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Original Article

Antimicrobial Resistance Pattern of Clinically Significant Microorganisms Isolated from Dhaka, Bangladesh

Sabreena Chowdhury Raka[1*], Arifur Rahman[2], Sabiha Kamal[1] and Md. Sohanur Rahman[2]

[1]Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, 4/2- Sobhanbagh, Dhanmondi, Dhaka-1207, Bangladesh.
[2]Department of Pharmacy, BRAC University, 41 Pacific tower, Mohakhali, Dhaka-1212, Bangladesh.

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ABSTRACT

Infectious diseases are the most common health problems. Diagnosis and treatment of the bacterial diseases are ambiguous, especially in Bangladesh. Though the present condition of health care settings in Bangladesh has improved, the bacterial diseases have become more prone to the public health. Bacterial sensitivity patterns of common infections like respiratory tract infection, urinary tract infection, enteric fever, wound infection are not always attainable because of the restless use of antibiotics. Multidrug-resistant in primary infection is an emerging threat in Bangladesh**.** Prevention and containment of antibiotic resistance are very necessary for Bangladesh. The prior concern of this investigation is to surface the present scenario of antibiotic resistance prevailing in Bangladesh especially in Dhaka city. From the investigation, it is evident that various kinds of microbial infection have already been resistant to antibiotics and some are at the borderline. The result is prominent as it covered a wider range by comparing five different aspects like blood, urine, sputum, swab and pus samples. Moreover, in the past there has not been a single investigation conducted focusing on these five aspects altogether at a time. The establishment of an alliance and regulation indicating the use of antibiotics should consider as a national priority.

Keywords: Infectious disease; Sensitivity; Dispensing; Swab; Zones of inhibition; Resistance.

Address for Correspondence: Sabreena Chowdhury Raka, Lecturer, Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, 4/2-Sobhanbagh, Dhanmondi, Dhaka-1207, Bangladesh. Email: raka.pharmacy@diu.edu.bd

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INTRODUCTION

Antimicrobial resistance is a worldwide problem [1]. It is spreading to the developing countries like Bangladesh due to improper choice of drugs by the doctors and pharmacists [2]. Factors like unfettered manufacture and dispensing of antimicrobials, shortened antimicrobial therapy, insufficient access to effective drugs, drugs of questionable quality and sometimes the poverty are likely to be contributing to antimicrobial resistance [3]. Available evidences regarding this does not support the diagnosis and treatment of bacterial diseases in Bangladesh which was done with only urine in accordance with blood sample [4]. For our investigation, a vast number of samples were collected regarding the antibiotic resistant on different microorganisms from blood, urine, swab, sputum and pus samples in Bangladesh focusing Dhaka city. In the past, no study was conducted to find out the antibiotic resistant on the organisms which were collected or recovered from the urine, blood, sputum, pus, swab all together from the Bangladeshi patients. Blood and urine samples do not contain all microbes those affect the human body. Pus, sputum and swab tests are also important to find out the all kinds of microbes in human body. So, here in this investigation a long term planning was considered to conduct a new study on Bangladeshi patients to find out the resistance of different antibiotics on different microorganisms. Data were collected for a prolonged period of time and analyzed minutely.

Urinary tract infection is very common in Bangladesh and so many studies was conducted before based on that. For example, a survey conducted with truck stand workers in Dhaka, Bangladesh the prevalence rates of syphilis and gonorrhea among men was observed to be 4.1 and 7.7%, respectively [5]. Among hotel based sex workers, a total of 8.5% had syphilis infection and 86.8% proved positive for at least one reproductive tract infection (RTI) or sexually transmitted infection (STI) [6]. Evidence of syphilis infection was found in 6.0% of respondents, in slum communities of Dhaka city while prevalence rates of gonorrhea were 1.7% [7]. In a recent study, the most frequently discovered microorganisms found to cause leucorrhea included *Gardnerella vaginalis*, *Candida albicans*, *Chlamydia trachomatis* and *Trichomonas vaginalis* [8]. The antibiotics which have been mostly used against both complicated and uncomplicated UTI include ampicillin, trimethoprim, sulfamethoxazole, cephalexin, gentamicin, amoxicillin, nalidixic acid and nitrofurantoin [9]. However, resistance to most of these antibiotics are widespread and quite high in different geographic regions of Bangladesh. Gentamicin, because of its toxicity, has restricted use in clinical practice [10]. Specific urinary antiseptics like nalidixic acid or nitrofurantoin are limited to lower UTI, while resistant mutants develop quite rapidly in susceptible bacterial populations, in case of nalidixic acid. A recent study conducted in 2008–2009 demonstrated the presence of ciprofloxacin resistant ETEC in the drinking water of Bangladesh [11]. So, this is clear that how urine sample is so important to conduct such a study on Bangladeshi people.

