Research Article

Study on Prevalence and Antimicrobial Susceptibility Patterns of Clinical Isolates in a Tertiary Care Teaching Hospital

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ABSTRACT

Context: Antimicrobial resistance is currently the most significant challenge to effectively treating infections globally. The threat of antibiotic resistance is growing at an alarming rate in developing countries, perhaps more rapidly. **Aim:** This study aims to determine the susceptibility patterns of micro-organisms to antibiotics and the prevalence of micro-organisms among common pathogens in a tertiary care hospital. **Materials and Methods:** The study was carried out in three phases. A retrospective study (first phase) was conducted for one year (January 2020-December 2020), and a prospective study (second phase) was performed for six months (April 2021-October 2021) in the inpatient department of General Medicine and Surgery on the sensitivity pattern of micro-organisms and in the third phase, obtained data's from both the studies were compared and analysed. **Results:** A total of 980 cases were analysed in the first phase, in which majorly identified micro-organisms were *E. coli* (35.1%), *Klebsiella* (24.6%), and *S. aureus* (6.73%). During the second phase, 84 cases indicated that *E. coli* (30.9%) was highly sensitive to Imipenem, meropenem, and amikacin and showed higher cephalosporin resistance. In the third phase, comparing the data obtained from these studies revealed that the sensitivity pattern of *E. coli* to Piperacillin/tazobactam and meropenem has decreased from 26.9% to 9.5% and 29.7% to 17.5%. The sensitivity pattern of *MSSA* to Doxycycline and gentamicin increased from 1.1% to 3.2%. On the contrary, the sensitivity of *MRSA* to ofloxacin and gentamicin has decreased from 2% to 0% and 1.2% to 0%, respectively. Also, *Klebsiella*'s prevalence has increased from 18.6% to 26.2%, and *E. coli* has decreased from 33.2% to 30.9%. **Conclusion:** From the study, most clinical micro-organisms have developed resistance against ofloxacin antibiotics compared to other antibiotics.

Keywords: Antimicrobial Resistance, Antibiotics, Surgical site Infections, Comparative Study, Prevalence.

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INTRODUCTION

For many decades Antimicrobial Resistance (AMR) has been a growing threat to the treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses, and fungi, which resulted in reduced efficacy of antibacterial, anti-parasitic, antiviral, and antifungal drugs, making the treatment of patients difficult, costly, or even impossible.[1] Many other studies' results refer to the organism and the development of resistance patterns that changed over time. Even from one geographical area, the organism and AMR profile differ from specimen to specimen.[2] There is no regular global census on methodology and data collection for antimicrobial resistance surveillance. Routine surveillance in most countries is based on the samples

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taken from patients with severe infections associated with health care and those in which first-line treatment has failed.[1]

India is among the nations with the highest burden of bacterial infections. Consequently, antimicrobial resistance's impact is likely higher in the Indian setting.[3] Despite major advances in infection control policies, Healthcare-Associated Infections (HAI) remain a major public health problem and patient safety threat worldwide.[4] Recent work by the World Health Organization shows that Surgical Site Infection (SSI) is the most surveyed and frequent type of Healthcare-Associated Infection (HAI) in low and middle-income countries and affects up to one-third of patients who have undergone a surgical procedure.[5]

Surgical Site Infections (SSIs) are the most common Nosocomial Infections (NI) in surgical patients. These risks are associated with the patient's length of hospital stay, increased hospital costs, and patient mortality.[6] A study showed that subjects who developed SSI were five times more likely to be re-admitted and re-operated on those without infection and were also reported to be twice as likely to die during the postoperative period. While the global estimates of SSI have varied from 0.5–15%, studies in India have consistently shown higher rates ranging from 23–38%.[7]

Few studies of the incidence and causes of SSI and its prevention have been conducted in resource-limited countries. Furthermore, isolation and antibiogram profiles require periodic monitoring, especially in settings like India, where SSIs account for considerable morbidity and mortality rates.[8]

METHODS AND MATERIALS

The study was conducted at a private tertiary care hospital in Coimbatore. The study was conducted in the Department of General Medicine and Surgery. The study was conducted with the approval of the institutional review board of Sri Ramakrishna College of Pharmacy. Informed consent was obtained from the patient's parents or guardians. 196 consecutive isolates were obtained from various clinical specimens of hospitalised adult patients. The study included all the inpatients above 18 years of age who were prescribed at least one antibiotic in the General medicine and Surgery ward. The outpatients, immune-compromised patients, and those unwilling to participate in the study were excluded in the study. A pilot study was carried out in the Department of General Medicine and Surgery to find the scope of the study in this department. All the cases containing antibiotic prescriptions were monitored to know the frequency and extent of antibiotic use and the conditions in which it was prescribed. A standard data entry format for collecting patient details was designed. During the ward rounds, the patient data with special reference to the antibiotic prescribed was recorded in the format.

