Int.J.Curr.Microbiol.App.Sci (2014) 3(9) 116-126

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 9 (2014) pp. 116-126**
http://www.ijcmas.com

Original Research Article

Drug Sensitivity Pattern of Pathogenic Isolates in Intensive Care Unit of Tertiary Care Hospitals

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A B S T R A C T

Antibiogram are used to check if the causative agent belongs to a species, capable of exhibiting resistance to commonly used antibiotics, to study the epidemiology of resistance, to evaluate the efficacy of a new antibiotic. Quality of life can be improved by enhancing standards of medical treatment at all levels of the health care delivery system. Information about antibiotic use patterns is necessary for a constructive approach to problems that arise from the multiple antibiotics available. A total of 49 isolates were recovered from 45 patients enrolled over a period of three months out of which most were bacterial and very few were fungal. The samples from the patients were collected once they admitted to the ICU section within 48 hours. In this study, the samples were collected, processed by staining method, by inoculating them into the selective media, followed by biochemical test and finally antibiogram was done in order to obtain the resistance pattern of the organisms present in the ICU wards. Different organisms were obtained from different patients from different samples such as tissue, ear, CVP, sputum, endotracheal, throat, pus and urine. It is important to study the antibiogram of the pathogenic organism as it helps to prevent the outbreak of resistant organism and also by knowing the proper MIC concentration it become more custom-tailored treatment that is directed only at the causative bacterium, that will prevent the eradication of normal flora of the human body.

Keywords

Antibiogram, Pathogenic Isolates, Intensive Care Unit, Tertiary Care Hospitals

Introduction

The study of the microbial interactions with animals becomes the prime importance for diagnosis and treatment of dreadful diseases in clinical industry. Although the primary interest is in diseases caused by these interactions, it must also be appreciated that microorganisms play a critical role in human survival. The normal commensal population of microbes participates in the metabolism of food products, provides essential growth factors, protects against infections with highly virulent microorganisms, and stimulates the immune response. In the absence of these organisms, life as we know it would be impossible. A hospital-acquired infection is usually one that first appears three days after a patient is admitted to a hospital or other health care facility. The microbial population that colonizes the human body is numerous and diverse. While

a patient is admitted to the hospital for treatment of other conditions, nosocomial infections may be acquired from other patients, hospital staff, contaminated objects or solutions, or from the patient himself (such as transfer from one site of the body to another). Most common nosocomial infections are surgical wound infections, urinary and respiratory tract infections, and bacteremia (bloodstream infections). Many of these infections are by antibiotic-resistant bacteria, known as superbugs, and can often have serious consequences for the individual and the hospital community. Nosocomial infection is also known as hospital or healthcare-acquired infections (Koo, 2009). To prevent and control these emerging nosocomial infections, we need to increase national surveillance, "risk adjust" infection rates so that inter hospital comparisons are valid, develop more noninvasive infection resistant devices, and work with health-care workers on better implementation of existing control measures such as hand washing.

The concept of attacking invading microorganisms without harming the host was first introduced by Paul Ehrlich. In 1910 he discovered "salvarsan", which he announced as a magic bullet for the treatment of syphilis. Penicillin, produced by the fungus, *Penicillium notatum*, was first discovered by Alexander Fleming in 1928, purified by Florey and Chain in 1940, and shown to have wide applicability in the treatment of infection caused by a variety of bacteria. With the help of colleagues in the USA, it was produced in sufficient quantity to be a miracle cure for wound infections during the Second World War. A study of Lipsitch *et al.,* (2000) concluded that "use of an antibiotic for which resistance is not present will be positively associated at the individual level with carriage of bacteria resistant to another antibiotic but negatively associated at the population level with the prevalence of resistance to the other antibiotic". Resistance of susceptible bacteria can occur during antimicrobial treatment, e.g., by mutations (Bonten and Mascini 2003). Healthcare workers often are carriers but also can be vectors (cross-transmission) (Salgado *et al*., 2005). In addition, an increasing number of patients are already colonized with resistant bacteria on admission in the ICU. When colonization pressure with resistant strains is above a certain level, the risk of cross-transmission becomes extremely high and very difficult to overcome (inoculums effect) (Philippart *et al.*, 2007).

