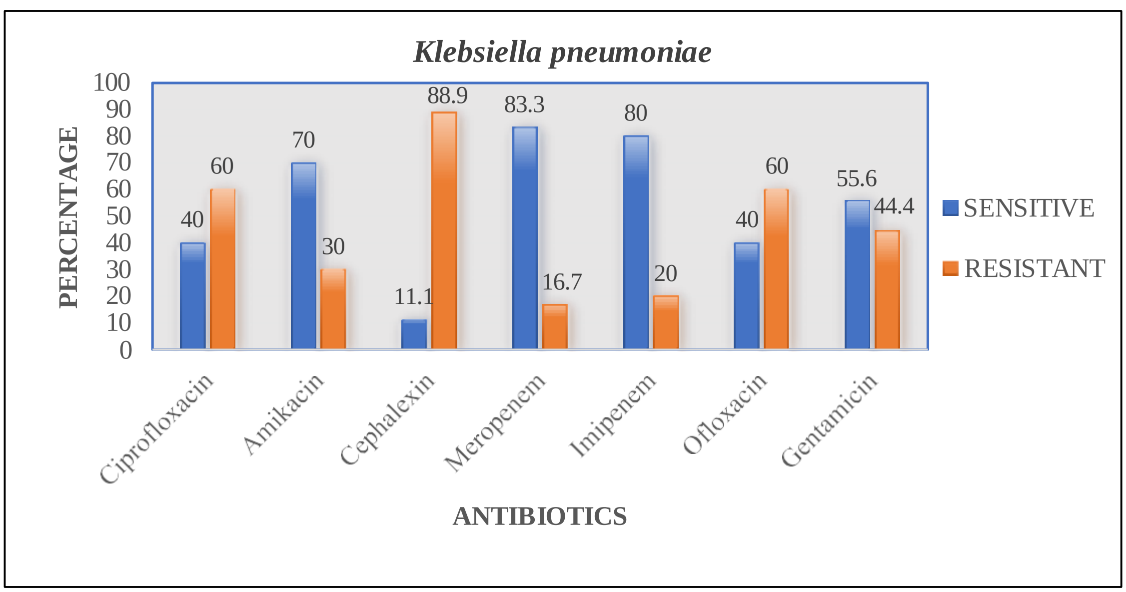

Figure 7. Antibiotic susceptibility pattern of *Klebsiella pneumoniae* isolates among Bloodstream Infections (BSIs)

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Among the antibiotics, Meropenem exhibited the highest sensitivity rate at 83.3%, followed closely by Imipenem at 80%, suggesting their efficacy as carbapenem agents in combating *Klebsiella pneumoniae* bloodstream infections. However, resistance to Meropenem and Imipenem, though comparatively low at 16.7% and 20%, indicates emerging concerns about resistance even in these potent antibiotics. Amikacin also showed a high sensitivity rate of 70%, with resistance at 30%, making it a strong candidate for treatment. Conversely, Cephalexin exhibited the lowest sensitivity (11.1%) and the highest resistance (88.9%), underscoring its limited utility against this pathogen