The study was carried out in four phases

Phase 1

To conduct a retrospective analysis of the prevalence and sensitivity pattern of micro-organisms for a period of one year (Jan 2020- Dec 2020).

Phase 2

To conduct a prospective analysis of the sensitivity pattern of micro-organisms isolated from patients admitted to the Surgical and General Medicine Departments during six-month period from April 2021 – October 2021.

Phase 3

To compare the data obtained from the retrospective and prospective study. The comparative phase revealed the development of resistance by micro-organisms to certain antibiotics.

Phase 4

To perform suitable statistical analysis to compare the results obtained.

RESULTS

The study was conducted to understand the sensitivity pattern of micro-organisms to various antibiotics used in the hospital in the Surgical and General Medicine Departments of the study hospital. Phase I of the study was a retrospective analysis of micro-organisms' prevalence and sensitivity patterns for one year (Jan 2020- Dec 2020). A total of 980 cases were analysed during the retrospective study. The age and gender distribution of the patients are described in Figures 1 and 2.

Fifteen different micro-organisms were isolated, of which the major organisms identified were *E. Coli* (35.1%), *Klebsiella* (24.6%), *and MRcons S. aureus* (6.73%), which was described in Table 1.

Figures 3 and 4 reveal the isolation of different micro-organisms in the specimen. The sensitivity and resistance pattern of micro-organisms in other specimens like urine, blood, sputum, pus, and aspiration fluid are described in Tables 2-6, respectively.

Phase II of the study was a prospective analysis of the sensitivity pattern of micro-organisms isolated from patients admitted to the Surgical and General Medicine Departments during 6 months period from April 2021

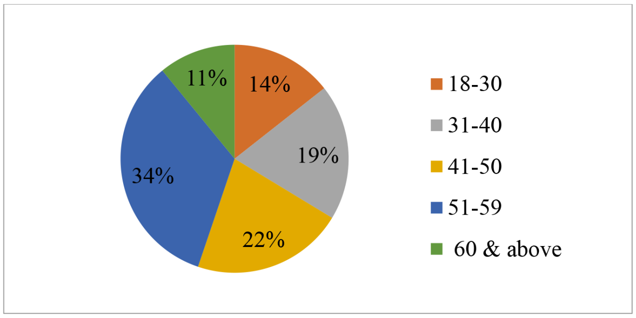

Figure 1: Age distribution of 980 cases collected during retrospective analysis.

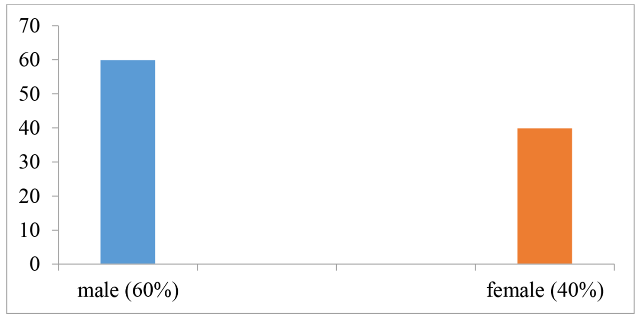

Figure 2: Gender distribution of 980 cases collected during retrospective analysis.

Table 1: Different micro-organisms which were isolated.

Organisms	Urine	Blood	Sputum	Pus	Asp. Fluid	Total
E. coli	281	46	1	11	5	344 (35.1%)
K. pneumoniae	103	30	75	19	5	242 (24.6%)
Pseudomonas aeruginosa	51	36	59	15	-	161 (16.4%)
Enterococcus faecium	1	5	-	9	-	15 (1.5%)
K. oxytoca	10	-	-	-	-	10 (1.0%)
C. tropicalis	9	-	-	-	-	9 (0.9%)
C. albicans	14	3	-	-	-	17 (1.7%)
Proteus vulgaris	1	-	-	12	-	13 (1.3%)
Proteus mirabilis	7	-	2	14	-	23 (2.3%)
MRcons Staph. auerus	-	52	-	14	-	66 (6.73%)
MRconsstaph. haemolytics	-	21	-	-	-	21 (2.1%)
MRconsstaph. epidermis	-	5	-	-	-	5 (0.5%)
Staph. auerus	-	7	-	8	-	15 (1.5%)
Acinetobacter baumanni	-	-	38	-	-	38 (3.87%)
Enterobacter aerogens	-	-	1	-	-	1 (0.1%)
Total	487 (49.7%)	205 (20.9%)	176 (18%)	102 (10.4%)	10 (1%)	980