Along with the problem of nosocomial infection goes the burden of "multidrug" antimicrobial resistance (MDR) (Carlet *et al*., 2007). The ongoing emergence of resistance in the community and hospital is considered a major threat for public health (Willems *et al*., 2007). Due to the specific risk profile of its residents, the ICU also is deemed the epicenter of resistance development. The ICU has even been described as a factory for creating, disseminating, and amplifying antimicrobial resistance (Ben *et al*., 2007).

Objective

This was a prospective study carried out at the tertiary care hospitals in and nearby Bangalore over a period of three months. The aim was to study the sensitivity pattern of nosocomial infections among surgical patients in order to create appropriate strategies to reduce the risk of newly emerging antibiotic resistant organisms.

Materials and Methods

Sample Collection: The clinical samples were collected from the patients of different

Hospitals in and nearby Bangalore, using pre-sterilized robust, leak-proof, sterile containers. Precaution measures were taken to minimize the contamination. The clinical sample was mixed well and processed on the same day. Different samples like pus samples, endotracheal samples, ear swab, throat samples, tissue samples, sputum samples, urine samples and CVP samples were collected in order to study the sensitivity pattern of the organisms present in the ICU samples.

Transportation: When some time may elapse before the sample is examined, and especially where delicate pathogens, may be present, it is advantageous to place the swab in a transport medium, such as Stuart's medium, which preserves the stability of the pathogens. The medium is non-nutrient, because the less delicate commensal bacteria present in the specimen would outgrowth the pathogens in a nutrient medium. When the patient is not close to the bacteriological laboratory there is a risk that the pathogen in a bacteriological specimen may not survive or may be over grown by non pathogens during the time it takes to transport the specimen to the laboratory.

Transport media are available with different ingredients and in different containers for special purposes, such as deep semi-solid thioglycollate medium for anaerobes. Sterile disposable swab kits incorporating a transport medium are very useful for the submission of specimens from a patient who is at some distance from the laboratory.

Maintenance of Pure Culture

The colonies obtained were analyzed for colony morphology and sub cultured in Nutrient Agar plates incubated at 30–35˚for 42 hours and then stored at a refrigeration temperature of 4˚C for further use.

Microbiological Techniques

Antibiotic Sensitivity Test

The organisms isolated by quantitative culture of the pus, throat, ear, tissue, endotracheal tube, urine, sputum and central venous catheter from ICU patients were identified based on standard microbiological techniques. The susceptibility of the clinical isolates to some routinely used antibiotics was determined by the Kirby-Bauer disc diffusion method (CLSI document).

Results and Discussion

Antibiotic Sensitivity Pattern

Different samples from the ICU patients were collected and processed in order to obtain the frequency of the nosocomial pathogens present in the ICU wards and to study their antibiogram profile.

The overall frequencies of microorganisms obtained from ICU samples

Total fifty isolates were obtained from ICU sample out of which thirty isolates were gram negative, seventeen were gram positive organism and two were yeast cells.

Antibiotic Sensitivity Pattern

Three different clinical samples of *Acinetobacter* sp. were obtained and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:
Strain one was resistant to various antibiotics like Vancomycin, Ceftizoxime, Ciprofloxacin, Neomycin, Tetracycline, Doxicycline, Imipenem, Meropanem, Moxifloxacin, Cefaparazon and Levofloxacin but was sensitive to Tobramycin.

Strain two was resistant to Vancomycin, Ceftizoxime, Ciprofloxacin, Neomycin, Tetracycline, Doxicycline and Imipenem but sensitive to Moxifloxacin.

Strain three was resistant to Vancomycin, Ceftizoxime, Tobramycin, Neomycin and Tetracycline but was sensitive to Ciprofloxacin.

Four different strains of *Citrobacter* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that: Strain one was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Pipercillin Tazobactum, Moxifloxacin, Cefaparazon and Levofloxacin but sensitive to Tobramycin.

