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ANTIBIOTIC SENSITIVITY AND RESISTANCE PROFILES OF BACTERIAL ISOLATES IN THE INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL

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Abstract:

Background: Antibiotics are the cornerstone of modern medicine, playing a crucial role in the treatment of bacterial infections. Research identify specific resistance patterns among bacterial isolates, crucial for guiding treatment decisions, enhancing infection control strategies, and addressing the broader public health challenge of antibiotic resistance. Objective: To analyse the antibiotic sensitivity and resistance profile in an Intensive Care Unit (ICU) of a tertiary care hospital.

Materials and Methods: This cross-sectional, prospective study was conducted over a three months period in January 2023 to January 2024 and involved 150 participants admitted to the ICU of a tertiary care hospital. The culture and sensitivity patterns of clinical isolates from blood, urine, sputum, endotracheal tube (ET) aspirates, catheter sites, and wound swabs were analyzed. Positive

cultures were isolated, and their antibiotic sensitivity testing was performed according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI).
Results: Cultures were obtained from 150 participants. Among these, 111 patients had positive cultures, while 39 had negative cultures. The isolated bacteria were predominantly gram-negative bacilli, with Escherichia coli being the most common (18.6%), followed by Acinetobacter (14.5%), Klebsiella (11.6%), Pseudomonas (9.8%), and Proteus (1.74%). Among gram-positive organisms, coagulase-negative staphylococcus (CoNS) was the most frequently isolated (15.6%), followed by Streptococcus (2.32%). Fungal growth was observed in 26 samples (15.11%). The distribution of samples with positive cultures included blood (n = 48), sputum (n = 17), urine (n = 39), ET aspirate (n = 40), pus (n = 11), catheter sites (n = 4), ear swabs (n = 2), and stool (n = 1).
Conclusion: The prevalence of gram-negative bacterial infections is rising in ICUs, complicating the selection of appropriate antibiotics. Therefore, studying the antibiotic sensitivity and resistance patterns in a hospital setting is crucial for guiding clinicians in initiating empirical antibiotic treatment in critical cases.

Introduction

Antibiotics have long been the cornerstone of modern medicine, playing a crucial role in the treatment of bacterial infections. However, the emergence of antibiotic resistance represents a significant public health crisis globally, posing a severe threat to human health.[(1)] In India, which bears one of the highest burdens of infectious diseases worldwide, the inappropriate and irrational use of antimicrobial agents has exacerbated the development of antimicrobial resistance (AMR).[(2)] Several factors, including poor financial conditions, inadequate healthcare infrastructure, a high disease burden, and the unregulated sale of inexpensive antibiotics, have intensified the AMR crisis in the country.[(3-4)] Nosocomial infections, particularly in critical care settings, are a common cause of hospitalization.[(5)] The rate of such infections ranges from 5% to 30% among patients in intensive care units (ICUs). The increased risk of infection in these settings is associated with the severity of patient illness, prolonged exposure to invasive devices and procedures, frequent patient contact with healthcare personnel, and extended hospital stays. Over the past two decades, infection control practices and the development of new antimicrobials have primarily focused on controlling and treating infections caused by gram-positive organisms. [(6-9)] However, there has been a recent rise in infections caused by gram-negative bacteria in ICUs, with some multi-drug-resistant (MDR) strains presenting a significant challenge due to the limited availability of effective treatment options. Infections caused by MDR gram-negative organisms are associated with high morbidity and mortality rates. [(10)]

The present study addresses a critical concern in modern healthcare: the escalating problem of antibiotic resistance among bacteria, particularly in high-risk environments such as intensive care units (ICUs). With the widespread use of antibiotics, bacteria have developed mechanisms to resist these drugs, rendering once-effective treatments ineffective. This phenomenon not only complicates patient care but also poses a significant public health threat by limiting treatment options and increasing healthcare costs.

Despite the well-documented global challenge of antibiotic resistance, there remains a crucial gap in understanding the specific resistance profiles of bacterial isolates within ICUs of tertiary care hospitals. ICUs are unique environments where patients with severe illnesses are often treated with multiple antibiotics, creating a selective pressure that promotes the emergence and spread of resistant bacteria. Understanding the prevalence and patterns of antibiotic resistance in this setting is essential for guiding empirical therapy decisions, implementing effective infection control measures, and ultimately improving patient outcomes.

This study aims to fill this knowledge gap by systematically analyzing the antibiotic sensitivity and resistance profiles of bacterial isolates obtained from patients admitted to the ICU of a tertiary care hospital. By characterizing the resistance mechanisms and identifying trends in antibiotic resistance, the study seeks to provide clinicians with critical data to optimize antibiotic prescribing practices

and combat the growing threat of resistance. Furthermore, the findings from this study may contribute to the development of targeted interventions and policies aimed at preserving the efficacy of existing antibiotics and ensuring better patient care in ICU settings.

Materials and Methods:

This prospective observational study was conducted at a teaching tertiary care hospital in January 2023. A total of 150 adult patients admitted to the ICU during this period were included. Data were collected from the participants and included participant identity, diagnosis, comorbidities, source of infection, results of microbial culture, antibiotic sensitivity and resistance patterns, antibiotic use, duration of hospital stay, and clinical outcomes.

Various diagnostic tests were employed to analyze different specimens collected from participants, including blood, sputum, urine, endotracheal (ET) aspirate, pus, central venous catheter tips, ear swabs, and stool. Blood cultures were used to detect bacteria or fungi in the bloodstream. Sputum cultures identified respiratory pathogens. Urine cultures diagnosed urinary tract infections by identifying bacterial colonies and determining their antibiotic sensitivity. ET aspirate cultures, collected from mechanically ventilated patients, helped diagnose ventilator-associated pneumonia. Pus cultures identified organisms in abscesses or wounds, guiding effective antibiotic selection. Central venous catheter tip cultures detected colonization or infection by identifying bacteria or fungi that might cause bloodstream infections. Ear swab cultures identified pathogens causing ear infections. Stool cultures detected enteric pathogens like Salmonella, Shigella, and certain strains of Escherichia coli. Each of these tests played a crucial role in identifying causative organisms, understanding their antibiotic sensitivity and resistance patterns, and guiding effective clinical management of infections. All collected data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 23.0. The analysis utilized appropriate statistical methods to interpret the data. Frequencies and percentages were calculated for the demographic profiles of the participants, while means and standard deviations were used to describe quantitative data that followed a normal distribution. For comparisons between two independent continuous groups, a parametric independent Student's t-test was employed. Discrete (categorical) groups were compared using the chi-square (χ^2) test. Statistical significance was defined as a p-value of ≤ 0.05, and a p-value of ≤ 0.01 was considered highly significant.

Results:

Out of the 150 ICU admissions, 129 participants had culture-positive results, while 21 cases were culture-negative. In some instances, culture samples were collected from multiple sites based on the clinical requirements of the participants. Among the culture grown cases, 89 samples were gram-negative and 42 were gram-positive organisms and 19 were positive for fungal growth as depicted in Figure 1. The distribution of specimens that yielded microbial growth included blood (n = 34), sputum (n = 23), urine (n = 28), endotracheal (ET) aspirate (n = 32), pus (n = 17), central venous catheter tip (n = 7), ear swab (n = 4), and stool (n = 3) and vaginal swab (n = 2).

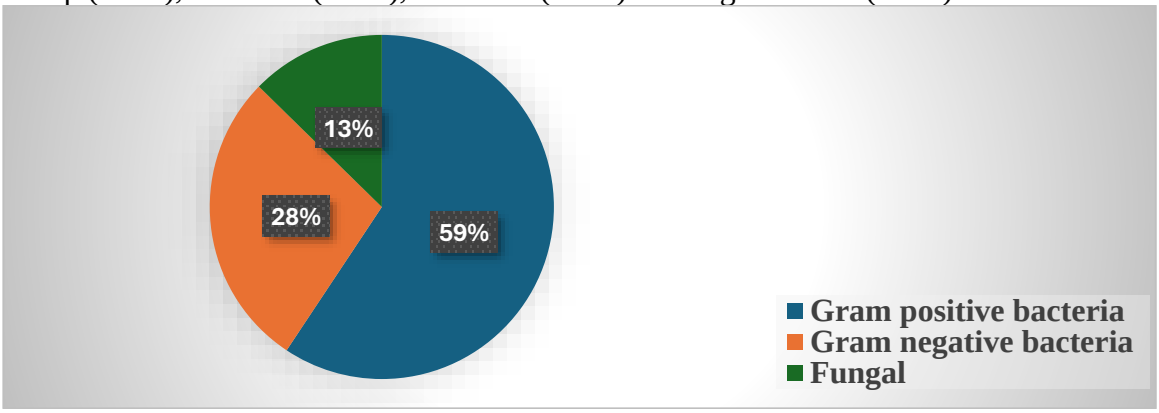

Fig 1: Gram's staining and organism isolated.