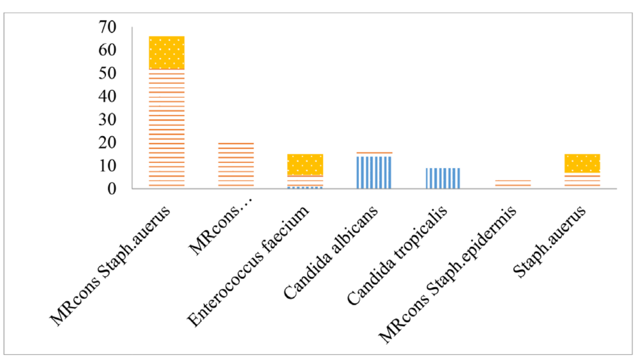

Figure 3: Gram positive organisms in different specimen.

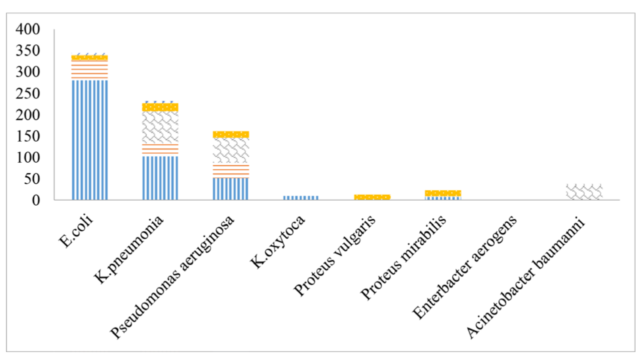

Figure 4: Gram negative organisms in different specimen.

Table 2: Sensitivity and resistant pattern of micro-organisms in urine.

Antibiotics	Organisms																	
	E. coli		*P. aeruginosa*		*K. Pneuoniae*		*K. oxytoca*		*C. tropicalis*		*Candida albicans*		*Proteus mirabilis*		*Proteus vulgaris*		*Enterococcus faecium*	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Amp	-	278	-	25	-	-	-	07	-	-	-	-	-	09	-	01	-	-
Ptz	222	-	29	-	53	-	06	-	-	-	-	-	09	-	-	-	-	-
Ti	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ci	51	156	-	16	12	-	03	-	-	-	-	-	05	02	-	-	-	-
Caz	45	99	-	-	-	-	03	03	-	-	-	-	02	-	-	-	-	-
Cpt	-	131	-	13	10	-	-	03	-	-	-	-	-	02	-	-	-	-
Cfs	-	112	-	17	13	-	-	-	-	-	-	-	-	-	-	-	-	-
Mem	243	-	29	-	78	-	05	-	-	-	-	-	04	-	04	-	-	-
Im	249	-	40	-	78	-	05	-	-	-	-	-	09	-	05	-	-	-
Fos	160	-	31	-	41	-	-	-	-	-	-	-	02	-	02	-	-	-
Pb	-	-	03	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-
Cl	-	-	05	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-
Dox	131	52	-	18	31	-	06	-	-	-	-	-	-	03	-	01	-	-
Ak	123	-	32	32	25	-	-	-	-	-	-	-	03	-	-	-	-	-
Gen	92	64	-	17	25	-	05	-	-	-	-	-	03	-	03	-	-	-
Na	-	294	-	18	-	-	-	05	-	-	-	-	-	09	-	01	-	-
Nf	127	40	-	19	-	-	-	04	-	-	-	-	-	07	02	01	-	-
Of	52	132	27	10	29	-	04	02	-	-	-	-	09	-	-	-	-	-
Nor	84	145	23	-	25	-	03	03	-	-	-	-	07	05	-	-	-	-
Flu	-	-	-	-	-	-	-	-	-	12	13	01	-	-	-	-	-	-
It	-	-	-	-	-	-	-	-	07	03	11	02	-	-	-	-	-	-
Kt	-	-	-	-	-	-	-	-	11	-	13	01	-	-	-	-	-	-
Cc	85	110	18	-	18	-	03	-	10	05	13	05	-	04	-	-	-	-
ApB	-	-	-	-	-	-	-	-	11	-	12	01	-	-	-	-	-	-
Nys	-	-	-	-	-	-	-	-	11	02	12	02	-	-	-	-	-	-
Lz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	02	-
Va	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	02	-

Table 3: Sensitivity and resistant pattern of micro-organisms in blood.