Strain two was resistance to Vancomycin, Ceftizoxime, Ciprofloxacin, Doxicycline, Moxifloxacin, Cefaparazon, and Levofloxacin. But sensitive to Tobramycin and Meropanem. Strain three was resistant to Vancomycin, Ceftizoxime, Doxicycline, Cefaparazon and Tetracycline but was sensitive to Ciprofloxacin.

Strain four was resistant to Vancomycin, Ceftizoxime, Doxicycline and Cefaparazon. But it was sensitive to Pipercillin and Tazobactam. Six different strains of *E. coli* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:

Stain one was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Moxifloxacin and Cefaparazon but was sensitive to Meropanem and Imipenem.

Strain three was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Moxifloxacin, Cefaparazon and Ciprofloxacin but was sensitive to Meropanem.

Strain four was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline and Cefaparazon but was sensitive to Imipenem. Strain five was resistant to Ceftizoxime, Vancomycin, Neomycin, Tetracycline and Doxicycline Cefaparazon and Tobramycin but was sensitive to Meropanem and Imipenem.

Strain six was resistant to Vancomycin, Neomycin and Tetracycline but was sensitive to Ciprofloxacin and Doxicycline.

Two different strains of *Enterococcus* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that: Strain one was resistant to Linezolid, Ampicillin, Pipercillin Tazobactam and Meropanem but was sensitive to Doxicycline.

Strain two was resistant to Linezolid, Ampicillin and Vancomycin but was sensitive to Imipenem and Meropanem. Six different strains of *Klebsiella* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:

Strain one was resistant to most of the antibiotic but was sensitive to Tobramycin.

Stain two was resistant to Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Pipercillin Tazobactum, Moxifloxacin, Cefaparazon and Levofloxacin but was sensitive to Vancomycin.

Strain three was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Moxifloxacin and Cefaparazon but was sensitive to Imipenem.

Strain four was resistant to Neomycin and Doxicycline but was sensitive to Imipenem.
Strain five was resistant to Tobramycin, Tetracycline, Pipercillin Tazobactum, Moxifloxacin, Levofloxacin and Cefaparazon but was sensitive to Ciprofloxacin.

Strain six was resistant to Vancomycin, Tobramycin, Ceftizoxime, Cefaparazon and Ciprofloxacin but was sensitive to Pipercillin Tazobactum.

Single strain of *Providentia* sp. was isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:

The strain was resistant to Vancomycin, Ceftizoxime, Doxicycline and Cefaparazon but was sensitive to Imipenem. Seven different strains of *Pseudomonas* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:

Strain one was resistant to all antibiotic.
Strain two was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Meropanem, Moxifloxacin, Cefaparazon and Levofloxacin but was sensitive to Ciprofloxacin. Strain three was resistant to Vancomycin, Tobramycin, Ceftizoxime, Neomycin, Tetracycline, Doxicycline, Moxifloxacin, Imipenem and Pipercillin Tazobactum but was sensitive to Levofloxacin and Moxifloxacin.

Strain four was resistant to all antibiotics.
Strain five was resistant to all antibiotics except Ciprofloxacin.
Strain six was resistant to all antibiotics.
Strain seven was resistant to Vancomycin, Doxicycline, Neomycin, Tetracycline and Ceftizoxime but was sensitive to ciprofloxacin.

Strain eight was resistant to Vancomycin, Ceftizoxime, Neomycin, Tetracycline and Doxicycline but was sensitive to Meropanem.

Strain nine was resistant to Vancomycin, Ceftizoxime, Tetracycline and Doxicycline but was sensitive to Ciprofloxacin.

Single strain of *Rhodococcus* sp. was isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:
The strain was resistant to Vancomycin, Doxicycline and Linezolid but was sensitive to Pipercillin and Tazobactum.

Two different strains of *Salmonella* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:
Strain one was resistant to Vancomycin, Tetracycline and Doxicycline but was sensitive to Ciprofloxacin.

Strain two was resistant to Tetracycline and Gentamycin but was sensitive to Moxifloxacin.