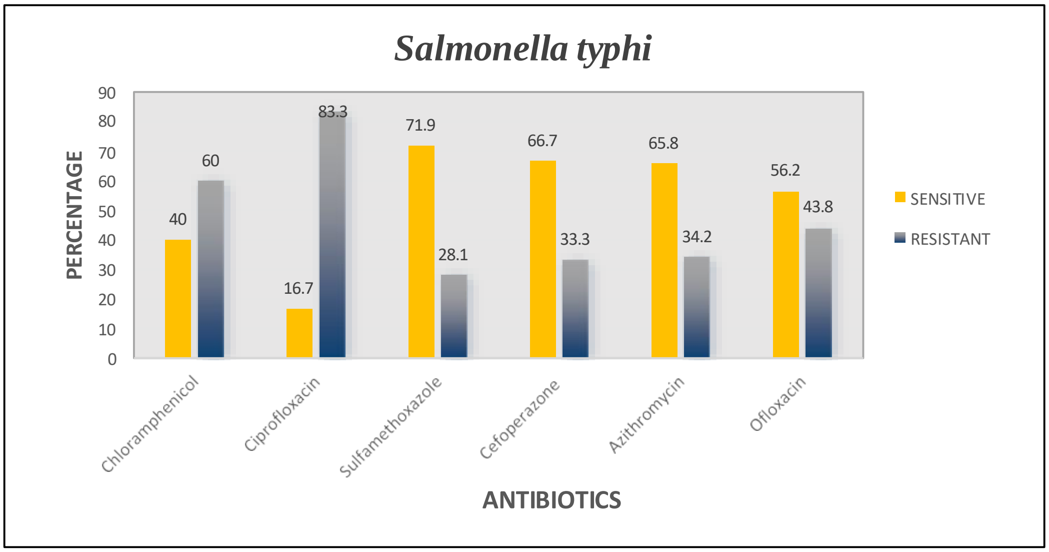

Figure 8. Antibiotic susceptibility pattern of *Salmonella typhi* isolates among Bloodstream Infections (BSIs)

*Salmonella typhi s*howed the greatest resistance to ciprofloxacin 83.3% while it exhibited the highest sensitivity to Sulfamethoxazole 71.9%, cefoperazone 66.7%, azithromycin, showed 65.8% and Ofloxacin shows 56.2% sensitiviy from *Salmonella Typhi* infection resistance and 50% sensitivity. Therefore, cefoperazone proved to be the most effective antibiotic against *Salmonella Typhi*, with the resistant rate of Sulfamethoxazole 29.1%, cefoperazone 33.3%, azithromycin, showed 34.2% and Ofloxacin shows a bit high resistant to infection about 43.8%.

4. Discussion

Bloodstream Infections refers to infectious diseases that are indicate by the existence of bacteria in the bloodstream. Bloodstream infections remain one of the most important causes of morbidity and mortality worldwide. The current study identified a higher prevalence of bloodstream infections (BSIs) among females (55.1%) compared to males (44.9%). This gender disparity in infection rates could be influenced by several biological, clinical, and social factors. Biologically, hormonal differences are known to modulate immune responses; estrogen in females has been associated with enhanced innate and adaptive immunity, potentially resulting in more pronounced inflammatory responses to infections. Clinically, women are more likely to undergo invasive procedures such as catheterization, gynecological surgeries, or interventions during pregnancy, which are known risk factors for bloodstream infections. Socially, disparities in health-care access and utilization may also play a role, as women in some regions are more likely to seek medical attention later in the course of an illness, leading to increased severity of infections at presentation. These findings are consistent with global studies on BSIs. A study by Muleta D. (2022) conducted in Ethiopia reported similar trends, attributing the higher prevalence in females. In contrast, [4], analyzing data from a cohort in the United States, found a marginally higher incidence of BSIs among males, primarily linked to occupational exposure and a higher prevalence of lifestyle-related risk factors like intravenous drug use and alcohol consumption.

In our study Gram positive *Staphylococcus aureus* emerged as the dominant microorganism. The prevalence of organism *Staphylococcus aureus* recorded in our study was N= 56 (%) which is similar to the results reported in the study by Ayoyi et al. included a total of 1020 pregnant women out of which 29.7% reported with positive *Staphylococcus aureus* bacterial isolates (46) while Akoachere et al. studied in total 133 participants from both Buea and Bamenda and N=33(24.1%) participants showed high prevalence of *Staphylococcus aureus* mostly were females patients(47) 3.3% prevalence of *Staphylococcus species* was reported in Saudi Arabia which is not in agreement with our study.(48)

Other gram positive isolates reported in our study were *Enterococcus faecalis* about 5% which is higher in comparison to the 1.9% occurrence rate reported in the study by Ayoyi et al. similar results were recorded by Mike-Ogburia et al. reported with 1.3% prevalence rate(46,49) However, our study results were not in agreement with the study results of Almutawif and Eid where a 10.8% prevalence rate of *enterococcus faecalis* was recorded which is higher in comparison to our study.(48)

The most popular Gram-negative organism isolated from pregnant women with blood stream infections in our study included mainly *Escherichia coli* with a prevalence of 28% which is less in comparison from the study by N. G. et al. where a higher prevalence of *Escherichia coli* was seen of 56.79% While study by Begum et al. exhibited a significant 60% prevalence of *Escherichia coli*.[5], [6]. The occurrence of *Escherichia coli* in our study was greater when compared to studies conducted in Iraq and Nigeria accounting to 17.34% and 18.3% respectively of *Escherichia coli* prevalence among pregnant women [6], [7].