CoNS is the most frequent isolate from blood culture, E. coli and fungal growth from urine culture, and Klebsiella and Acinetobacter from ET secretions. E. coli (28%) was the most common organism isolated, followed by Acinetobacter (11.33%), Klebsiella (9.33%), Pseudomonas (7.33%), Enterococcus (1.33%), Staphylococcus(2%) and Proteus (2%). Among the gram-positive organisms, CoNS (20.66%) was the most common organism followed by Streptococcus (2.66%) and Nonfermenting gram-negative Bacillus (1.33%). In all, 22 samples, i.e., (14.66%) were positive for fungal growth (Table 1). E. coli was most sensitive to colistin (97.52%), followed by tigecycline (81.23%), nitrofurantoin (74.62%), aztreonam (69.36%), and meropenem (62.36%) (Table 2 and Fig. 2). Acinetobacter showed highest sensitivity to colistin (66%) followed by tigecycline (66%) (Fig. 3). Klebsiella demonstrated highest sensitivity to colistin(74%) (Fig 4). CoNS documented more sensitivity to togecycline(74.12%) and teicoplanin (74.23%)(Fig 5). Enterococcus was showed greater sensitivity to linezolid (85.56%), tigecycline (76.23%) and vancomycin (75.32) (Fig. 6). Streptococcus was produced more sensitivity to cefepime, ceftazidime, clindamycin, vancomycin and linezolid (78% and Fig. 9). Staphylococcus showed 100% sensitivity to tigecycline and nitrofurantoin (Tabe 2 and Fig. 10). Similarly, Table 2 and Figs.5 and 6 depicted the sensitivity pattern of other isolated organisms. E. coli, Acinetobacter, Pseudomonas, Proteus, and Enterobacter showed resistance to cephalosporins and piperacillin–tazobactam. Resistance to colistin was observed more in Proteus, and CoNS Staphylococcus showed 100% resistance to vancomycin and clindamycin, as depicted in Table 3.

Table 1: Frequency of Organisms isolated.

No.	Organisms	Frequency
1	Escherichia coli	42 (28%)
2	Acinetobacter	17 (11.33%)
3	Klebsiella	14 (9.33%)
4	Pseudomonas	11 (7.33%)
5	Coagulase negative Staphylococcus	31(20.66%)
6	Enterococcus	2(1.33%)
7	Proteus	3 (2%)
8	Staphylococcus	3 (2%)
9	Nonfermenting gram-negative Bacillus	2 (1.33%)
10	Streptococcus	3 (1.33%)
11	Fungal	22 (14.66%)
	Total	**150 (100%)**

Table 2: Antibiotic-Sensitivity Pattern of Isolates

Antibiotic	E. coli	Acineto	Kleb	Pseud	CoNS	Entero	Prot	Strepto	Staph
Ak	71.36	6	36	34	19.36	32.65	35.23	48.23	47
Gm	45.36	11	43	46	51.23	28.36	36.	33	48
Amx	11.23	1	14	6.39	21.36	58.36	36.23	1	0
Amp	2.36	2	1	1	25	1	2	1	1
Cfm	15.96	8	26	25.36	26.96	14.23	1	**78**	45
Ctx	14.25	5	23	24	29	16	1	76	52
Ctzm	13.68	5	26	28	29	12.36	4	**78**	52
Cfpz	43.28	9	26	28.36	28.36	19.23	1	73	51
Cxm	16.98	6	22	25.36	28.45	16.56	1	74	49
Cfu	28	3	22	29	24	12.36	1	74	48
Cpx	19.63	7	18	52.32	32.32	22.36	1	25	52
Lfx	3.96	0	0	25.3	32.47	1	2	1	0
Ofx	1	0	1	0	1	0	1	1	0
Ctmx	22	9	23	21	42.36	25.32	1	48	52
Cl	1	1	0	1	45.36	0	1	0	1

Col	**97.52**	**66**	**74**	49.23	45.36	25.36	1	49	47
Ip	**64.25**	25	49	56	18	26.36	36.24	48	54
Mp	**62.36**	29	36	54.36	24.56	33.32	39.32	28	49
Nf	**74.62**	1	0	1	62	32.65	0	1	**100**
Ptz	42.36	15	0	39.54	19.23	32.63	38.25	1	45
Tig	**81.23**	**66**	53	25.36	**74.12**	**76.23**	1	22	**100**
Tpn	8.63	1	15	6.36	**74.23**	68.26	0	1	52
Mcn	8.59	42	15	19.63	52.36	11.23	0	0	52
Cli	3.85	1	8	9.36	55.58	33.28	1	**78**	1
Vmn	3.12	1	9	1	65.23	**75.32**	1	**78**	52
Lzd	4.52	1	0	1	54.23	**85.56**	39.56	**78**	49
Doxy	4.25	1	0	1	55	14.23	1	2	55
Rif	1	8	1	2	48.23	26.35	1	0	48
Aznm	**69.36**	1	0	1	0	1	2	0	2

Ak, amikacin; Amx, amoxicillin; Amp, ampicillin; Gm, gentamicin; Cfm, cefepime; Ctx, ceftriaxone; Czm, ceftazidime; Cpz, cefaperazone; Cfx, cefexime; Cfu, cefuroxime; Cpx, ciprofloxacin; Lfx, levofloxacin; Ofx, oflaxacin; Ctmz, cotrimoxazole; Cl, clarithromycin; Col, colistin; Ip, imepenem; Mp, meropenem; Nf, nitrofurantoin; Ptz, piperacillin–tazobactam; Tig, tigecycline; Tpn, tiecoplanin; Mcn, minocycline; Cli, clindamycin; Vmn, vancomycin; Lzd, linezolid; Doxy, doxycycline; Rif, rifampicin; Aznm, aztreonam; NT, not tested; E. coli, Escherichia coli; Acineto, Acinetobacter; Kleb, Klebsiella; Pseud, Pseudomonas; Entero, Enterococcus; Prot, Proteus; Strepto, Streptococcus; Staph, Staphylococcus.