Antibiotics	Organisms																	
	E. coli		*P. aeruginosa*		*K. pneuoniae*		*Mrconsstaph. hominis*		*Mrconsstaph. haemolytics*		*Candida spp*		*Mrconsstaph. epidermis*		*Staph.auerus*		*Enterococcus faecium*	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Amp	0	50	-	35	-	36	-	-	-	-	-	-	-	-	-	-	-	-
Ptz	37	5	29	-	16	19	-	-	-	-	-	-	-	-	-	-	-	-
Etp	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	16	9	-	-	-	-	05	-	-	-	-	-	-	-	05	-
Ci	21	27	-	32	02	28	-	36	-	21	-	-	-	9	10	-	07	-
Cu	-	-	-	-	-	-	-	6	-	9	-	-	-	-	-	-	-	-
Caz	6	20	16	9	04	18	-	-	-	-	-	-	-	-	-	-	-	-
Ctx	-	-	-	32	2	-	-	28	2	14	-	-	-	9	10	6	-	-
Cpt	21	22	1	23	11	23	-	5	-	-	-	-	-	-	-	-	-	-
Cfs	4	20	-	27	9	17	-	-	-	-	-	-	-	-	-	-	-	-
Mem	41	3	29	3	23	16	-	7	-	-	-	-	-	-	-	-	-	-
Im	41	3	29	3	23	16	-	7	-	-	-	-	-	-	-	-	-	-
Pb	6	-	3	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-
Cl	2	-	3	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-
Dox	34	7	-	32	20	23	16	31	-	15	6	-	-	7	8	5	4	5
Ak	42	4	31	-	21	28	03	-	0 7	-	-	-	-	-	-	-	-	-
Gen	44	9	26	3	15	20	20	33	08	19	-	-	3	9	11	-	-	-
Of	19	21	23	9	17	23	12	30	05	22	-	-	04	5	08	10	-	5
Nor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flu	-	-	-	-	-	-	-	-	-	-	9		-	-	-	-	-	-
It	-	-	-	-	-	-	-	-	-	-	7	6	-	-	-	-	-	-
Kt	-	-	-	-	-	-	-	-	-	-	9		-	-	-	-	-	-
Cc	19	30	-	32	14	25	18	27	2	11	7	1	8	4	5	6	-	5
ApB	-	-	-	-	-	-	-	-	-	-	12	1	-	-	-	-	-	-
Nys	-	-	-	-	-	-	-	-	-	-	6	6	-	-	-	-	-	-
Lz	-	-	-	-	-	-	57	-	24	-	-	-	10	-	18	-	8	-
Va	-	-	-	-	-	-	57	-	24	-	-	-	10	-	18	-	8	-

Table 4: Sensitivity and resistant pattern of micro-organisms in sputum

Antibiotics	Organisms											
	Acinetobacter		*P.aeruginosa*		*K.pneumoniae*		*Proteus mirailis*		*E. coli*		*Enterobacter aerogens*	
	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR
Amp	45	-	-	52	-	45	-	03	-	01	-	01
Ptz	03	44	-	10	52	07	02	-	01	-	-	01
Ti	-	--	-	15	-	-	-	-	-	-	-	-
Ci	-	44	23	49	25	23	02	--	-	01	-	01
Caz	-	48	27	21	20	38	02	-	-	01	-	01
Cpt	-	48	-	48	13	37	02	-	-	01	-	01
Cfs	-	48	-	49	13	37	02	-	-	01	-	01
Mem	03	46	38	14	54	26	03	-	01	-	01	-
Im	03	46	38	14	54	26	03	-	01	-	01	-
Pb	45	-	14	-	32	-	-	-	-	-	-	-
Cl	45	-	14	-	32	-	-	-	-	-	-	-
Dox	--	45	-	49	29	22	-	03	01	-	-	01
Ak	03	45	35	11	52	18	03	-	01	-	01	-
Gen	03	46	23	19	41	18	03	-	-	01	01	-
Of	03	45	27	19	47	27	02	-	01	-	01	-
Cc	03	40	47	-	32	27	03	-	-	01	01	-

Table 5: Sensitivity and resistant pattern of micro-organisms in pus.

Antibiotics	Organisms															
	Proteus vulgaris		*Enterococcus faecium*		*Proteus mirabilis*		*Staph.MSSA*	*Staph.MSSA*	*Staph MRSA*		*P.aeruginosa*		*E. coli*		*K.pneumoniae*	
	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR	SS	RR
Ak	06	02	07	01	05	03	04	02	07	02	08	03	05	02	05	02
Imp	04	01	05	02	06	01	02	01	05	03	06	01	03	-	11	03
Mrp	04	01	05	02	06	01	02	01	05	03	06	01	-	-	11	03
Cfs	-	-	06	02	-	-	-	-	-	-	07	02	08	01	-	-
Amp	07	03	04	03	08	04	05	02	09	02	-	-	10	01	06	04
Cl	10	-	-	-	-	-	-	-	-	-	-	-	-	-	07	01
Cot	09	02	02	01	09	02	02	01	07	01	09	04	06	02	16	02
Dox	05	03	06	03	10	01	02	01	12	01	05	03	04	02	12	04
Ci	-	-	08	-	12	02	04	02	-	-	12	01	08	02	15	01
Of	03	07	-	-	04	01	04	03	06	03	10	01	08	03	11	04
Cip	-	-	-	-	-	-	-	-	-	-	03	01	-	-	-	-
Va	02	01	01	01	-	-	-	-	-	-	-	-	-	-	-	-
Lz	02	01	01	01	-	-	-	-	-	-	-	-	-	-	-	-
Ct	-	-	-	-	06	03	03	03	04	02	12	02	05	04	17	01
p	-	-	09	-	05	02	-	-	03	01	-	-	-	-	-	-
Ery	-	-	04	-	02	-	-	-	-	-	07	01	-	-	05	04
Lf	-	-	07	-	-	-	02	01	-	-	-	-	-	-	-	-

