Original Research Article

Antibiotic resistance pattern of bacteria isolated from various clinical specimens in a tertiary care hospital

Sailaja B. S. G.[1], Prasad P.D.[2]

[1]Dr. B. S. G Sailaja, Assistant Professor, Department of Microbiology, GSL Medical College, Rajahmundry, Andhra Pradesh, [2]Dr. P.D. Prasad, District Hospital Pathologist, Chittoor, Andhra Pradesh, India.

Corresponding Author: Dr. P.D. Prasad, District Hospital Pathologist, Chittoor, Andhra Pradesh. E-mail: bsgsailaja@gmail.com

Abstract

Background: Antibiotic resistance is a common phenomenon in bacteria, and it is a significant threat all over the world. With this a study was conducted to find the antibiotic resistance pattern of various bacterial isolates. **Methods:** This is a hospital-based study involving both in and outpatients. Patients with various infections were included, clinical specimen were collected accordingly. The pathogenic bacteria were isolated and identified. Antibiotic sensitivity testing was done by Kirby Bauer disc diffusion method. **Results:** The male female ratio was 1.23; 30% isolates were gram positive cocci and 70% were gram negative bacilli; *Klebsiella spp* (30.5%) was the predominant isolate followed by *Staphylococcus aureus* (25%); statistically the difference was not significant. Samples wise, predominant isolates were from urine followed by respiratory samples and skin samples; significant drug resistance was detected. **Conclusion:** A Significant rise of antibiotic resistance to various antibiotics in different classes of bacteria has been observed. Always there should be proper communication between the clinician and microbiologists is essential to get the best result while treating patient.

Keywords: Antibiotic resistance, Bacteria, Patients, Infections

Introduction

Antibiotic resistance of bacteria is significant threat all over the world. But the developing countries like India this is an even greater public health problem because India is one of the highest bacterial disease like urinary tract infections (UTI), respiratory tract infections (RTI), skin& soft tissue infections (STI). With this, antibiotics have a significant role in mortality and morbidity [1, 2].

UTIs are important medical problem, usually caused by the microbial invasion of the urinary tract that extends from the renal cortex. The most common bacterial infection accounting for 35% of total hospital acquired infections (HAIs) [3,4].

RTI pose serious problems owing to their great prevalence with associated high mortality rates and economic status [5]. STI are common infections of the skin, subcutaneous tissue and muscle which may be minor, self-limiting may lead to life threatening diseases requiring; these may be complicated and uncomplicated infections [6].

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India is one of the highest consumers of antibiotics in the world [7] and the drug resistance (DR) bacteria have increased in the last decade. Uncontrolled and inappropriate use of antibiotics is the main cause for DR. Among these, multi drug resistance (MDR), extremely drug resistance (XDR) TB, methicillin resistance *Staphylococcus aureus* (MRSA), penicillinase producing Neisseria gonorrhoea (PPNG), VA resistance Enterococci (VRE) are some important DR bacteria [8]. Surveillance studies are mandatory so that we every hospital can revise their antibiotic policies. With this a study was conducted to find the DR pattern of various bacterial isolates.

Methods

Study period: Study was conducted in the department of Microbiology, GSL Medical College from March to May 2019. Study protocol was approved by the institutional ethical committee.

Inclusion criteria: Individuals aged $\geq$ 18 years, with various UTI, RTI, STIs attending inpatient and outpatients' departments were included in the study.

Exclusion criteria: Patients on antibiotic treatment for the last three months, known foreign bodies implants, mechanical heart valves were excluded from the study.

Study design: The patients were explained about the study protocol in detail and informed written consent was taken either from the participants or their representatives. Various clinical samples such as urine, sputum, BAL, pleural fluid, tracheal aspirate, bronchial wash, endotracheal tip, throat swabs, pus swabs, blood, IV catheter tips, body fluids (CSF, ascitic fluid, synovial fluid) were collected based on the site of infection. Specimen was transported to microbiology laboratory immediately. Direct microscopic examination such as gram stain, wet mount and culture sensitivity was done as per the standards [9, 10, 11, 12, 13]. After overnight incubation, growth was classified by gram stain to gram positive cocci (GPC) and gram-negative bacilli (GNB). All the isolates were identified based on Gram staining and by using various biochemical reactions [13]. After identifying the bacteria, antibiotic sensitivity of isolates was done on Muller-Hinton agar (MHA) by the disk diffusion method [13], *Escherichia coli* ATCC 25922 was used as the control.