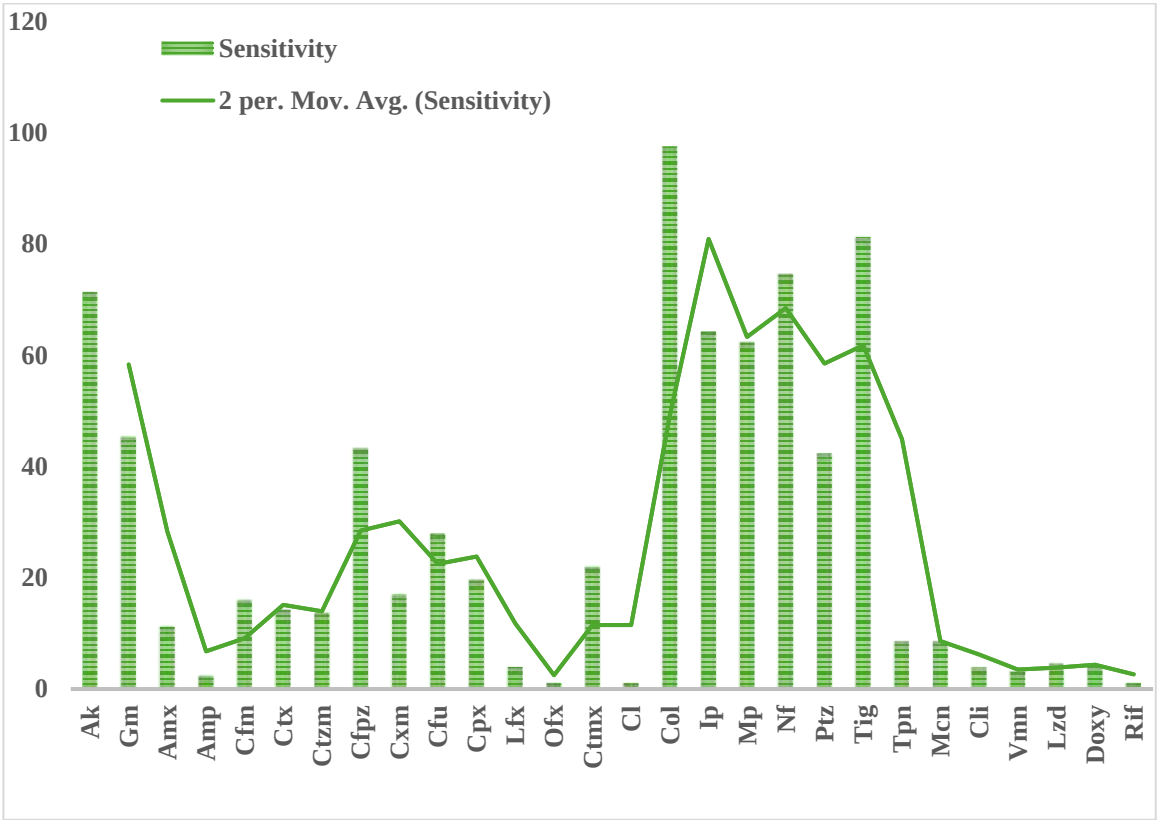

Fig 2: E. coli sensitivity pattern

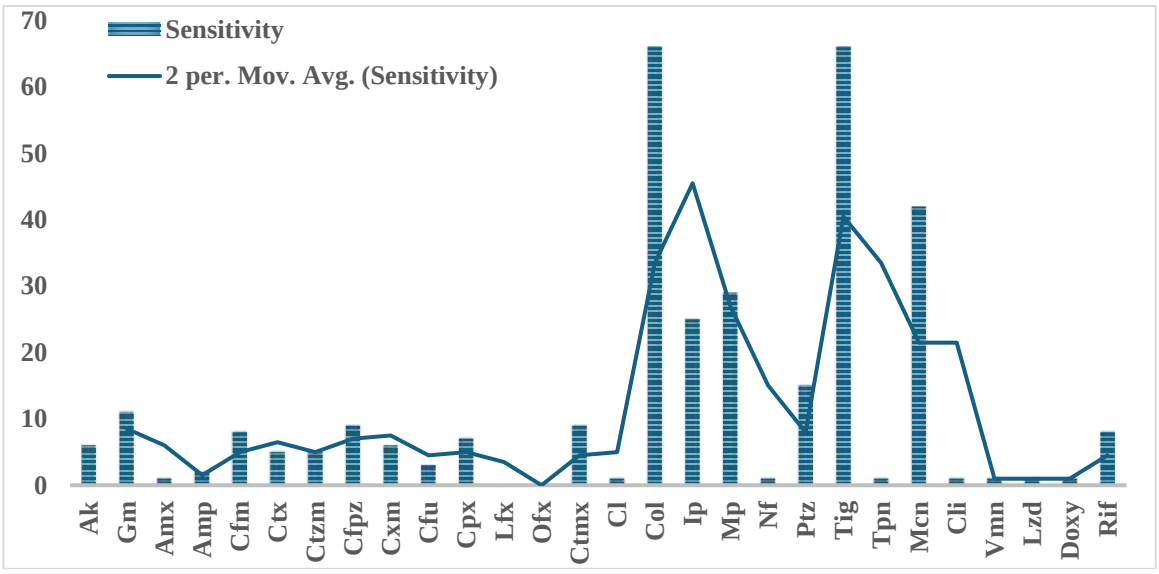

Fig 3: Acinetobacter sensitivity pattern

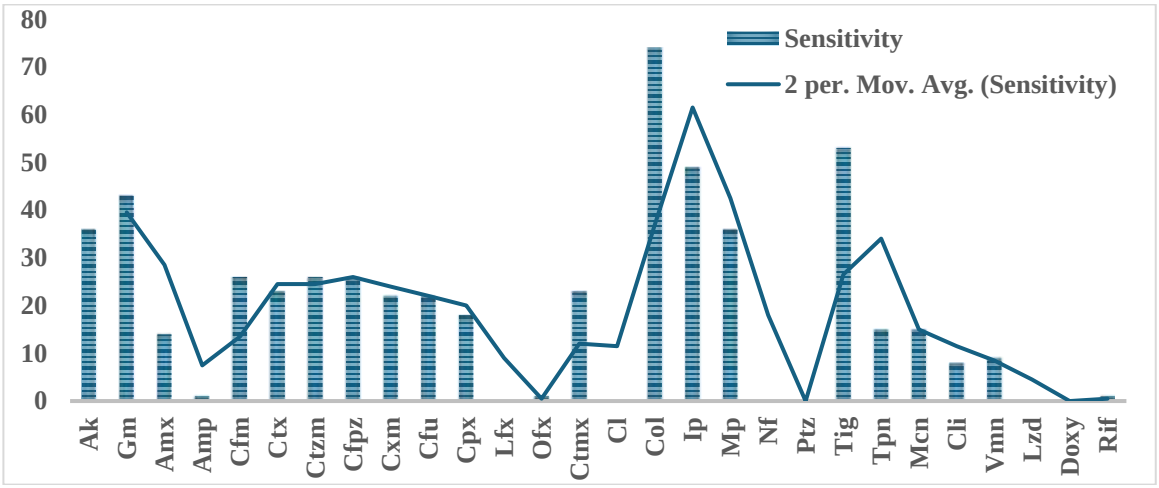

Fig 4: Klebsiella sensitivity pattern

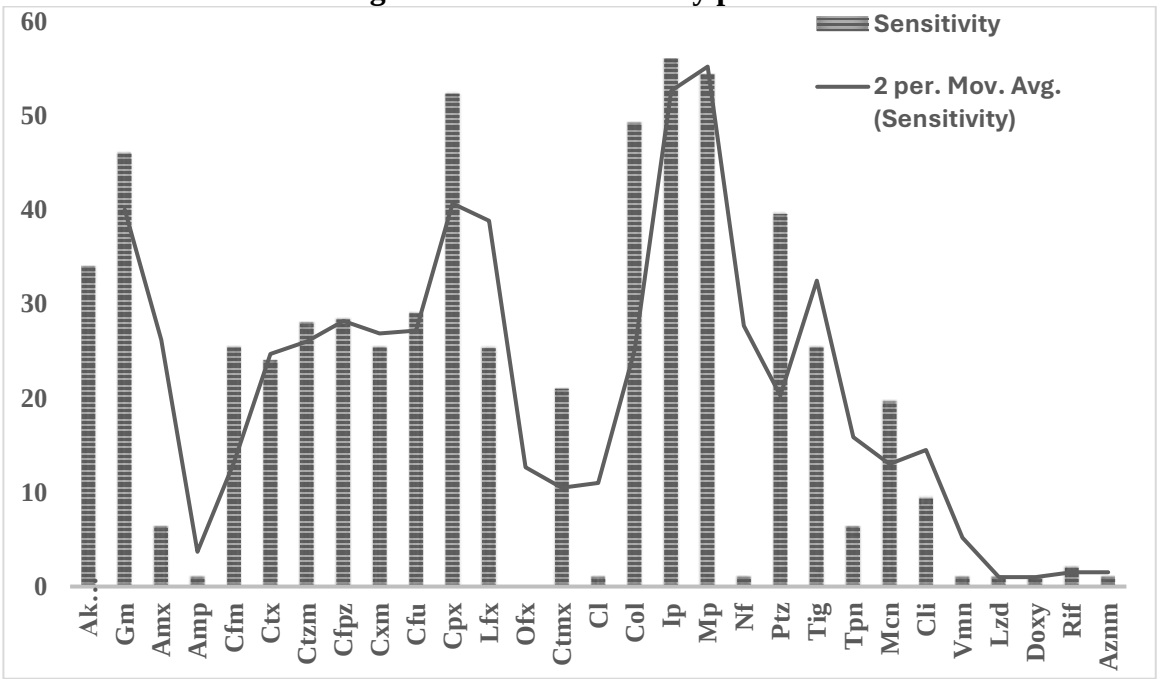

Fig 5: Pseudomonas sensitivity pattern

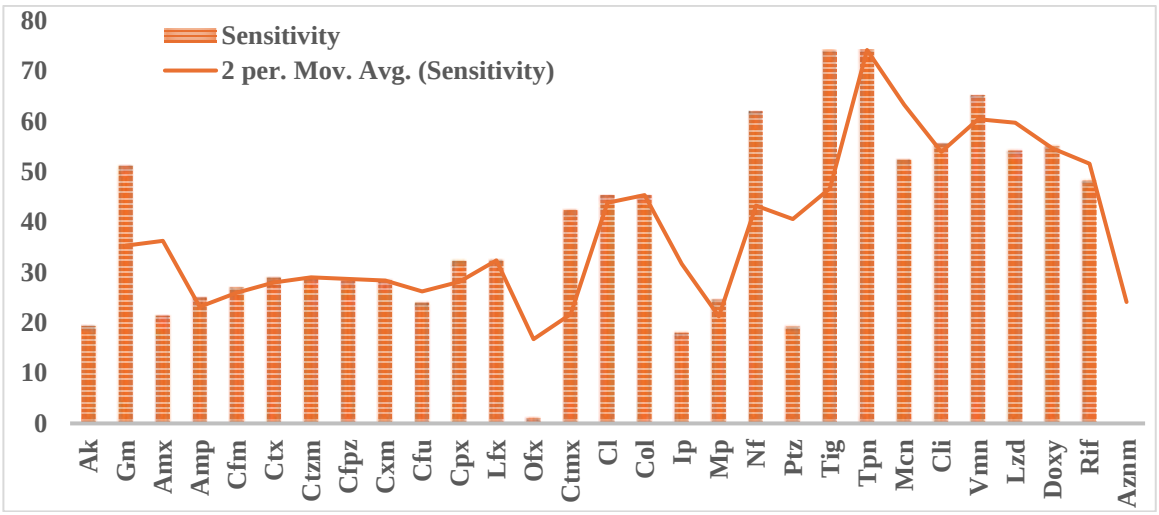

Fig 6: CoNS sensitivity pattern

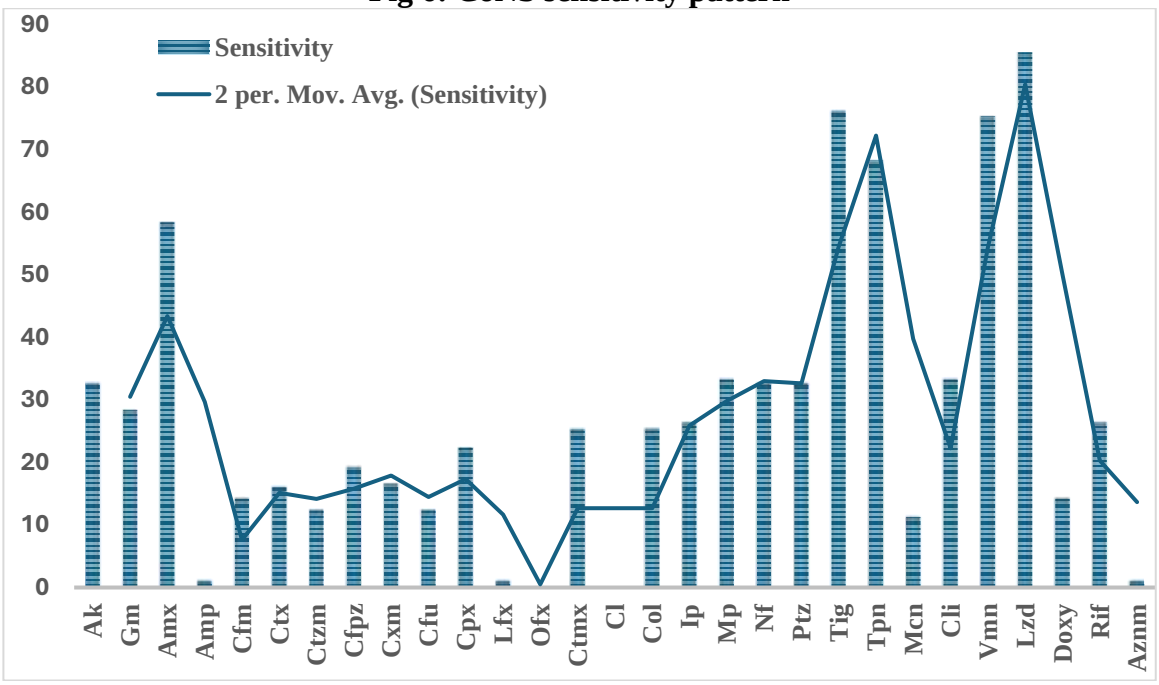

Fig 7: Enterococcus sensitivity pattern

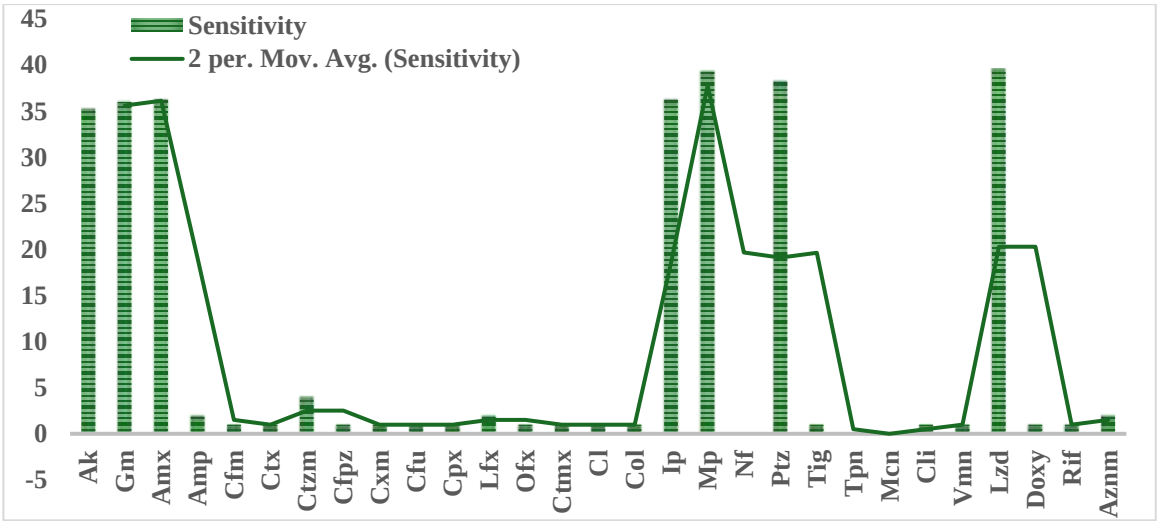

Fig 8: Proteus sensitivity pattern

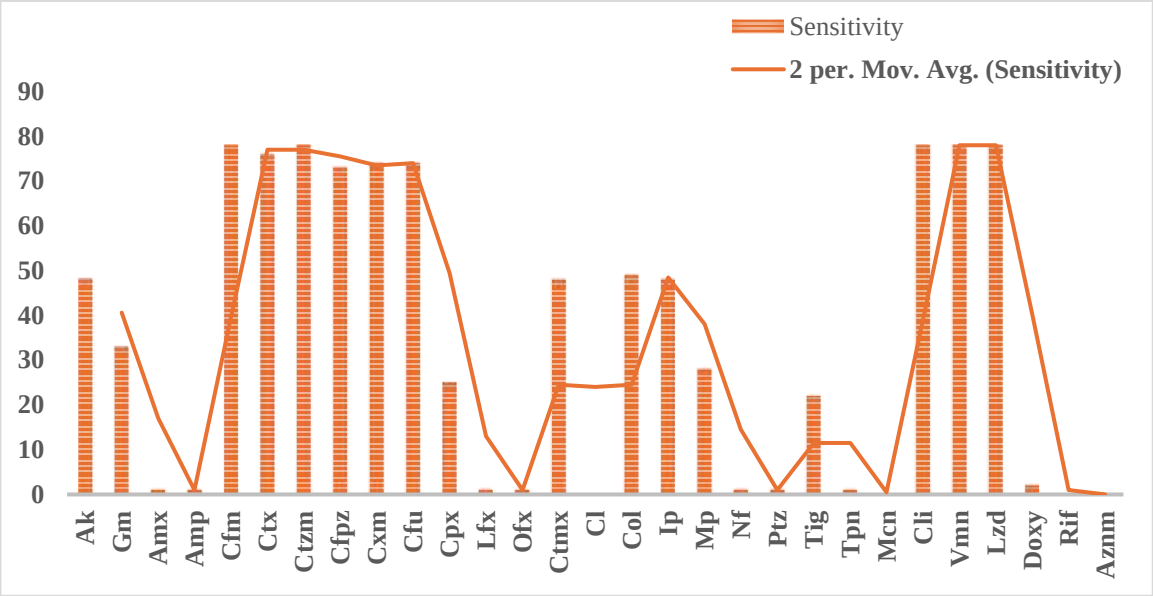

Fig 9: Streptococcus sensitivity pattern

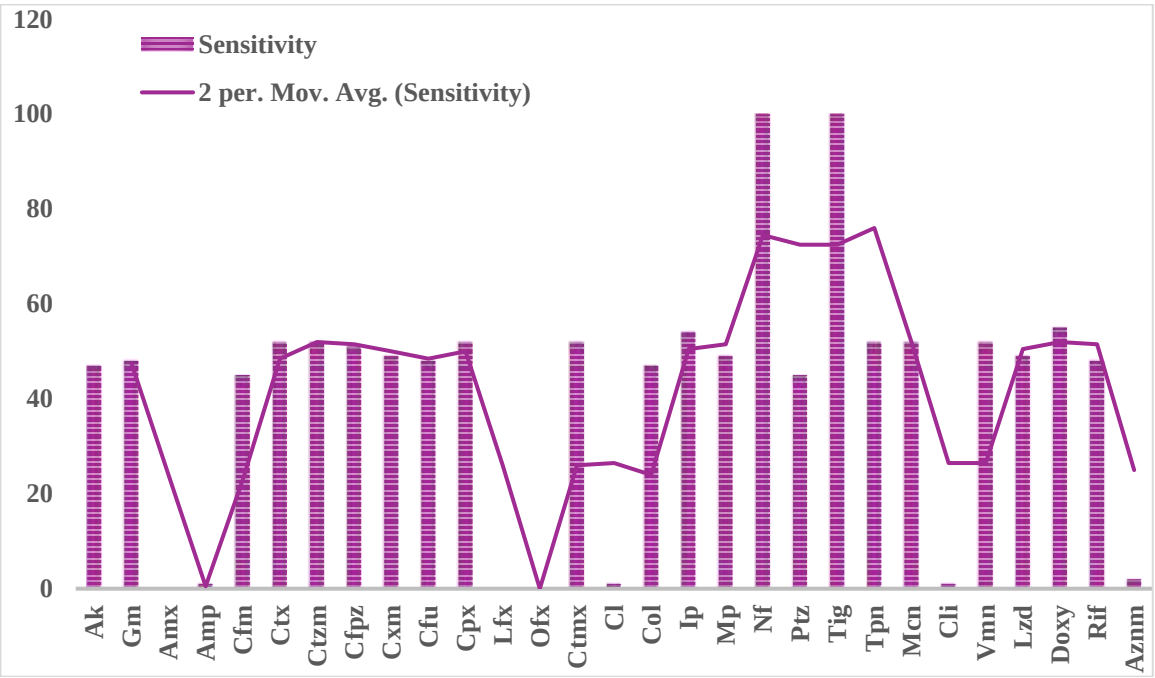

Fig 10: Staphylococcus sensitivity pattern

Table 3: Antibiotic-Resistance Pattern of Isolates

Antibiotic	E. coli	Acineto	Kleb	Pseud	CoNS	Entero	Prot	Strepto	Staph
Ak	16.23	0	50	72.56	78.56	56.32	56.23	45.23	45
Gm	22.25	0	61	52.36	45	78.56	65.36	26	45
Amx	38	0	**85**	**92**	78.26	60.23	63.23	0	0