Six different strains of *Staphylococcus* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that:

Strain one was resistant to mostly all antibiotic but was sensitive to Neomycin.
Strain two was sensitive to Imipenem but was resistant to Vancomycin, Doxicycline Pipercillin Tazobactum, Levofloxacin and Cefaparazon.

Table.1 Overall frequencies of micro organisms obtained from ICU samples

Frequency of Micro Organisms	No. of Isolates Obtained
Staphylococcus	6
Pseudomonas	9
Citrobacter	4
Enterococcus	2
Rhodococcus	1
Streptococcus	6
Acinetobacter	3
Candida	2
Klebsiella	6
Actinomyces	1
Salmonella	2
Providencia	1
E. coli	6

Fig.1 Overall frequencies of micro organisms obtained from ICU samples

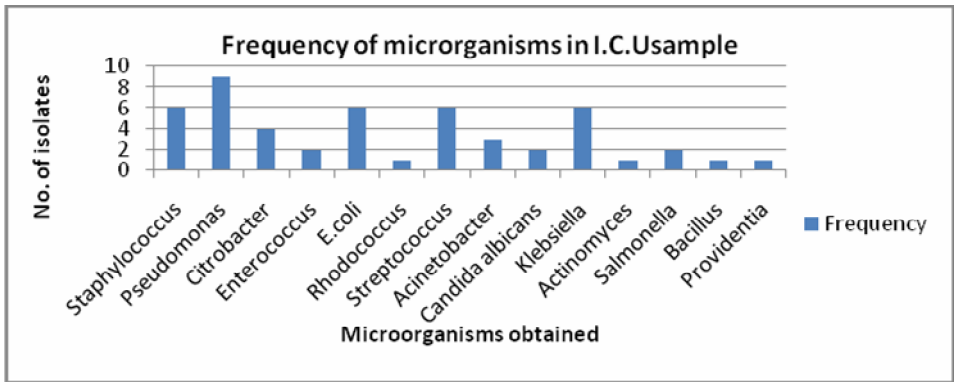


Fig.2 Sensitivity patterns of *Acinetobacter* strains

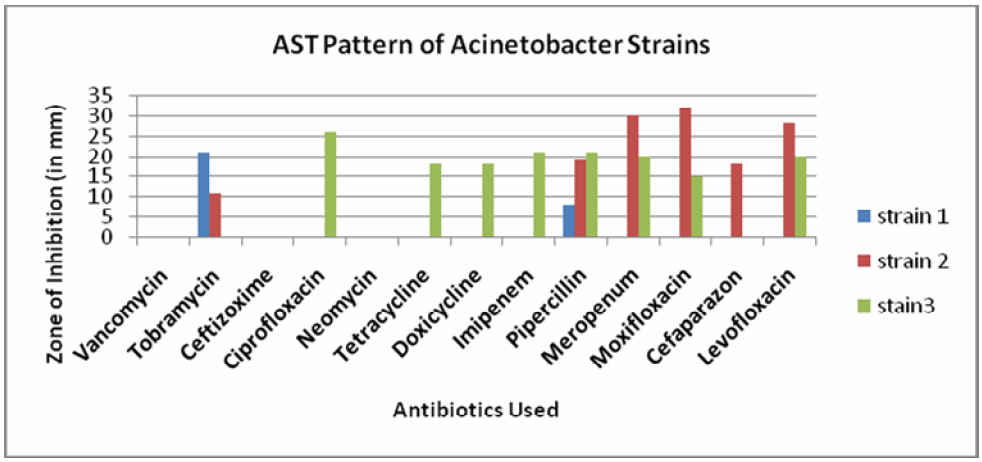


Fig.4 Sensitivity patterns of *Citrobacter* strains