Blood culture is the best approach to identify the dangerous microorganisms when a bloodstream infection is predicted, and also to guarantee that the antimicrobial treatment is needed. After urine blood is the largest culture method to identify the microorganisms [12]. Both methods recovered 73 organisms (76.8%); 20 (21%) were detected by LDP/LC methods only, and 2 (2.1%) were isolated by the conventional method only 95 isolated samples in a study of 400 blood samples in the year of 1992 in Bangladesh and from then it is mainly used [13]. As it is used mainly to identify the microbes so after the culture and using various kits, it is also possible to find the antibiotic sensitivity with those microbes. So it is clear that, from very past the antibiotic was gaining the resistance property in Bangladesh, now a days it is more increasing.

Pus is a thick yellowish or greenish opaque liquid produced in infected tissue, consisting of dead white blood cells and bacteria with tissue debris and serum [14]. During infection, macrophages release cytokines which trigger neutrophils to seek the site of infection by chemotaxis. There, the neutrophils release granules which destroy the bacteria. The bacteria resist the immune response by releasing toxins called leukocidins [15]. As the neutrophils die off from toxins and old age, they are destroyed by macrophages, forming the viscous pus. Some microbes are really easy to find here like *Streptococcus pneumoniae* (Fraenkel's pneumococcus), *Klebsiella pneumoniae* (Friedländer's bacillus), *Salmonella typhi* (Bacillus typhosus), *and Pseudomonas aeruginosa.*

Sputum is defined as a mixture of saliva and mucus coughed up from the respiratory tract, typically as a result of infection or other disease and often examined microscopically to aid medical diagnosis. As saliva contaminates the sample with oral bacteria, best sputum samples contain very little saliva [16]. This is especially true for samples for lab testing in cytology or microbiology. Specimen adequacy is assessed by the laboratory technologists by examining a Gram stain or

cytology stain of the sputum. This is also very necessary to conduct the study in Bangladesh.

Swab is an absorbent pad or piece of material used in surgery and medicine for cleaning wounds, applying medication, or taking specimens [17]. Sputum has very common but swab is not that much common to be used as bacteria culture in Bangladesh, but increasing day by day. We took the swab samples as well so that no lacking was lying behind during the investigation on Bangladeshi patients.

MATERIALS AND METHODS

The present study has been planned in associated with one of the most popular and renowned diagnostic centers in Dhaka city, named 'Medinova Diagnostic Center'. The objective was to find the presence of different types of microorganism in different specimens like blood, urine, pus, sputum and swab with the sensitivity pattern of various antibiotics on them. The study duration was January 2016 to August 2016 (eight months). Total 826 samples (report) were collected during the study period from different specimens. Among them 203 reports were taken from blood sample, 179 were from urine sample, 174 were taken from sputum sample, 120 were taken from swab sample and lastly 150 were taken from the pus sample. All samples were incubated in 37o C aerobically in the culture media and the colony count was done in 1×105/ml. For positive blood cultures, sub-culturing was performed on blood-agar plates. Following overnight incubation, a pure colony was picked from the subculture for identification and susceptibility testing. The identification of gram-positive bacteria and the susceptibility test were conducted using MicroScan Pos Combo 28, MicroScan StrepPlus Panels, and MicroScan Walkaway-96 System (Siemens, West Sacramento, CA, USA). The identification of gram-negative bacteria and susceptibility testing were performed using the MicroScan Neg BP Combo 42 Panel (Siemens). In the event of disagreement between results from the Verizone assay and identification results using the conventional method, sequence analysis of 16S rRNA and rpoB gene was performed for gram-positive bacteria and Klebsiella species, respectively. In some cases, the thioglycollate agar media, tryptone soya broth was also used to culture the microorganisms.

Antibiotic susceptibility pattern was done by disk diffusion method. The isolated organisms were taken into media for antibiotic susceptibility test by Kirby-Bauer disc diffusion technique. Disc diffusion tests were done and interpreted by following the recommendations of the Clinical and Laboratory Standards Institute (CLSI, 2007) [18]. The tests were performed on Muller-Hinton agar plates (pH 7.2-7.4). The surface was inoculated by sterile cotton swab stick lightly. The swab stick was dipped into bacterial suspension for incubation having an equivalent turbidity to 0.5 McFarland standards [19]. The swab stick was then taken out and squeezed on the wall of the test tube to discard extra suspension. Inoculated plates were incubated at 37 °C for 24 hours [20]. After the incubation on different plates, a bacterial isolate is tested for resistance to each of different antibiotics. The clear zones around each disc are the zones of inhibition that indicate the extent of the test organism's inability to survive in the presence of the test antibiotic [21].

RESULTS AND DISCUSSION

For this investigation total 826 samples (report) were collected during the whole study period (January-August 2016). Among them 203 reports were taken from blood sample, 179 were from urine sample, 174 were taken from sputum sample, 120 were taken from swab sample and lastly 150 were taken from the pus sample. Those samples were also divided to the gender wise so that we could get the ratio of male and female, lastly came to an end that which kind of gender are affected more.