Amp	38.56	0	0	0	0	0	0	0	0
Cfm	**63.23**	**92**	62	72	56	0	**85**	35	40
Ctx	52	**85**	56	58	80	**95**	35	56	48
Ctzm	**63.25**	**90**	60	72	71.25	**80**	**100**	28	44
Cfpz	42.35	**90.**	60.23	74	72	78	**100**	38	45
Cxm	48.25	85	55	70	63.23	**100**	35	45	51
Cfu	45	**90**	50	69	59	**85**	**95**	38	52
Cpx	18.25	**90**	75	48	71.26	70	66.25	70.25	43
Lfx	18.28	0	0	**85.26**	65.23	0	0	0	0
Ofx	19.23	0	0	0	0	0	0	0	0

Ctmx	45.26	**95**	68.25	71.25	55.23	75.28	66.36	40	53
Cl	19	23.62	26.26	0	0	51.18	0	0	0
Col	4.25	39	25	55.26	**85.23**	70.25	**92**	45	28
Ip	25.36	18.14	41	62.25	75.29	58.29	59.63	49.62	45
Mp	25.36	69.54	**75.28**	52.36	42.58	71.28	69.36	60.28	45
Nf	10.57	0	0	**95**	48.36	79.36	62.54	**98**	0
Ptz	48.56	78.58	0	0	**88.25**	75.28	60.35	**100**	48
Tig	0	38	45	74.12	39.28	28.54	**95**	78.36	0
Tpn	19.57	0	69	**95.25**	28.54	36.25	**98**	**97**	48
Mcn	0	50	0	75.05	38.25	**80.25**	**100**	29.63	45
Cli	18.25	0	0	**95.45**	26.25	59.63	**95**	29.23	**90.25**