Klebsiella pneumonia is the third most prevalent microorganism in our study and second most popular Gram negative microorganism accounting for about 26% in our study which is higher when compared to Nigerian studies accounting for about 22.0% and 10.3% of prevalence among pregnant women.(50,51) A prospective observational study conducted in Bangladesh reported 16.67% of *Klebsiella pneumonia* prevalence.(52) Johnson *et al*. study executed at the southwestern Uganda exhibited a significant prevalence of Gram negative species out of which *Klebsiella pneumonia* remained predominant with incidence rate of 37.41%.(53)

Review of past literature indicated that antibiotics were vital in fighting against bloodstream infections but during the recent years pregnant women had been reporting with increased antibiotic resistance and it has become a major public health issue of the 21st century.(23) The results of antibiotic profiles of pregnant women included in our study displayed that gram positive species *Staphylococcus aureus* showed high resistance rates against ampicillin about 88% and azithromycin 87%. These results were in agreement to Almutawif and Eid's study results in which resistance rates greater than 51% were recorded against ampicillin but were in contrast with antibiotic azithromycin because erythromycin, and oxacillin were used instead of azithromycin.(48) Our study results were in contrast with the study by Khatoon's *et al.* study which revealed *Staphylococcus aureus* were 100% highly resistant against amoxicillin instead of ampicillin and 88.4% to erythromycin instead of azithromycin.(44) Present study results discovered that linezolid displayed 98% effectiveness against *Staphylococcus aureus* samples which were similar to the study results of Khatoon *et al.* where 100% sensitivity was observed while in contrast with Rahman *et al.* study displayed 66.67% sensitivity rates against linezolid.(44,56)

Enterococcus faecalis showed high sensitivity to linezolid 80% which is in agreement with a study conducted in Bangladesh where sensitivity observed against linezolid was 79.76% (56) *Enterococcus faecalis* displayed high resistance against azithromycin 80% which is in contrast with the study conducted in India by Rizvi *et al.* which highlighted that *Enterococcus faecalis* displayed high resistance rates of 40% against erythromycin instead of azithromycin.(57) However, Linezolid proved to be greatly effective on both gram positive organisms in the present study and was in agreement with the past studies while azithromycin indicated similar resistance rates in our study but was not in accordance with the past studies as erythromycin was used.(50,57)

Among Gram negative species *Escherichia coli* showed high resistance against ampicillin 97% and showed great sensitivity against amikacin 93%, fosfomycin 83%, gentamicin 73%. The present study results are in agreement with the results of the study conducted in University of Gondar Teaching Hospital, Northwest Ethiopia which depicted resistance rates greater than 93.3% recorded against ampicillin.73% sensitivity against gentamicin was reported in present study results in comparison to the study carried out in Northwest Ethiopia were in contrast with 94.7% sensitivity against gentamicin.(58)

Similarly, *Klebsiella pneumonia* in our results showed high sensitivity to gentamicin 84% and cefotaxime 80% leading to difference in agreement with study conducted in Kanifing General Hospital, The Gambia where sensitivity observed against gentamicin and cefotaxime reported was 50.0% and 40.0% respectively.(59) *Klebsiella pneumonia* isolates displayed high resistance rates of 97% against the antibiotic amoxicillin-clavulanic acid and these results were in accordance with the observations made by Asmat *et al.* revealing resistance against amoxicillin-clavulanic acid to be greater than 55% among *Klebsiella* isolates.(55)

Our study highlighted that gentamicin was greatly effective for both *Acinetobacter baumannii* 90% and *Pseudomonas aeruginosa* 88%. For both organisms, Ciprofloxacin proved to be effective too at 80% and 88% respectively for *Acinetobacter baumannii* and *Pseudomonas aeruginosa*. Present study results were in agreement with previous studies observations where both gentamicin and ciploflaxcin were documented as 100% sensitive for *Pseudomonas* isolates.(59)

Our study results were high in comparison to study by Teferi et al. reported both sensitivity and resistance at 50% against gentamicin for *Pseudomonas* isolates while in the same study 100% sensitivity was recorded against Ciprofloxacin for *Pseudomonas* isolates which was not in agreement with our study results.(60)

Similarly, *Acinetobacter baumannii* showed 90% sensitivity against gentamicin and 91% resistance against imipenem in comparison to the study results a study conducted in Theran recorded 40.7% sensitivity against gentamicin for *Acinetobacter* isolates.(61)

Saeidi et al. study recorded resistance of 33.4% and 100% against imipenem and gentamicin respectively, which is not in accordance with our study results. The same study showed 66.6% sensitivity and 33.4% resistance against ciprofloxacin and imipenem.(62)