Blood Sample: From the investigation of 203 blood sample, 152 samples indicated the present of *Salmonella Typhi* which were 74.87% of the total blood sample. This was totally unexpected. *Salmonella Typhi* was found fully sensitive to different types of antibiotics like cefixime (100%), cotrimoxazole (100%), gentamycin (100%) and ceftriaxone (100%). Cholramphenicol was also found very sensitive to the same microorganisms because 120 (78.96%) samples showed that result. Nalidexic Acid is another popular antibiotic and it was found resistant to *Salmonella Typhi* too. 124 (81.57%) samples showed that resistance. Another finding was, E.coli had a sensitive issue to the most of the antibiotics. Another evidence had come up from the study that, the number of the male patients (62.07%) are more than the female patients (37.93%) who had microbes on their blood samples.

Urine Sample: According to the Bangladeshi perspective urinary tract infection is high and also very common. In most of the areas of Bangladesh urine is taken as main specimen for detecting microorganism in human body. For our investigation 179 samples were taken from the urine. 124 showed that the blood had E.coli. All 124 samples were sensitive to the three antibiotics.

They are imipenem (100%), meropenem (100%) and mecillinum (100%). Imipenem and meropenem belong to the same class of antibiotics. So, the finding was, these resistances are occurred to the same classes of antibiotics with the same ratio. Colistin 120 (96.78%), another class of antibiotic had a resistant property to E.coli. Amoxicillin 104 (80.64%) had a resistance to the same microorganism. For amikacin, 116 (93.54%) samples were found to be sensitive. The most fascinating factor was the intermediate property for resistance of antibiotics. It was very low. Most of the cases, the average percentages for different antibiotics was below 10%, especially for E.coli. The other microorganisms were found in blood sample in a very low amount than E.coli. Unlike the blood samples, here for urine samples it was clearly seen that Bangladeshi women (74.86%) were more in number than men (24.14%).

Sputum Sample: For sputum samples some interesting results were found. Mostly Pseudomonas organisms were present on sputum samples. Total 174 sputum samples were collected. Pseudomonas was present on 54 samples. Ciprofloxacin, amoxiclav, cefotaxime, ceftriaxone, cefixime and cotrimoxazole were 100% resistant to that. Cefotaxim, ceftriaxone and cefixime belong from the same class of antibiotics. Gentamycin, colistin and piperacillin were very sensitively resistant to the Pseudomonas because all 54 (100%) samples were found to do so. E.coli was present on 37 samples. The investigation showed that all samples particularly either sensitive or resistant to all kinds of antibiotics. The same result was found from the 41 samples on which Klebsiella was present and also from 42 samples where Candida was found. For sputum sample, men (68.39%) are also ahead than women (31.61%) in Bangladesh in term of affection to microbes.

Swab sample: There were total 120 samples taken from swab. 60 samples were found as the presence of pseudomonas. 100% were found to resistant for cefalexin, cefuroxime and cephradin which belong to the same class. So it is again clear that the resistant property is identical for the same classes of antibiotics. All 60 (100%) samples were found sensitive for piperacillin. For the other antibiotics the resistant property varied from 40% to 80%. Streptococcus pyogenes were present in 38 samples and individually all are found either resistant or sensitive to the other antibiotics. Remaining 22 samples demonstrated the same result and proteus was present there. According to the swab sample results, Bangladeshi men patients (55.83%) are more affected than the women patients (44.17%).

Pus Sample: Total 150 samples were taken from the pus. E.coli was found in 50 samples. All the antiobiotics were found resistant or senstitive (100%) excluding amoxiclav, imipenem and gentamycin. They had a ratio of 50%. Pseudomonas was present on also 50 samples. Most of the antibiotics were fully resistant or sensitive (100%) excluding gentamycin, amikacin and ciprofloxacin. They had a resistant property upto 60%. An interesing finding was, Staphylococcus was fully resitant or sensitive to the all antibiotics but cefalosporin classed antibiotics were varying from 20% to 80% which was really noticable. Surprisingly for pus sample, the male patients (57.33%) from Bangladesh are more affected by the animicrobial resistant than the female oatients (42.67%)

CONCLUSION

This study is a proper reflex of the current condition of the antimicrobial resistance among the various people in Bangladesh. The day is not too far when more than 90% antimicrobial agents currently available will not work on Bangladeshi people any more. From the evidences of this study, it was clearly shown that Bangladeshi people are too much resistant to the antimicrobial agents. This resistance was not only depending on some particular antibiotics but for most of the popular antibiotics. Another finding was, though there was some ratio differences between male and female patients but that was very near. It can be told that, both male and female patients were affecting at the same time. So, proper measure should be taken to take back this antibiotic resistant problems upon Bangladeshi people from the borderline to intermediate position. It is urgently needed to determine antimicrobial practices in all kind of population throughout Bangladesh. It is also important to determine the duration of compliance to therapy, reasons for noncompliance, sources of medications and prevalence of use of antimicrobials so that we can apply necessary recommendations for the proper use of antimicrobial resistance in Bangladesh.