Vmn	16.25	0	**80**	**90.23**	38.54	26.52	**95**	29.56	95
Lzd	18.25	0	**95.23**	**85**	45.23	18.25	68.56	39.25	49
Doxy	18.25	0	**95.**	**98**	45	**82.3**	0	**100**	48
Rif	12.35	0	**85.63**	**95**	25.36	74.25	0	**98**	45
Aznm	18.56	0	0	0	0	0	0	0	0

Ak, amikacin; Amx, amoxicillin; Amp, ampicillin; Gm, gentamicin; Cfm, cefepime; Ctx, ceftriaxone; Czm, ceftazidime; Cpz, cefaperazone; Cfx, cefexime; Cfu, cefuroxime; Cpx, ciprofloxacin; Lfx, levofloxacin; Ofx, oflaxacin; Ctmz, cotrimoxazole; Cl, clarithromycin; Col, colistin; Ip, imepenem; Mp, meropenem; Nf, nitrofurantoin; Ptz, piperacillin–tazobactam; Tig, tigecycline; Tpn, tiecoplanin; Mcn, minocycline; Cli, clindamycin; Vmn, vancomycin; Lzd, linezolid; Doxy, doxycycline; Rif, rifampicin; Aznm, aztreonam; NT, not tested; E. coli, Escherichia coli; Acineto, Acinetobacter; Kleb, Klebsiella; Pseud, Pseudomonas; Entero, Enterococcus; Prot, Proteus; Strepto, Streptococcus; Staph, Staphylococcus.