– October 2021. A total of 126 cases were documented, and only in 84 cases, a sensitivity pattern is made during the phase 2 study. The age and gender distribution of the patients are described in Figures 5 and 6.

A standard data entry format for collecting patient details was designed, and, during the ward rounds, the entire patient data with special reference to the antibiotics prescribed and their costs were recorded in the format. Figures 7 and 8 reveal the number of antibiotics prescribed per case and category prescribed, respectively.

Figure 9 describes the de-escalation of antibiotics. In the prospective study, a total of 126 cases were collected. Out of which, 84 cases with culture and sensitivity tests were performed, and in 34 cases (40%), the de-escalation of antibiotics was done by physicians. Table 7 shows different micro-organisms isolated from the various specimens, in that *E. coli* (30.9%) was the major organism identified. Figures 10 and 11 reveal the isolation of different micro-organisms in a different specimen. The sensitivity and resistance pattern of

Table 6: Sensitivity and resistant pattern of micro-organisms in aspiration fluid.

Antibiotics	Micro-organisms			
	E. coli		*K. pneumoniae*	
	S	R	S	R
Ak	05	-	02	02
Imp	04	01	03	01
Mrp	04	01	03	01
Cfs	-	-	-	-
Amp	03	01	01	03
Cl	-	-	03	01
Cot	-	-	04	01
Dox	05	-	-	-

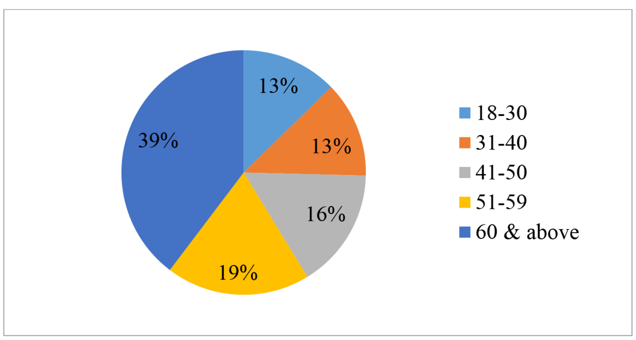

Figure 5: Age distribution of 126 cases collected during prospective analysis.

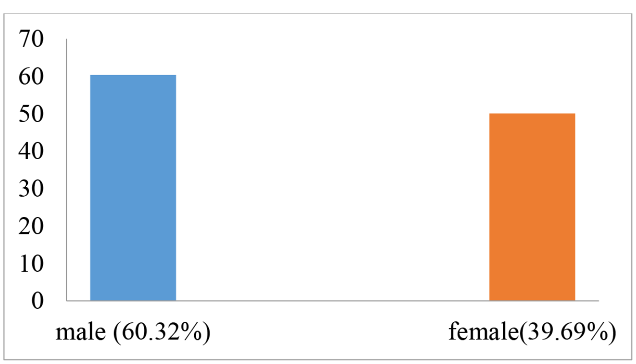

Figure 6: Gender distribution of 126 cases collected during prospective analysis.

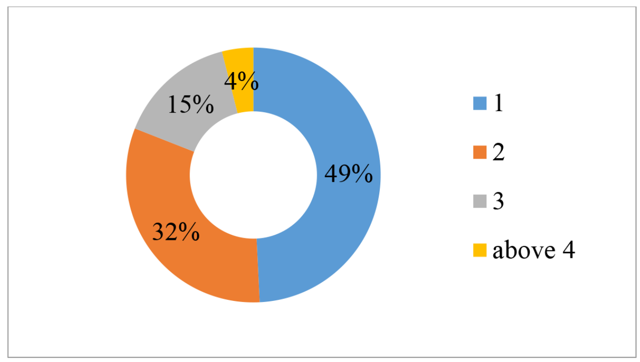

Figure 7: Number of antibiotics prescribed per case.