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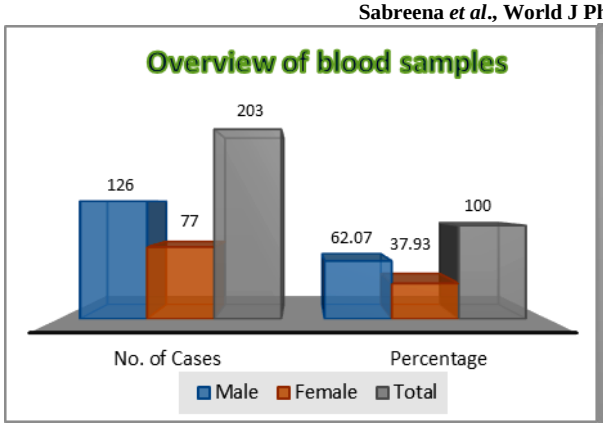

***Figure 1**: Overview of blood samples*

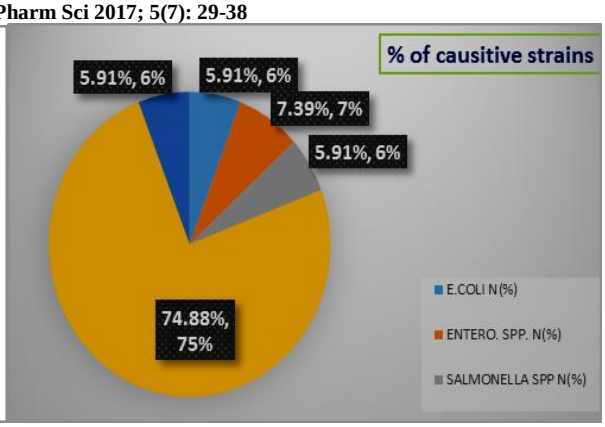

***Figure 2**: Causative stains for blood samples*

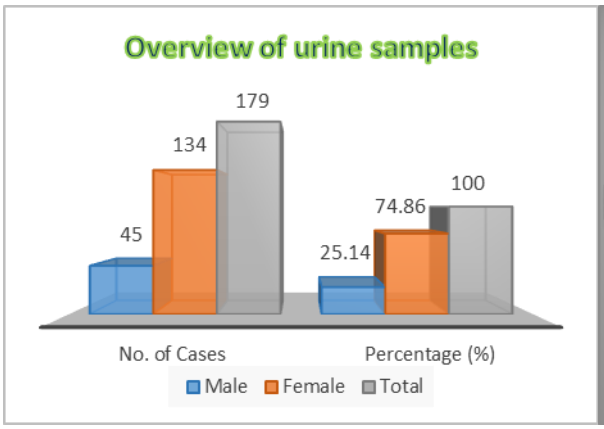

***Figure 3**: Overview of urine samples*

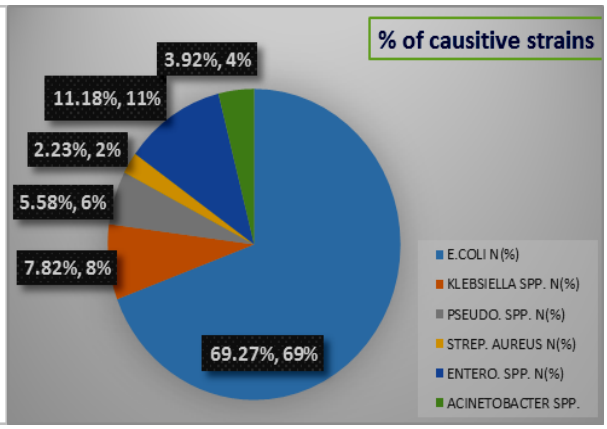

***Figure 4**: Causative stains for urine samples*

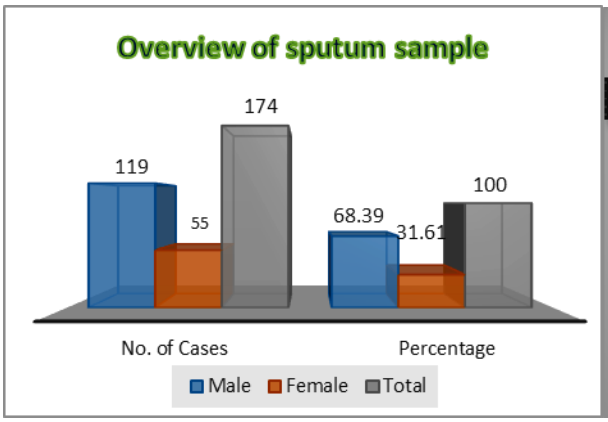

***Figure 5**: Overview of sputum samples*

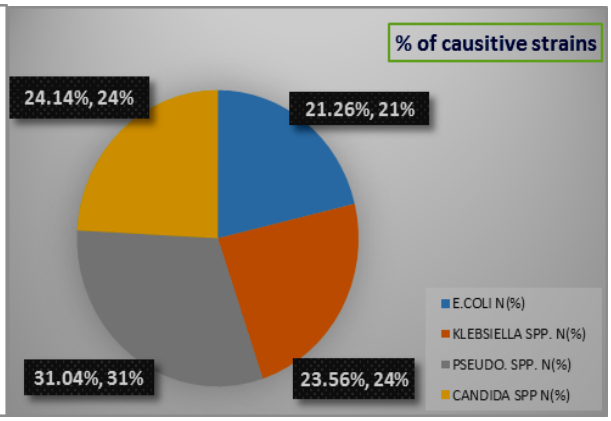

***Figure 6**: Causative stains for sputum samples*

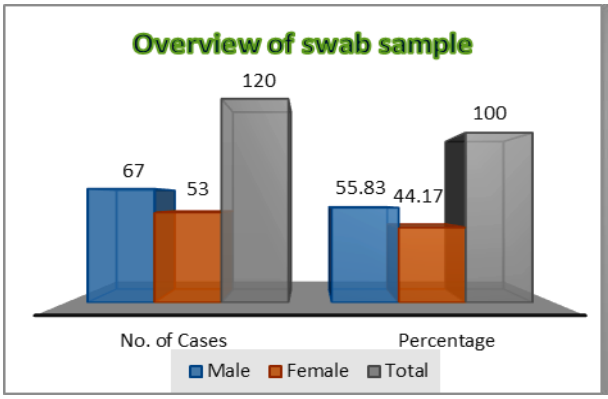

***Figure 7**: Overview of swab samples*

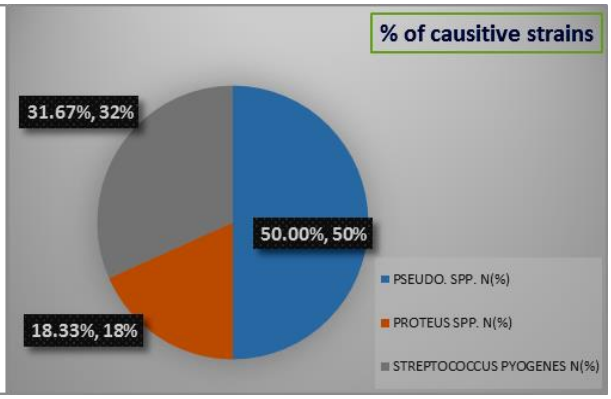

***Figure 7**: Causative stains for swab samples*

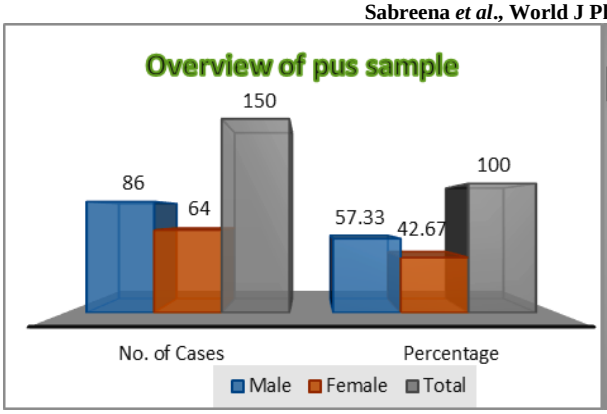

***Figure 8**: Overview of pus samples*

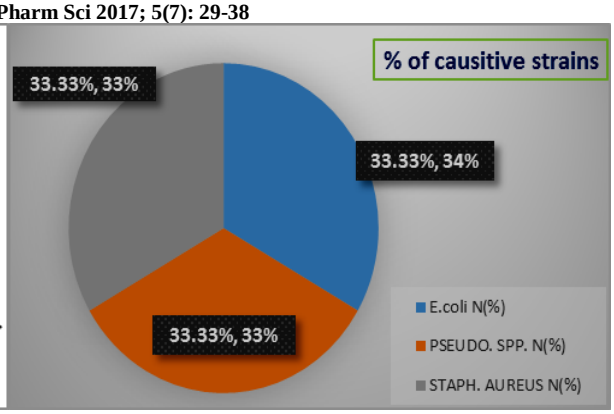

***Figure 9**: Causative stains for pus samples*

***Table 1**: Summary table for blood samples*

Antibiotic	Sensitivity	E.COLI N (%)	ENTERO. SPP. N (%)	SALMONELLA SPP N (%)	SALMMONELLA ATYPHI N (%)	SALMMONELLA PARATYPHI 'A' N (%)
Amikacin	S	12(100)	10(66.67)	N/D	N/D	N/D
	R	0(0.00)	5(33.33)			
	I	0(0.00)	0(0.00)			
Cefixime	S	6(50)	10(66.67)	12(100)	152(100)	12(100)
	R	6(50)	5(33.33)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cefuroxime	S	6(50)	10(66.67)	N/D	N/D	12(100)
	R	6(50)	5(33.33)			0(0.00)
	I	0(0.00)	0(0.00)			0(0.00)