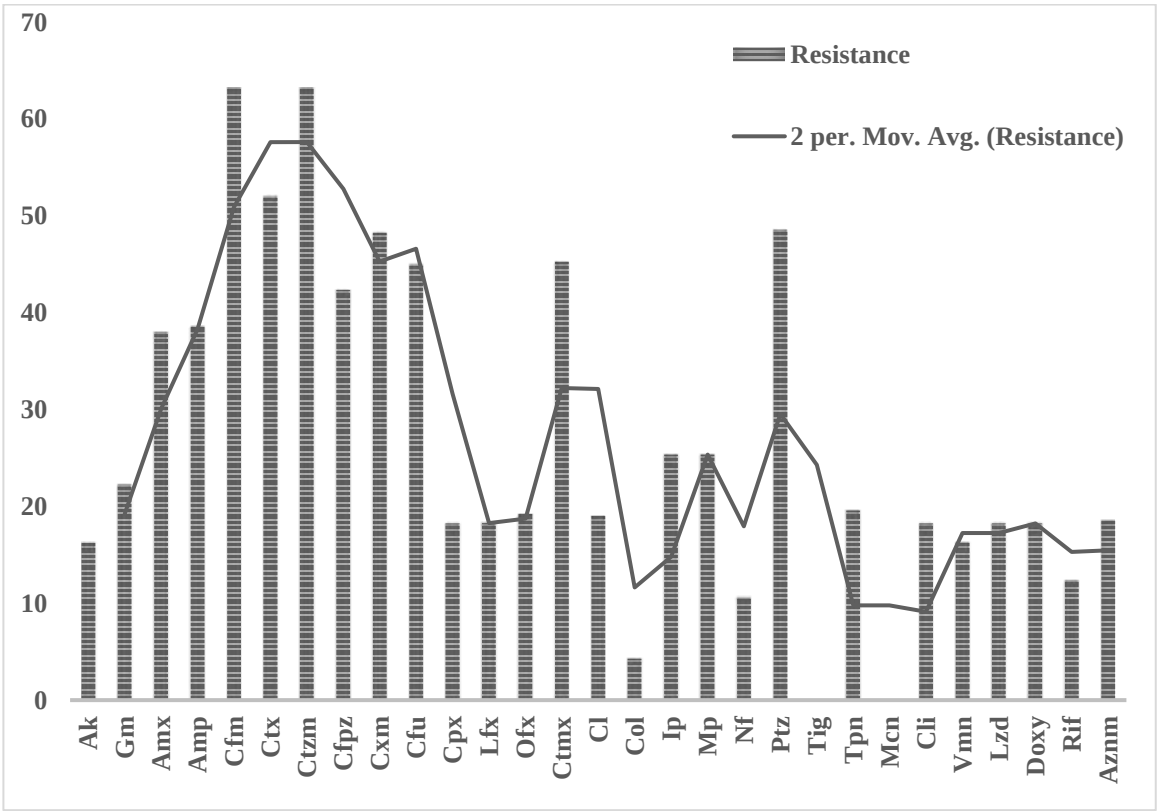

Fig 11: E. coli resistance pattern

Fig 12: Acinetobacter resistance pattern

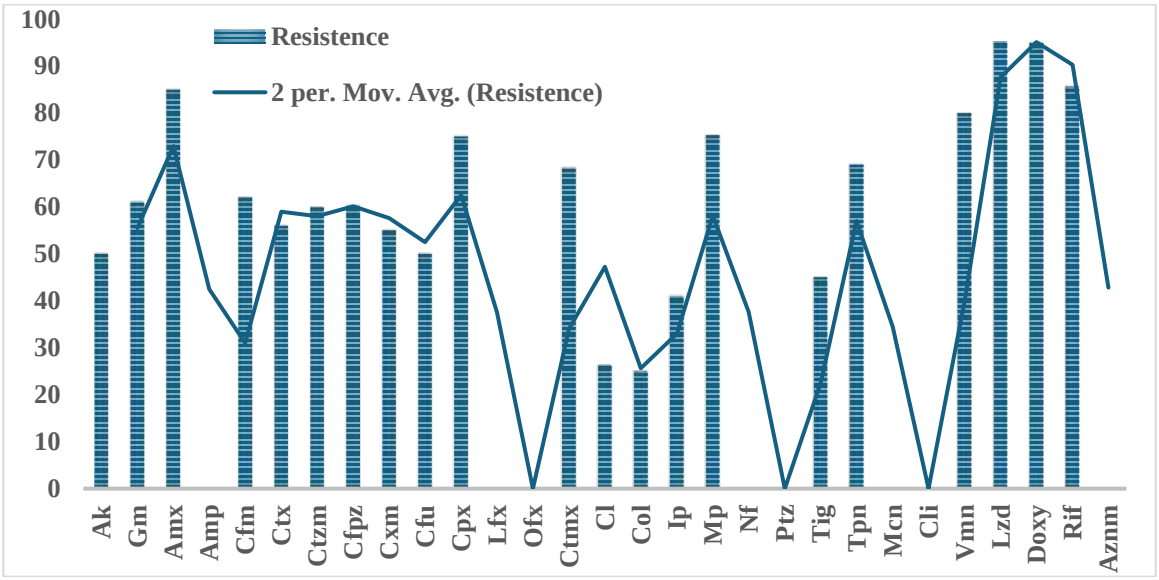

Fig 13: Klebsiella resistance pattern

Fig 14: Pseudomonas resistance pattern

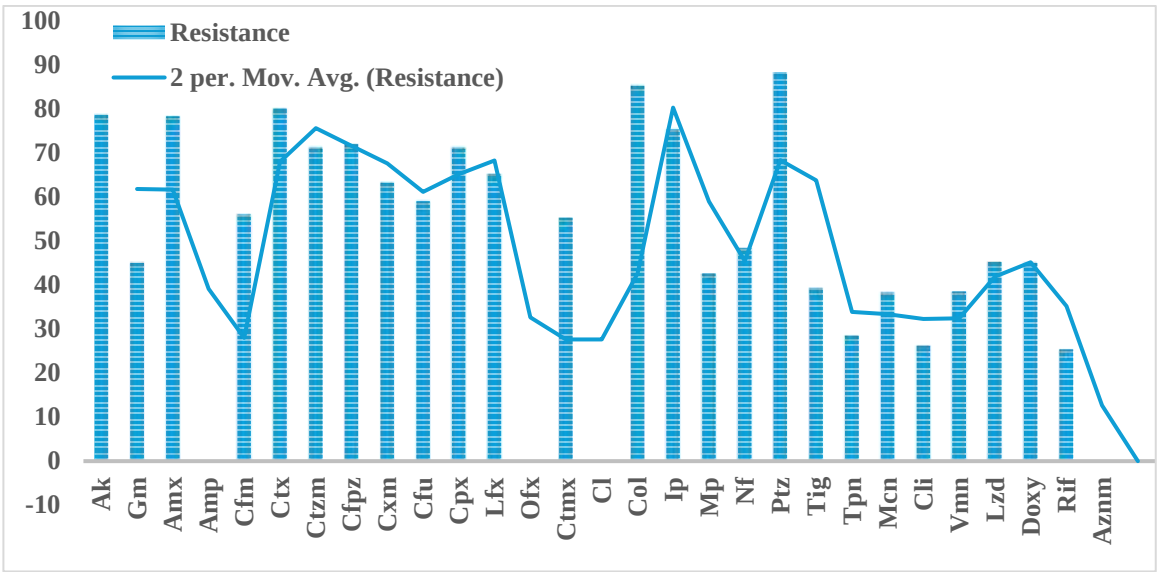

Fig 15: CoNS resistance pattern