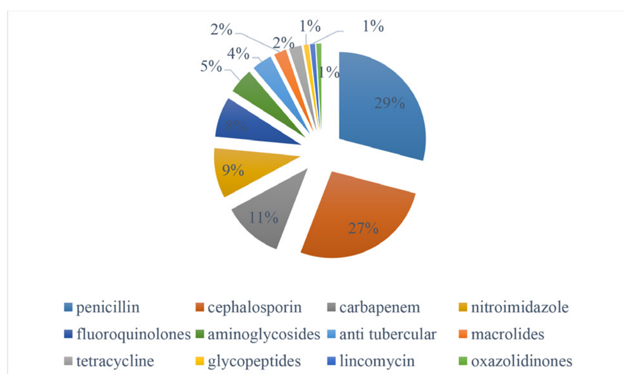

Figure 8: Category of antibiotics prescribed.

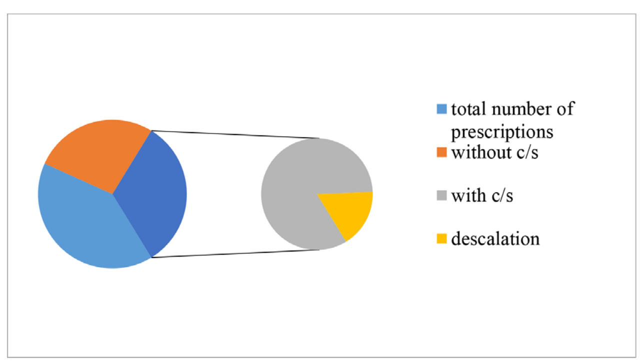

Figure 9: De-escalation of antibiotics.

Table 7: Different specimens isolated during prospective phase.

Organisms	Urine	Blood	Sputum	Pus	Aspiration fluid	Total
E. coli	18	8	-	-	-	26(30.95%)
K.pneumoniae	6	-	8	-	8	22(26.17%)
Enterococcus faecium	8	-	-	4	-	12(14.29%)
Enterobacter cloacae	4	-	-	-	-	4 (4.76%)
Proteus vulgaris	-	-	-	4	-	4 (4.76%)
MRSA (Staph.auerus)	-	4	-	-	-	4(4.76%)
MSSA (staph auerus)	-	4	-	-	-	4(4.76%)
Mycobacterium tuberculosis	-	-	8	-	-	8(9.52%)
TOTAL	36	16	16	8	8	84

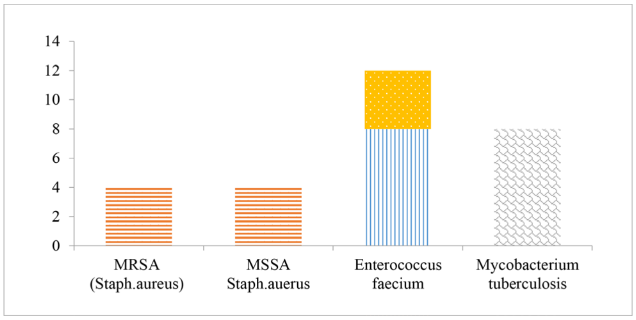

Figure 10: Gram positive organisms in different specimen.

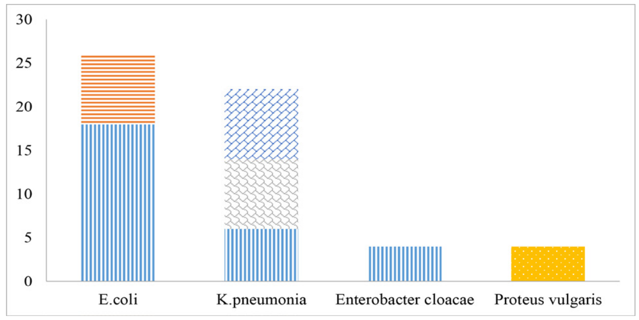

Figure 11: Gram-negative organisms in different specimens.

micro-organisms in different specimens like urine, blood, sputum, pus, and aspiration fluid respectively.

Phase III of the study was to compare the data obtained from the retrospective and prospective study. The comparative phase revealed the development of resistance by micro-organisms to certain antibiotics. The percentage prevalence of micro-organisms is described in Table 8. Table 9 shows the emergence of resistance. The sensitivity of *E. coli* to Piperacillin/tazobactam and meropenem has decreased from 26.9% to 9.5% and 29.7% to 17.5%, respectively.

Phase IV of the study compared the data using the statistical tool. Data were collected, and the statistical analysis was performed using SPSS (version 21; SPSS Inc., Chicago, IL, USA). Values were tested for statistical significance using a Paired Sample *t*-Test. A *p*-value of 0.05 or less was considered significant.