Ciprofloxacine	S	12(100)	5(33.33)	0(0.00)	0(0.00)	0(0.00)
	R	0(0.00)	5(33.33)	0(0.00)	48(31.57)	0(0.00)
	I	0(0.00)	5(33.33)	12(100)	104(68.43)	12(100)
Cotrimoxazole	S	12(100)	10(66.67)	12(100)	152(100)	12(100)
	R	0(0.00)	5(33.33)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Gentamycin	S	12(100)	0(0.00)	12(100)	152(100)	12(100)
	R	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	3(100)	0(0.00)	0(0.00)	0(0.00)
Amoxiclav	S	0(0.00)	10(66.67)	N/D	N/D	N/D
	R	12(100)	0(0.00)			
	I	0(0.00)	5(33.33)			
Cefotaxime	S	6(50)	10(66.67)	N/D	N/D	N/D
	R	6(50)	5(33.33)			
	I	0(0.00)	0(0.00)			
Ceftriaxone	S	6(50)	10(66.67)	12(100)	152(100)	12(100)
	R	6(50)	5(33.33)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cephalexin	S	0(0.00)	10(66.67)	N/D	N/D	N/D
	R	0(0.00)	5(33.33)			
	I	12(100)	0(0.00)			
Nalidexic Acid	S	N/D	N/D	0(0.00)	24(15.78)	0(0.00)
	R			12(100)	124(81.57)	8(6.67)
	I			0(0.00)	4(2.63)	4(33.33)
Colistin	S	6(50)	N/D	N/D	N/D	N/D
	R	6(50)				
	I	0(0.00)				
Arithromycin	S	N/D	5(33.33)	0(0.00)	20(13.15)	0(0.00)
	R		10(66.67)	6(50)	32(21.05)	4(33.33)
	I		0(0.00)	6(50)	100(65.78)	8(66.67)
Fusinic Acid	S	N/D	10(66.67)	N/D	N/D	N/D
	R		5(33.33)			
	I		0(0.00)			

Chloramphenicol	S	N/D	N/D	12(100)	120(78.96)	12(100)
	R			0(0.00)	32(21.05)	0(0.00)
	I			0(0.00)	0(0.00)	0(0.00)
Ampicillin	S	0(0.00)	5(33.33)	6(50)	92(60.52)	4(33.33)
	R	12(100)	10(66.67)	6(50)	48(31.57)	4(33.33)
	I	0(0.00)	0(0.00)	0(0.00)	12(7.8)	4(33.33)