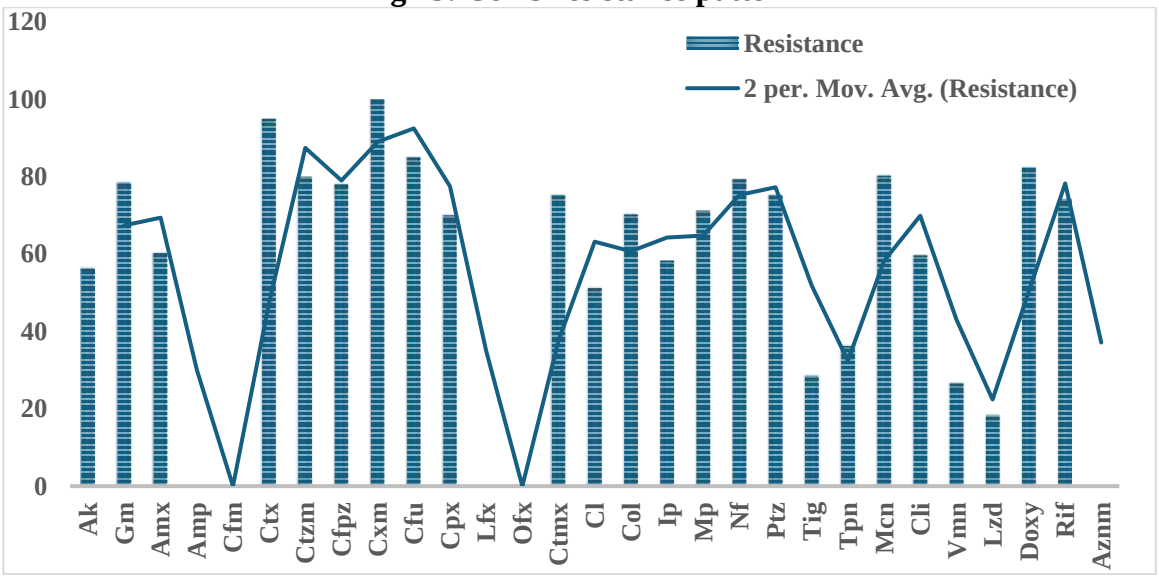

Fig 16: Enterococcus resistance pattern

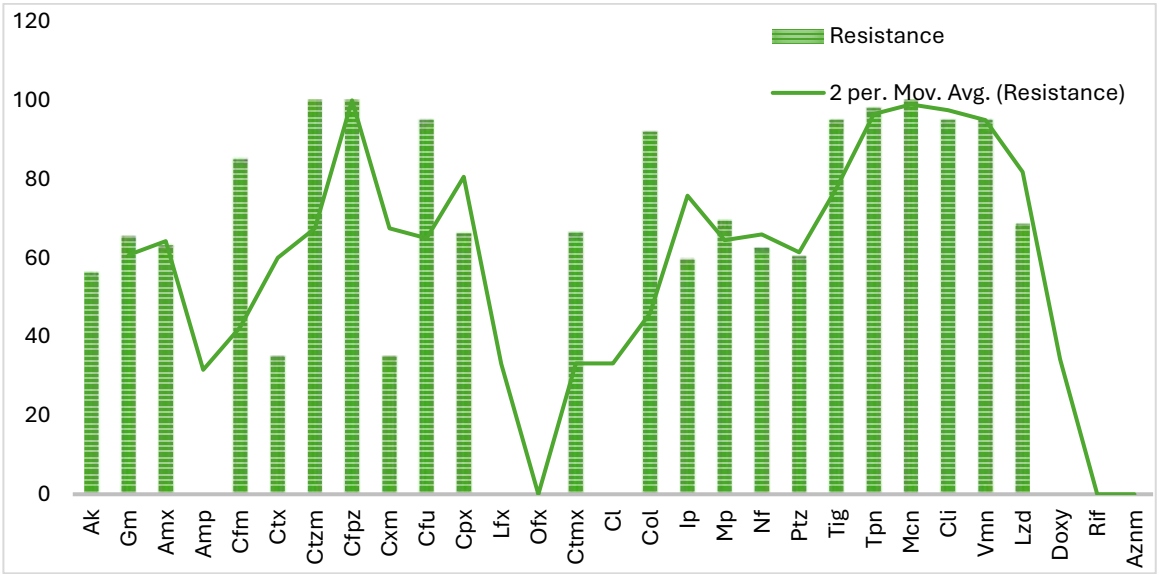

Fig 17: Proteus resistance pattern

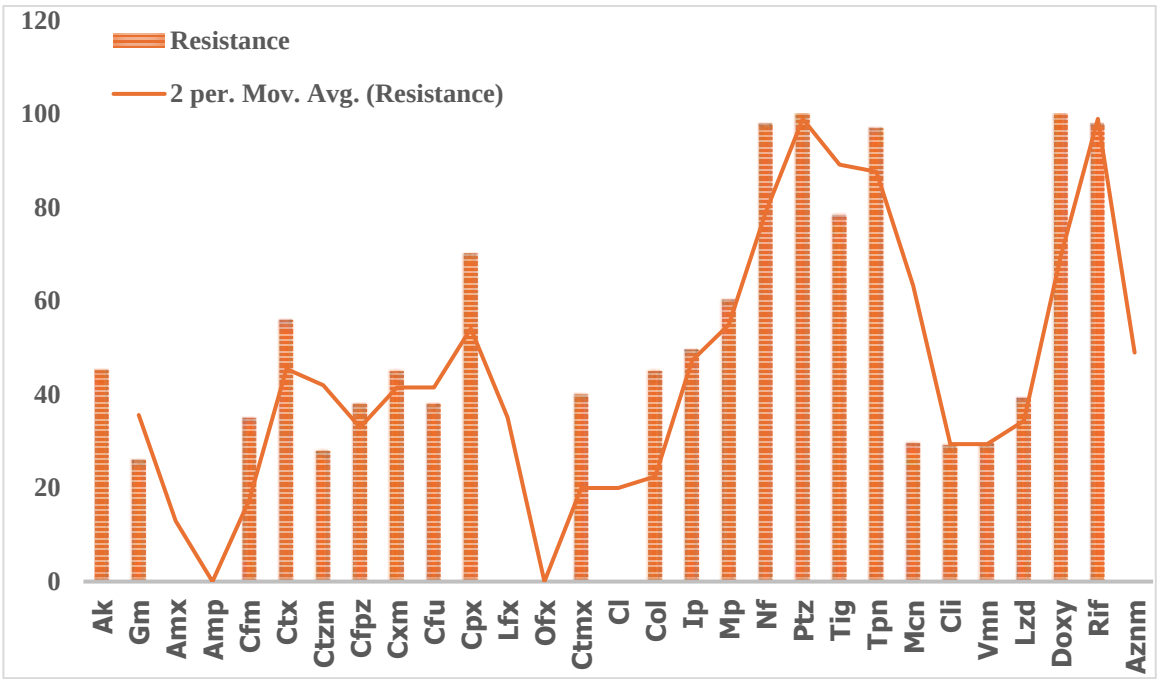

Fig 18: Streptococcus resistance pattern

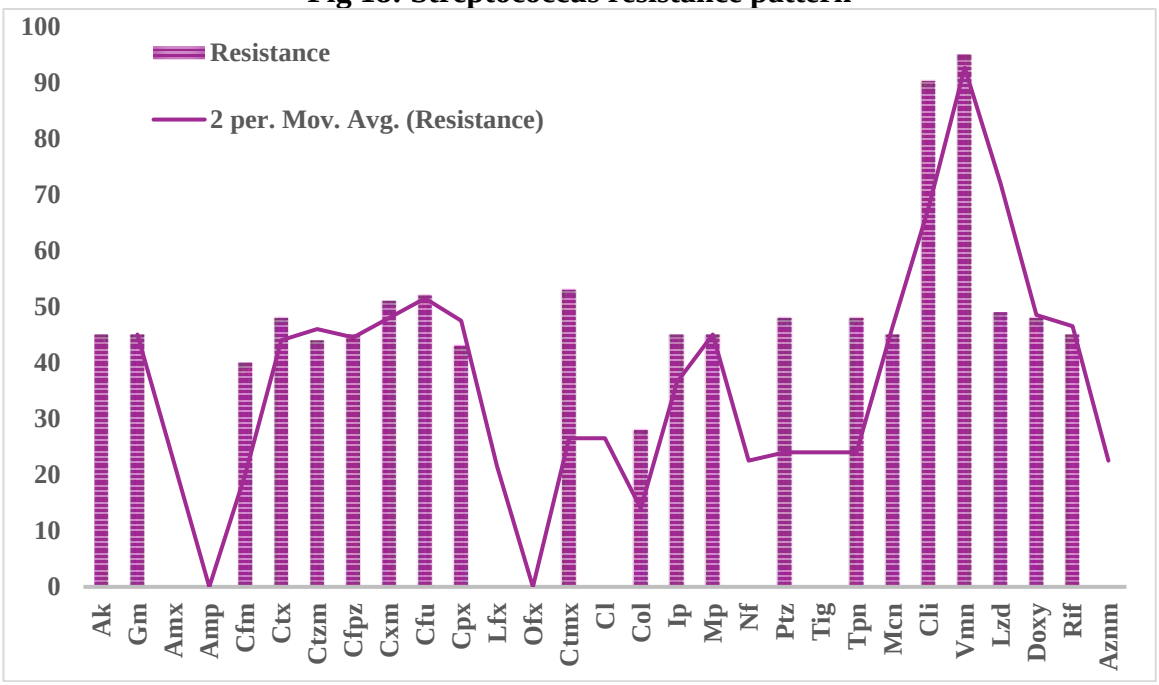

Fig 19: Staphylococcus resistance pattern.