Statistical analysis: Statistical analysis was done by using SPSS version 21. Chi square test was to find statistical analysis, $P<0.05$ was considered as statistically significant.

Results

During the study period the culture positivity was 302 (100%); 30% were GPC and 70% GNB. The male female ratio was 1.23. Isolate wise, *Klebsiella spp* was the predominant among GNB and *Staphylococcus aureus* among GPC (Figure 1); statistically the difference was not significant.

Table-1: Number of isolates, clinical specimen wise; n (%)

Specimen	GPC 92 (30)	GNB 210 (70)	Total 302 (100)
Urine	8 (9.3)	78 (90.6)	86 (28.3)
Respiratory	47 (46)	55 (53.9)	102 (33.6)
Skin & Soft tissue	37 (32.4)	77 (67.5)	114 (37.7)
GPC: Gram positive cocci; GNB: Gram negative bacilli			

Table-2: Antibiotic susceptibility pattern of the isolates in percentage.

Isolate	P & CONGENERS P&AMP	2nd Gen CPS CX	3rd Gen CPS CTR CTX CAZ	4th Gen CPS CPM	FQ CIP NX	AG AK GEN	M E AZ	GP VA TEI	TET	LZ	COT	NIT	PIT	AMC	C IMP MRP
S.aureus	S94	S03	S07	S08	S31	S82	S89	S100	S08	S100	S24	S 89	S100	S100	S100
	R06	R97	R93	R92	R69	R18	R11	R0	R92	R0	R76	R11	R0	R0	R0
Sterpto	S100	S24	S22	S12			S 54	S100	S89	S100	S55		S100	S100	S100
	R0	R76	R78	R88			R44	R0	R11	R0	R45		R0	R0	R0
Entero	S100	S23	S08	S06	S0	S0	S10	S0		S0	S0	S 89	S0	S0	S0
	R0	R77	R92	R94	R100	R100	R90	R100		R100	R100	R11	R100	R100	R100
E.coli	S97	S25	S10	S08	S31	S14					S24	S 92	S0	S18	S0
	R03	R75	R90	R92	R69	R86					R76	R08	R100	R82	R100
Kleb	S100	S46	S22	S14	S22	S24					S12	S 81	S04	S22	S0
	R0	R54	R78	R86	R78	R76					R78	R19	R96	R78	R100
Pseudo	S100	S66	S50	S50	S42	S22					S21	S 77	S04	S28	S0
	R0	R36	R50	R50	R58	R78					R79	R23	R96	R72	R100
Proteus	S100	S24	S08	S08	S22	S22					S11	S 89	S0	S12	S0
	R0	R76	R92	R92	R78	R78					R89	R11	R100	R88	R100

S- Sensitive; R- Resistance; β lactam group (Penicillin: P, Ampicillin: AMP); 2nd generation Cephalosporins (Cefoxitin: CX); 3rd generation Cephalosporins (Ceftriaxone: CTR, Cefotaxime: CTX, Ceftazidime: CAZ). 4th generation Cephalosporins (Cefepime: CPM); Fluroquinolones (Ciprofloxacin: CIP, Norfloxacin: NX); Aminoglycosides (Amikacin: AK, Gentamycin: GEN); Macrolides (Erythromycin: E, Azithromycin; AZ); Glycopeptides (Vancomycin: VA, Teicoplanin: TEI); Tetracyclines: TET; Linezolid: LZ; Cotrimoxazole: COT; Nitrofurantoin: NIT; β lactam + β lactamase inhibitors (Piperacillin tazobactum: PIT, Amoxycillin clavulanic acid: AMC); Carbapenems (Meropenem: MRP, Imipenem: IMP).