*N/D = No Data; S = Sensitive, R = Resistant, I = Intermediate

***Table 2**: Summary table for urine samples*

Antibiotic	**Sensitivity**	**E.COLI N (%)**	**KLEBSIELLA SPP. N (%)**	**PSEUDO. SPP. N (%)**	**STREP. AUREUS N (%)**	**ENTERO. SPP. N (%)**	**ACINETOBACTER SPP.N (%)**
Amikacin	S	116(93.54)	14(100)	5(50)	N/D	N/D	0(0.00)
	R	6(4.83)	0(0.00)	5(50)			7(100)
	I	2(1.61)	0(0.00)	0(0.00)			0(0.00)
Cefixime	S	40(32.25)	8(57.14)	0(0.00)	0(0.00)	8(40)	0(0.00)
	R	84(67.75)	6(42.86)	10(100)	4(100)	10(50)	7(100)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)	2(10)	0(0.00)
Ceftazidime	S	68(54.83)	8(57.14)	0(0.00)	4(100)	8(40)	0(0.00)
	R	46(37.09)	6(42.86)	10(100)	0(0.00)	10(50)	4(100)
	I	10(8.06)	0(0.00)	00.00)	0(0.00)	2(10)	0(0.00)
Cefuroxime	S	70(56.45)	8(57.14)	0(0.00)	4(100)	14(70)	0(0.00)
	R	50(40.32)	6(42.86)	10(100)	0(0.00)	6(30)	4(100)
	I	4(3.22)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Ciprofloxacine	S	76(61.29)	8(57.14)	0(0.00)	4(100)	2(10)	0(0.00)
	R	32(25.80)	0(0.00)	10(100)	0(0.00)	14(70)	7(100)
	I	16(12.90)	6(42.86)	0(0.00)	0(0.00)	4(20)	0(0.00)
Cotrimoxazole	S	60(48.39	10(71.43)	0(0.00)	4(100)	0(0.00)	7(100)
	R	62(50)	4(28.57)	10(100)	0(0.00)	20(100)	0(0.00)
	I	2(1.61)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Gentamycin	S	N/D	14(100)	5(50)	4(100)	8(40)	0(0.00)
	R		0(0.00)	5(50)	0(0.00)	10(50)	7(100)
	I		0(0.00)	00.00)	0(0.00)	2(10)	0(0.00)
Meropenem	S	124(100)	12(85.70)	0(0.00)	N/D	N/D	0(0.00)
	R	0(0.00)	2(14.30)	10(100)			7(100)
	I	0(0.00)	0(0.00)	0(0.00)			0(0.00)
Amoxiclav	S	56(45.16)	6(42.86)	0(0.00)	4(100)	18(90)	0(0.00)
	R	42(33.87)	8(57.14)	10(100)	0(0.00)	2(10)	7(100)
	I	26(20.96)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cefotaxime	S	56(45.16)	8(57.14)	0(0.00)	4(100)	14(70)	0(0.00)
	R	68(44.84)	6(42.86)	10(100)	0(0.00)	4(20)	7(100)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)	2(10)	0(0.00)
Ceftriaxone	S	60(48.39)	8(57.14)	0(0.00)	4(100)	16(80)	0(0.00)
	R	60(48.39)	6(42.86)	10(100)	0(0.00)	2(10)	7(100)
	I	4(3.22)	0(0.00)	0(0.00)	0(0.00)	2(10)	0(0.00)
Cephalexin	S	56(45.16)	8(57.14)	0(0.00)	4(100)	10(50)	0(0.00)
	R	64(51.16)	6(42.86)	10(100)	0(0.00)	10(50)	7(100)
	I	4(3.22)	0(0.00)	00.00)	0(0.00)	0(0.00)	0(0.00)
Imipenem	S	124(100)	12(85.70)	0(0.00)	N/D	N/D	0(0.00)
	R	0(0.00)	0(0.00)	10(100)			7(100)
	I	0(0.00)	2(14.30)	0(0.00)			0(0.00)
Nalidexic Acid	S	24(19.35)	6(42.86)	0(0.00)	N/D	N/D	0(0.00)
	R	96(77.43)	4(28.57)	10(100)			7(100)