Discussion:

Antibiotic resistance is an emerging problem in critically ill cases, which affects prognosis and survival of the participants. It also results in prolonged stay in hospital, increasing the cost of treatment. [11-13] In present study, of the 150 cases sent, 76% were culture positive compared to 46.4% by Chakravarthi et al. [14] Among these, gram negative accounted for 28%, gram-positive were 59%, and fungal growth was yielded in 13% of samples (Fig. 1). The most common organisms isolated in present study were E. coli (28%), Klebsiella (9.33%) Acinetobacter (11.33%), and Pseudomonas (7.33%). This is comparable to other studies where gram-negative organisms were most isolated.10 Among gram-positive, CoNS was the most common organism isolated (20.66%). Fungal growth was also seen in 14.66% samples (Table 1). In Asian countries including India, most of the isolates obtained from ICU participants are gram-negative organisms such as E. coli, Klebsiella, and Acinetobacter followed by gram-positive organisms like Staphylococcus

comparable to our study.[15–17] CoNS was the most common organism isolated in blood culture, i.e., (48.96%), followed by E. coli and Pseudomonas, this is comparable to studies done by Vanitha Rani et al.,[18] Javeed et al.,[19] Jain et al.,[20] Rajeevan et al.,[21] and Shrestha et al.[22]

The data highlights significant variations in antibiotic effectiveness against different bacterial pathogens. Amikacin (Ak) is most effective against E. coli (71.36%) and Staphylococcus (47%) but less so against Acinetobacter spp. (6%), while Gentamicin (Gm) shows high efficacy against Pseudomonas spp. (51.23%) and Staphylococcus (48%), yet low against Acinetobacter spp. (11%). Amoxicillin (Amx) and Ampicillin (Amp) demonstrate very low effectiveness overall, with Amoxicillin slightly better against E. coli (11.23%) compared to Ampicillin (2.36%). Among cephalosporins, Cefoperazone (Cfpz) has relatively higher effectiveness against E. coli (43.28%), whereas Cefixime (Cfm) and Cefotaxime (Ctx) show moderate results across various bacteria. Ciprofloxacin (Cpx) is quite effective against Pseudomonas spp. (52.32%) and Staphylococcus (52%), while Levofloxacin (Lfx) and Ofloxacin (Ofx) have low effectiveness generally. Carbapenems, Imipenem (Ip) and Meropenem (Mp), show high effectiveness against a broad range, particularly Imipenem against Klebsiella spp. (49%) and Pseudomonas spp. (56%). Colistin (Col) is very effective against E. coli (97.52%) and Acinetobacter spp. (66%), but less so for Proteus spp. Nitrofurantoin (Nf) is highly effective against E. coli (74.62%) and Streptococcus spp. (100%) but ineffective against most others. Piperacillin-Tazobactam (Ptz) is effective against Pseudomonas spp. (39.54%) and Staphylococcus (45%), while Tigecycline (Tig) is very effective against Acinetobacter spp. (66%) and Enterococcus spp. (76.23%). Vancomycin (Vmn) shows high effectiveness against Enterococcus spp. (75.32%) and Staphylococcus (52%), and Linezolid (Lzd) is also highly effective against Enterococcus spp. (85.56%) and Streptococcus spp. (78%). Understanding these variations is crucial for selecting appropriate antibiotic treatments in clinical settings.

E. coli (46%) was commonly isolated from urine, followed by fungal growth and Acinetobacter. In other studies, such as Bajaj et al. [23] and Sheth et al.,[24] Klebsiella was commonly isolated from urine culture. Fungal urinary tract infection has become a significant nosocomial problem over the past decade;[21] however, laboratory yield of yeast in urine and its significance may be difficult to differentiate from colonization and infection. [24–27] Klebsiella was commonly isolated from ET aspirate culture (31%) followed by Acinetobacter and Pseudomonas. In most other studies done in respiratory ICU, Acinetobacter was commonly isolated followed by Klebsiella and Pseudomonas. [28–30] E. coli showed highest resistance to ceftazidime (63.25%), and cefepime (63.23%). This was identical to the study by Hsu et al., [31] Mangaiarkkarasi et al.,[32] and Oteo et al.[33] (Fig. 11). Acinetobacter showed high resistance to cephalosporins (96%) followed by piperacillin–tazobactam (84%) as also reported by Chakraverti et al.[14] (Fig. 12). Klebsiella showed high resistance to cephalosporins (75%), linezolid(95.23%), doxycycline (95%), rifampicin (85.63), amoxycillin (85%), vancomycin(80%) and meropenem (75.28%), tiecoplanin(69%%), and cotrimoxazole (68.25%). The resistance of Klebsiella to cephalosporins was also observed in other studies by Sheth et al.,[24] Javeed et al. (Fig. 13).[19] Pseudomonas showed the highest resistance to antipseudomonal drugs such as doxycycline(98%), clindamycin (95.45%), teicoplanin (95.25%), rifampin (95%), nitrofurantoin(95%) vancomycin(90.23%), and levofloxacin(85.26%)(Fig. 14).This pattern of resistance was observed by Mohana Sundaram et al.[34]. Enterococcus showed highest resistance to cefexime(100%), cotrimoxazole (95%), cefuroxime (85%), minocycline (80.25%), ceftazidime(80%) and nitrofurantoin(79.36%).(Fig. 16) Streptococcus showed 100% resistance to piperacillin-tazobactam and doxycycline.(Fig. 18).

Piperacillin-tazobactam has been a cornerstone of empirical antibiotic therapy, followed by carbapenems, in treating severely ill ICU patients. The Indian Council of Medical Research (ICMR) guidelines also recommend the use of β-lactam with β-lactamase inhibitors, such as piperacillin-tazobactam, as empirical antibiotic therapy in critically ill patients. However, our study observed significantly high resistance rates to piperacillin-tazobactam, ranging from 60% to 86% in both Gram-negative and Gram-positive infections, as indicated by culture and sensitivity reports.

The prevalence of carbapenem-resistant Enterobacteriaceae, including Klebsiella, E. coli, and Acinetobacter, has increased markedly over the past decade. This trend is reflected in our findings, where E. coli exhibited around 97.52% sensitivity to colistin, while Acinetobacter, Klebsiella, and Pseudomonas showed sensitivities of 66%, 74%, and 49.23%, respectively. The increasing resistance to piperacillin-tazobactam and the reliance on colistin highlight the pressing need for ongoing surveillance and updated treatment protocols to effectively manage these resistant infections.

The prevalence of multidrug-resistant organisms in our ICU can be attributed to factors such as prior antibiotic usage, previous severe Gram-negative infections, inappropriate antibiotic courses, and the high acuity of patients presenting with severe sepsis and septic shock, characteristic of a tertiary care hospital. The resurgence of older antibiotics, such as colistin, is a response to the increasing resistance of these organisms.

The present study demonstrated notable sensitivity of Gram-negative isolates to colistin, with E. coli showing 96.8% sensitivity, Acinetobacter 68%, Klebsiella 70%, and Pseudomonas 47%. However, the presence of pan-drug-resistant isolates, which exhibit resistance to all tested antibiotics, including carbapenems, colistin, and minocycline, underscores a significant threat. The emergence of these pan-drug-resistant organisms presents a formidable challenge, prompting critical reflection on future treatment strategies.

4o At this juncture, it is crucial to establish local antibiograms in every ICU setting, ideally on a quarterly basis, to enhance clinical decision-making regarding the initiation of empirical antibiotics. This approach, coupled with a comprehensive antibiotic stewardship program, is instrumental in preventing the emergence of multidrug-resistant (MDR) and extremely drug-resistant organisms. The strategic use of broad-spectrum empirical antimicrobials, followed by an aggressive de-escalation strategy, is vital to minimizing collateral damage to both current and future patients. Additionally, strict adherence to sterile techniques during device insertion, rigorous hand hygiene, and the use of gowns and gloves in ICU settings are essential practices. These measures not only prevent nosocomial infections but also contribute to improved patient outcomes and clinical responses.

Conclusion:

Antibiotic resistance is emerging as a significant challenge in contemporary clinical practice, exacerbating treatment complexities for healthcare providers and imposing substantial financial burdens on patients and their families. The prevalence of Gram-negative resistant infections is escalating within intensive care units (ICUs), contributing to heightened morbidity and mortality rates. Consequently, the implementation of regular antibiograms and robust antibiotic stewardship programs is imperative. These initiatives are critical for accurately identifying the causative organisms and understanding their sensitivity and resistance patterns, thereby facilitating the judicious initiation of empirical antibiotic therapy in emergency scenarios. Equally important is the emphasis on the de-escalation of antibiotic use when indicated, to mitigate the misuse of antibiotics and curb the progression of resistance. Optimal utilization of existing antimicrobial agents is essential for preserving their efficacy for future generations.

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