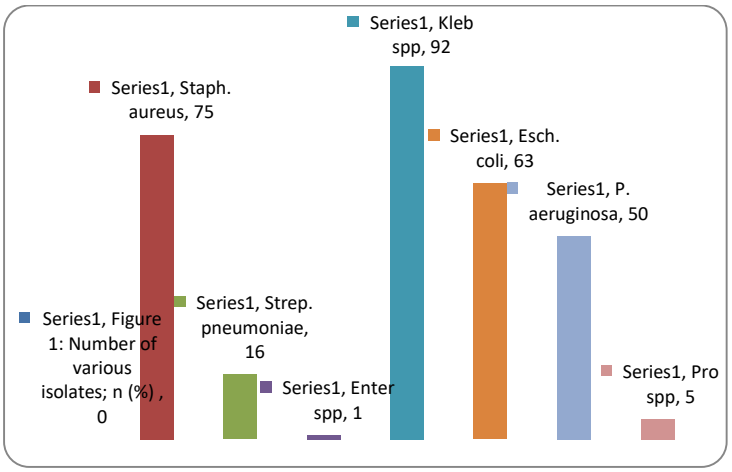

Figure-1: Prevalence of various isolates in the study (n)

Samples wise, predominant isolates were from urine followed by respiratory samples and skin samples (Table 1); significant DR was detected (Table 2).

Discussion

In this study, an attempt was made to find the prevalence of various bacteria as well as the drug susceptibility to various anti microbial agents. DR is the main concern for the treating specialists to choose the antibiotics especially for the hospitalized patients [14, 15] and also for pediatric group [16, 17]. For developing countries such as India, DR is a significant threat [18] because DR was reported to be one of the main causes of morbidity and mortality in India. This is mainly because of indiscriminate usage of antibiotics [19, 20].

Among GPC, *Staph. aureus* (75) is the prevalent pathogen isolated followed by *streptococcus pneumoniae* (16) and *Enterococcus spp.* (1); among GNB, the rate of isolation was Klebsiella species 92(30.4%), *Escherichia coli* 63 (20.8%), *Pseudomonas aeruginosa* 50 (16.5%) and Proteus species 05 (1.6%); DR was observed to almost all the pathogens.

Staph. aureus, commonest GPC showed 100% sensitivity to LZ, V, IMP; 82% sensitivity to GEN. Azimi Taher et al., reported that highest resistance rate to LZ (R=50%) and VA was reported to be an effective antibiotic [21]. Similar results were reported in the literature [22, 23, 24]. However, the results of these studies were not consistent with our findings and they had reported high resistance to VA.

In this study, most of the isolated were from UTIs; 86 were culture positive. Tsegaye Alemayehu et al., [25] also reported similar findings. The resistance rate of Klesiella in this study was, 100%, 86%, 78%, respectively for IMP, CPM and CIP. Taher Azimi et al., [21] reported 12.8%, 18.5% and 21%, DR respectively for levofloxacin, imipenem and ciprofloxacin.

As per the recent literatures, MDR organisms were reported from all over India for GP as well as GN bacteria [26]. This DR was reported not only towards old antibiotics, but recent anti bacterial agents such as carbapenem, tigecycline and 3rd generation cephalosporins.

In this institution, there is a standard antibiotic policy and monthly there will be review meetings on this. And standard instructions to follow the results of antibiotic susceptibility testing. Inspite of these, DR was reported. Because of easy availability of antimicrobial agents in the market. From microbiological point also, proper quality control should be followed.

However, this study had certain limitation. Short duration, small sample size, no IP and OP categorization, no categorization of infections such as UTI, RTI and no species level identification.

Conclusion

A significant rise of antibiotic resistance to various antibiotics in different classes of bacteria has been observed. Always there should be proper communication between the clinician and microbiologists is essential to get the best result while treating patient.

What the study adds to the existing knowledge?

The present study provides an epidemiological status of the significant rise of antibiotic resistance which is vital while designing the treatment plan.

Author's contribution

Dr. B. S. G Sailaja: Concept, study design and conduct of study.
Dr. P.D. Prasad P.D: Data analysis and manuscript preparation.

Findings: Nil; **Conflict of Interest**: None initiated
Permission from IRB: Yes

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