	I	4(3.22)	4(28.57)	0(0.00)			0(0.00)
Piperacillin	S	98(79.95)	12(85.70)	5(50)	N/D	N/D	0(0.00)
	R	20(16.12)	2(14.30)	5(50)			7(100)
	I	6(4.83)	0(0.00)	0(0.00)			0(0.00)
Mecillinum	S	124(100)	N/D	0(0.00)	4(100)	N/D	0(0.00)
	R	0(0.00)		10(100)	0(0.00)		7(100)
	I	0(0.00)		0(0.00)	0(0.00)		0(0.00)
Amoxycillin	S	104(80.64)	0(0.00)	5(50)	0(0.00)	18(90)	0(0.00)
	R	22(17.75)	14(100)	5(50)	4(100)	2(10)	7(100)
	I	2(1.61)	0(0.00)	00.00)	0(0.00)	0(0.00)	0(0.00)
Nitrofurantoin	S	80(64.51)	10(71.43)	0(0.00)	4(100)	18(90)	0(0.00)
	R	40(32.25)	0(0.00)	10(100)	0(0.00)	2(10)	7(100)
	I	4(3.22)	4(28.57)	0(0.00)	0(0.00)	0(0.00)	0(0.00)

*N/D = No Data; S = Sensitive, R = Resistant, I = Intermediate

***Table 3**: Summary table for sputum samples*

Antibiotic	Sensitivity	E.COLI N (%)	KLEBSIELLA SPP. N (%)	PSEUDO. SPP. N (%)	CANDIDA SPP. N (%)
Amikacin	S	37(100)	41(100)	36(66.67)	42(100)
	R	0(0.00)	0(0.00)	18(33.33)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cefixime	S	0(0.00)	41(100)	0(0.00)	42(100)
	R	37(100)	0(0.00)	54(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Ceftazidime	S	0(0.00)	41(100)	N/D	42(100)
	R	37(100)	0(0.00)		0(0.00)
	I	0(0.00)	0(0.00)		0(0.00)
Cefuroxime	S	0(0.00)	41(100)	18(33.33)	42(100)
	R	37(100)	0(0.00)	36(66.67)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Ciprofloxacine	S	0(0.00)	41(100)	0(0.00)	42(100)
	R	37(100)	0(0.00)	54(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cotrimoxazole	S	37(100)	41(100)	0(0.00)	42(100)
	R	0(0.00)	0(0.00)	54(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Gentamycin	S	37(100)	41(100)	54(100)	42(100)
	R	0(0.00)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Meropenem	S	0(0.00)	41(100)	36(66.67)	42(100)
	R	37(100)	0(0.00)	18(33.33)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Ofloxacin	S	37(100)	41(100)	N/D	42(100)
	R	0(0.00)	0(0.00)		0(0.00)
	I	0(0.00)	0(0.00)		0(0.00)
Amoxiclav	S	37(100)	41(100)	0(0.00)	42(100)
	R	0(0.00)	0(0.00)	54(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Cefotaxime	S	0(0.00)	41(100)	0(0.00)	42(100)
	R	37(100)	0(0.00)	54(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Ceftriaxone	S	N/D	41(100)	0(0.00)	42(100)
	R		0(0.00)	54(100)	0(0.00)
	I		0(0.00)	0(0.00)	0(0.00)
Colistin	S	N/D	41(100)	54(100)	42(100)
	R		0(0.00)	0(0.00)	0(0.00)
	I		0(0.00)	0(0.00)	0(0.00)
Piperacillin	S	37(100)	41(100)	54(100)	42(100)
	R	0(0.00)	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)	0(0.00)