Paired Sample *t*-Test

Student's *t*-test or *t*-test is the statistical method used to determine if there is a difference between the means of two samples. The test is often performed to find out if there is any sampling error or unlikeliness in the experiment. A paired *t*-test helps the data analytics to compare two means that are taken from the same data set to determine if the difference is zero. In the statistical procedure of Paired *t*-test, also known as dependent sample *t*-test, every data set, say individual, unit, or object, is measured twice consequential, providing the pairs of observation for paired *t*-Test. In simple words, this test is used to find if the mean of the dependent variable is the same in two same or related groups (Tables 10 and 11).

Table 8: Percentage prevalence of micro-organisms.

Micro-organism	% Prevalence	
	Retrospective (n=980)	Prospective (n=126)
E. coli	33.2	30.9
K. pnemoniae	18.6	26.2
Enterococcus faecium	1	14.2
MSSA	0.7	4.7
MRSA	5.3	4.7
Proteus vulgaris	1.2	4.7

It is clear from the results that the prospective study has observed a sample of 196 patient respondents, from which *E. coli, Klebsiella Pneumoniae*, MRSA and MSSA have become more resistant compared to the retrospective study.

Table 9: Emergence of resistance.

Organisms	Antibiotic	% Sensitivity Retrospective (n=980)	% Sensitivity Prospective (n= 126)	% Resistance
E. coli	AK	17.9	20.6	--
	PTZ	26.9	9.5	17.4
	MEM	29.7	17.5	12.2
	DOX	17.8	6.3	11.5
	OF	7.3	0	100
	NIT	12.9	3.2	9.7
K. pneumoniae	TI	2	0	100
	CI	5.6	6.3	--
	OF	10.6	16	--
	DOX	9.3	9.5	--
	MEM	17.2	16	1.2
MRSA	LZ	5.8	3.2	2.6
	VA	5.8	3.2	2.6
	G	2	0	100
	OF	1.2	0	100
MSSA	DOX	1.1	3.2	--
	G	1.1	3.2	--
	LZ	1.8	3.2	--
	VA	1.8	3.2	--

Table 10: Percentage analysis of antibiotics administered during the retrospective study.

Organism	Antibiotic	No of respondents	% Antibiotic administration
E. coli	AK	2	1.02
	PTZ	21	10.71
	MEM	22	11.22
	DOX	1	0.05
	OF	25	12.75
	NIT	9	4.51
K. Pneumonia	TI	39	19.89
	CI	2	1.02
	OF	2	1.02
	DOX	9	4.51
	MEM	8	4.08
MRSA	LZ	9	4.51
	VA	1	0.05
	G	25	12.75
	OF	12	6.12
MSSA	DOX	1	0.05
	G	5	2.55
	L	1	0.05
	VA	2	1.02
Total		196	100.00

Table 11: Paired sample t-test on the sensitivity and resistance of the antibiotics during the prospective study.

	Sensitivity		Resistance		*t*	P
	Mean	SD	Mean	SD		
E. coli						
AK	37.3	4.6	3.13	0.74	3.04	0.058
PTZ	44.5	8.8	3.46	0.66	14.20	0.015
MEM	28.6	8.0	3.50	0.85	7.19	0.034
DOX	27.6	8.0	3.25	0.82	2.51	0.071
OF	34.2	8.0	3.46	0.66	11.14	0.012
NIT	35.4	6.3	2.92	0.93	3.15	0.079
K. pneumonia						
TI	54.8	7.4	3.75	0.53	8.10	0.000
CI	5.5	5.1	3.91	0.28	-1.02	0.056
OF	6.7	4.9	3.94	0.34	-2.18	0.071
DOX	9.1	6.3	3.88	0.28	-2.65	0.066
MEM	6.8	2.8	3.92	0.53	1.77	0.762
MRSA						
LZ	12.1	8.5	2.17	0.64	5.12	0.120
VA	6.7	4.3	2.23	0.75	2.69	0.746
G	50.4	7.1	2.51	0.53	11.79	0.001
OF	7.5	7.4	3.32	0.38	15.46	0.000
MSSA						
DOX	32.4	2.9	2.62	0.62	4.710	0.109
G	11.5	1.7	2.48	0.84	3.26	0.222
L	17.8	3.7	2.79	0.59	7.65	0.432
VA	16.9	4.6	3.56	0.41	8.46	0.155

DISCUSSION

Antimicrobial resistance patterns can vary regionally and even among different hospitals within the same community. Antibiotics are prescribed unnecessarily and empirically for complaints where no antibiotic is required or where culture and sensitivity results could be safely awaited.[9] Overuse of antibiotics contributes to antimicrobial resistance and puts the patients at greater risk of carrying and becoming infected with resistant bacteria.