5. Conclusion

Bloodstream infections (BSIs) remain a significant public health concern, contributing to substantial morbidity and mortality worldwide. This study highlights the critical importance of understanding the bacteriological profile and antibiotic susceptibility patterns of pathogens responsible for BSIs. The findings underscore the predominance of specific bacterial pathogens, with varying resistance patterns across different antibiotics. The emergence of multidrug-resistant organisms, particularly among Gram-negative and Gram-positive bacteria, poses a serious challenge to effective treatment. Regular monitoring of local and regional antibiotic susceptibility trends is essential to guide empirical therapy and optimize treatment outcomes. The regular and indiscriminate use of antibiotics poses significant risks to individual and public health. Overuse can lead to the development of antimicrobial resistance (AMR), where bacteria evolve mechanisms to survive despite antibiotic treatment. Antimicrobial susceptibility patterns provide critical information about the effectiveness of antibiotics against specific pathogens. These patterns are determined through laboratory testing, where the sensitivity of a bacterial isolate to various antibiotics is evaluated. These infections, often originating from other parts of the body such as the lungs, intestines, urinary tract, or skin, can overwhelm the immune system, resulting in severe symptoms. These infections, often originating from other parts of the body such as the lungs, intestines, urinary tract, or skin, can overwhelm the immune system, resulting in severe symptoms. Commonly referred to as bacteremia, septicemia, or blood poisoning, BSIs represent a critical health concern requiring prompt diagnosis and effective management to prevent life-threatening complications.

Staphylococcus aureus emerged as the most dominant organism with 41.2% occurrence which is gram positive. *Escherichia coli* was identified to be the second most prevalent organism in our study with 211.8% which is gram negative. While other bacterial strains isolated were *Acinetobacter baumannii* occurring as the third most frequent organism with 10.3% among bloodstream infected patients, *Pseudomonas aeruginosa 7.4* % *Klebsiella pneumonia* 8.1%, *Salmonella typhi 5.8% are gram negative bacteria while gram positive bacteria are Enterococcus faecalis 4.4*%, *Staphylococcus epidermis 1.5% and Streptococcus* 2.2% were bacteria our study patients which were infected with blood stream infection. Antibiotic susceptibility patterns observed among all the 7 organisms discovered that isolated of gram positive species both *Staphylococcus aureus* and *Enterococcus faecalis* showed high sensitivity rates against linezolid and chloramphenicol (92.3% and 83.3% respectively) and showed high resistance against erythromycin and ampicillin (72.7%, 80% respectively). Similarly, gram negative isolates *Escherichia coli* showed high resistance against cephalexin 61.5% and great sensitivity against meropenem 91.7%. *Klebsiella pneumoniae* showed high sensitivity for meropenem 83.3%, and resistant to cephalexin 88.9%. Ciprofloxacin was greatly effective for both *Acinetobacter baumannii* 84.6% and *Pseudomonas aeruginosa* 66.7% and *Salmonella typhi* was sensitive to sulfamethoxazole 71.9% for bloodstream infectious patients. A considerable percentage of positive cases of BSIs patients are mostly between age 0-10 years. The antibiotic susceptibility patterns observed isolates showed resistance against a different antibiotic which was not used in previous studies ciprofloxacin ampicillin and amoxicillin antibiotics used in various countries. While others isolates sensitivity and resistance was shown which use similar antibiotics which are used in our study were meropenem and linezolid. The antibiotic susceptibility patterns emphasize the requirement to design awareness programs with the purpose to reduce risks of antibiotic resistance during blood stream infection patients.

6. Limitations

This study is subject to certain limitations and methodological shortcomings. It was conducted in a single-center hospital setting and there were resource constraints. Additionally, a limited time frame restricted the sample size impacting the depth of research and limiting the generalization of results.

7. Recommendations

Proper supervision of antibiotics usage, Policies to limit the selling of antibiotics without proper doctors slip, strict laws to be formed against quack pharmacists, physicians and quack pharmaceutical companies, Awareness programs in schools, colleges, universities on antimicrobial resistance to spread awareness among general public regarding self-medication and the hazards of consuming antibiotics without proper checkup from the physician, Data surveillance softwares not only in research centers but also in hospitals to keep check and balance of resistance from the type of drug at which stage of the medical complication. Lastly, Advancements in the production of novel drugs to be used against the current BSIs exhibiting resistance.

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