*N/D = No Data; S = Sensitive, R = Resistant, I = Intermediate

***Table 4**: Summary table for swab samples*

Antibiotic	Sensitivity	PSEUDO. SPP. N (%)	PROTEUS SPP. N (%)	STREPTOCOCCUS PYOGENES N (%)
Amikacin	S	36(60)	0(0.00)	38(100)
	R	24(40)	22(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Cefixime	S	0(0.00)	0(0.00)	38(100)
	R	48(80)	22(100)	0(0.00)
	I	12(20)	0(0.00)	0(0.00)
Ceftazidime	S	24(40)	0(0.00)	38(100)
	R	36(60)	22(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Cefuroxime	S	0(0.00)	22(100)	38(100)
	R	60(100)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Ciprofloxacine	S	N/D	0(0.00)	38(100)
	R		22(100)	0(0.00)

	I		0(0.00)	0(0.00)
Cotrimoxazole	S	48(80)	0(0.00)	38(100)
	R	0(0.00)	22(100)	0(0.00)
	I	12(20)	0(0.00)	0(0.00)
Gentamycin	S	24(40)	22(100)	38(100)
	R	36(60)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Meropenem	S	N/D	0(0.00)	38(100)
	R		22(100)	0(0.00)
	I		0(0.00)	0(0.00)
Ofloxacin	S	N/D	22(100)	38(100)
	R		0(0.00)	0(0.00)
	I		0(0.00)	0(0.00)
Amoxiclav	S	12(20)	22(100)	38(100)
	R	36(60)	0(0.00)	0(0.00)
	I	12(20)	0(0.00)	0(0.00)
Cefotaxime	S	24(40)	0(0.00)	38(100)
	R	36(60)	22(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Imipenem	S	48(80)	N/D	38(100)
	R	12(20)		0(0.00)
	I	0(0.00)		0(0.00)
Colistin	S	36(60)	N/D	38(100)
	R	24(40)		0(0.00)
	I	0(0.00)		0(0.00)
Piperacillin	S	60(100)	22(100)	38(100)
	R	0(0.00)	0(0.00)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)

*N/D = No Data; S = Sensitive, R = Resistant, I = Intermediate

Table 5*: Summary table for pus samples*

Antibiotic	Sensitivity	E.COLI N (%)	PSEUDO. SPP. N (%)	STAPH. AUREUS N (%)
Amikacin	S	50(100)	30(60)	40(80)
	R	0(0.00)	10(20)	10(20)
	I	0(0.00)	10(20)	0(0.00)
Cefixime	S	0(0.00)	0(0.00)	0(0.00)
	R	50(100)	50(100)	50(100)
	I	0(0.00)	0(0.00)	0(0.00)
Ceftazidime	S	0(0.00)	20(40)	10(20)
	R	50(100)	30(60)	20(40)
	I	0(0.00)	0(0.00	20(40)
Cefuroxime	S	0(0.00)	0(0.00)	50(100)
	R	50(100)	50(100)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Ciprofloxacine	S	0(0.00)	30(60)	N/D
	R	50(100)	10(20)	
	I	0(0.00)	10(20)	
Cotrimoxazole	S	0(0.00)	0(0.00)	30(60)
	R	50(100)	50(100)	10(20)
	I	0(0.00)	0(0.00)	10(20)
Gentamycin	S	25(50)	30(60)	50(100)
	R	25(50)	20(40)	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Meropenem	S	N/D	50(100)	50(100)
	R		0(0.00	0(0.00)
	I		0(0.00)	0(0.00)
Amoxiclav	S	25(50)	0(0.00)	50(100)
	R	0(0.00)	50(100)	0(0.00)
	I	25(50)	0(0.00)	0(0.00)
Cefotaxime	S	0(0.00)	0(0.00)	20(40)
	R	50(100)	50(100)	20(40)
	I	0(0.00)	0(0.00)	10(20)
Ceftriaxone	S	0(0.00)	0(0.00)	20(40)
	R	50(100)	50(100)	20(40)
	I	0(0.00)	0(0.00)	10(20)

Cephalexin	S	0(0.00)	0(0.00)	30(60)
	R	50(100)	50(100)	20(40)
	I	0(0.00)	0(0.00)	0(0.00)
Imipenem	S	25(50)	50(100)	N/D
	R	25(50)	0(0.00	
	I	0(0.00)	0(0.00)	
Colistin	S	50(100)	50(100)	0(0.00)
	R	0(0.00)	0(0.00	50(100)
	I	0(0.00)	0(0.00)	0(0.00)
Piperacillin	S	50(100)	50(100)	50(100)
	R	0(0.00)	0(0.00	0(0.00)
	I	0(0.00)	0(0.00)	0(0.00)
Amoxycillin	S	0(0.00)	0(0.00)	20(40)
	R	50(100)	50(100)	30(60)
	I	0(0.00)	0(0.00)	0(0.00)

*N/D = No Data; S = Sensitive, R = Resistant, I = Intermediate

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