Thus, continuous monitoring of the pattern of bacterial resistance serves as an empiric guide for therapy.[10] Due to antimicrobial-resistant infections and susceptibility trends to frequently prescribed medication used for management, minimal evidence is available about the severity of SSIs. This disparity makes it more difficult for physicians to choose empirical therapy. So, considering the above facts, the study aimed to isolate, cultivate, and identify the bacteria from the surgical sites and assess their susceptibility pattern for the commonly prescribed antibiotics in the study setting.[11]

E. coli (35.1%) was the major organism isolated during the retrospective study, followed by *Klebsiella* species (24.6%) and *MR cons Staph aureus* (6.73%). Masyenisri *et al*. conducted a similar study which also reported that *E. coli* (21%), *Staphylococcus* spp (32%), *Streptococcus* spp (13%), *Enterobacter* spp (10%), *Pseudomonas* (9%) were commonly isolated micro-organisms.[2] Meropenem showed the best sensitivity in *Klebsiella pneumonia, E. coli, S. aureus, P. aeruginosa. E. coli* was commonly isolated from urine specimens (28.67%), whereas *K. pneumoniae* was present more in sputum (7.65%) and *MRSA* was highly prevalent in the blood (5.31%). During the prospective study, *E. coli* was the major organism identified in 30.9% of isolated specimens, followed by *E. faecium* (14.2%). *K. pneumoniae* (23.7%). The sensitivity pattern of micro-organisms during the prospective study indicated that *E. coli* was highly sensitive to Meropenem and *K. pneumoniae* was sensitive to amikacin. Jangla SM and Naidu R conducted a similar study that revealed gram-negative isolates of *E. coli* (40%), followed by *K. pneumoniae* (27%), and *P. aeruginosa*. Sensitivity to carbapenems, aminoglycosides and beta-lactam -beta-lactamase inhibitor combination.[12] *E. coli* was the most frequently isolated micro-organism from urine (22.43%) and blood (9.5%) specimens, whereas *K. pneumoniae* and mycobacterium tuberculosis (9.5%) were from sputum. The comparison between retrospective and prospective work revealed that the sensitivity of *K. pneumoniae* to Ticarcillin has decreased from 2% to 0%. Similarly, Najlaa Abdullah D AL-Oqaili studied *K. pneumoniae* has also shown the development of resistance to Ticarcillin, piperacillin, aztreonam, ceftazidime, and ceftriaxone.[13] *E. coli* showed the sensitivity to piperacillin+tazobactam, meropenem, and ofloxacin decreased from 26.9% to 9.5%, 29.7% to 17.5%, and 7.3% to 0%, respectively. A study conducted by Claujens *et al*.[14] to determine antibiotic-resistant *E. coli* also revealed that *E. coli* has developed high resistance to ceftazidime, amoxicillin, piperacillin-Tazobactum, and ofloxacin.[14] The sensitivity pattern of *MSSA* to Doxycycline and gentamicin is increased from 1.1% to 3.2%. A study conducted by Basnet R *et al.* also reported that *MSSA* showed sensitivity to Amikacin and Gentamicin.[15] On the contrary, the sensitivity of *MRSA* to ofloxacin and gentamicin has decreased from 2% to 0% and 1.2% to 0%, respectively. Similarly, a study conducted by Eyob Yohaness Gary *et al.* concluded that MRSA showed decreased sensitivity to Gentamicin, Erythromycin, and Vancomycin.[16] Also, Klebsiella's prevalence has increased from 18.6% to 26.2%, and *E. coli* has decreased from 33.2% to 30.9%. Ofloxacin has developed resistance to major micro-organisms. In a prospective study, a total of 126 cases were collected. 84 cases with culture and sensitivity tests were performed, and 34 cases were de-escalated. From prospective cases collected during the study period, most patients admitted were Males (60.32%). The most prominent age group who had been prescribed antibiotics belonged to the age group of >60 years, which constitutes around 39% out of the total patients. Penicillins and Cephalosporins were the major categories of antibiotics prescribed (29% and 27%).

CONCLUSION

The reason for the selection of the given sites was that the pilot study revealed more scope for the study in the respective department as the prevalence of antimicrobial prescription is higher. When prescribing antibiotics, the knowledge of the organisms prevailing and the sensitivity pattern of antibiotics in the study hospital will help the healthcare professionals to select the appropriate antimicrobial agents to ensure rational therapy.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

MSSA: Methicillin-Sensitive *S. aureus*; **MRSA:** Methicillin-resistant *S. aureus;* **AMR:** Antimicrobial Resistance; **SSI:** Surgical Site Infections; **HAI:** Healthcare-Associated Infections; **NI:** Nosocomial Infections; **SPSS:** Statistics is a statistical software suite.

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