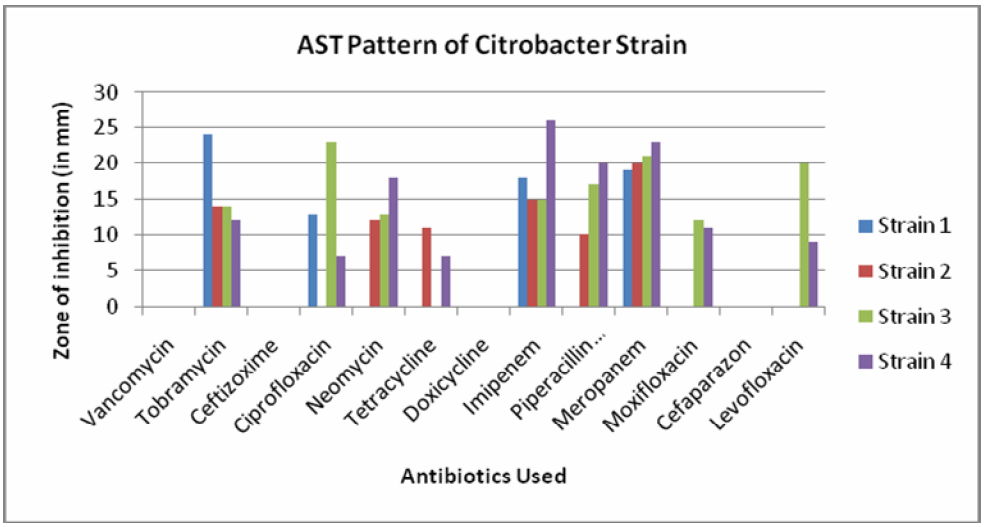


Fig.5 Sensitivity patterns of *E. coli* strains

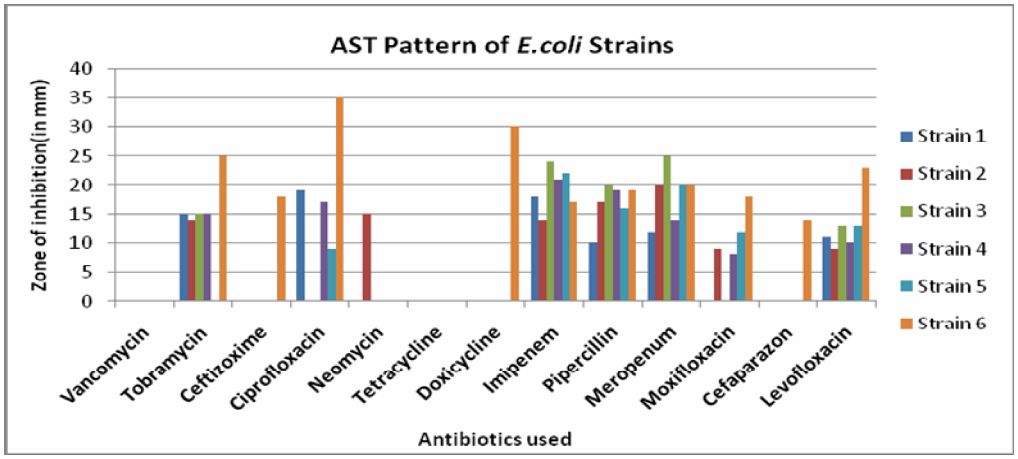


Fig.6 Sensitivity patterns of *Enterococcus* strains

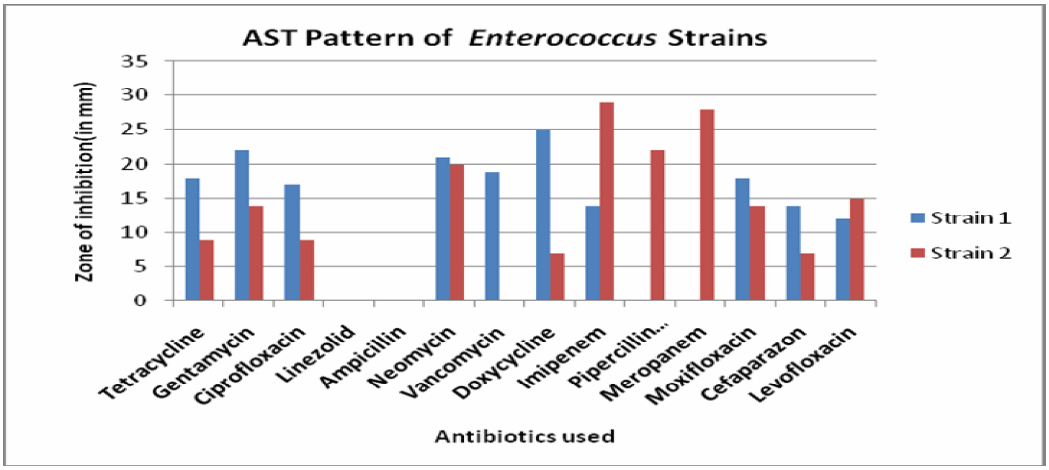


Fig.7 Sensitivity patterns of *Klebsiella* strains

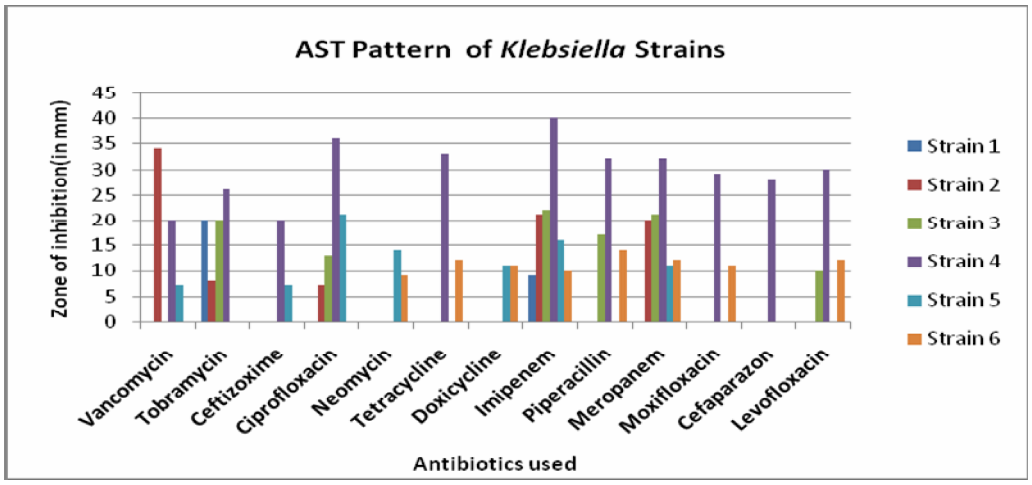


Fig.8 Sensitivity patterns of *Providentia* strains

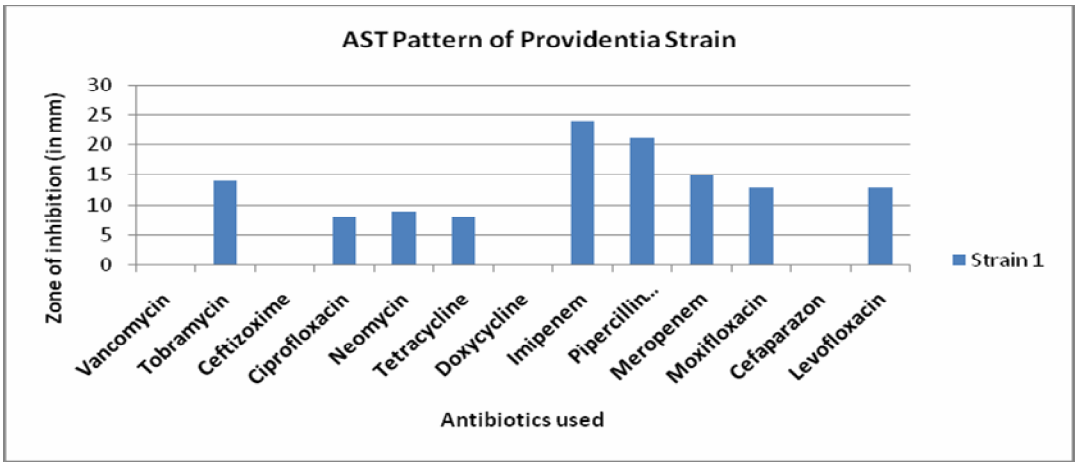


Fig.9 Sensitivity patterns of *Pseudomonas* strains

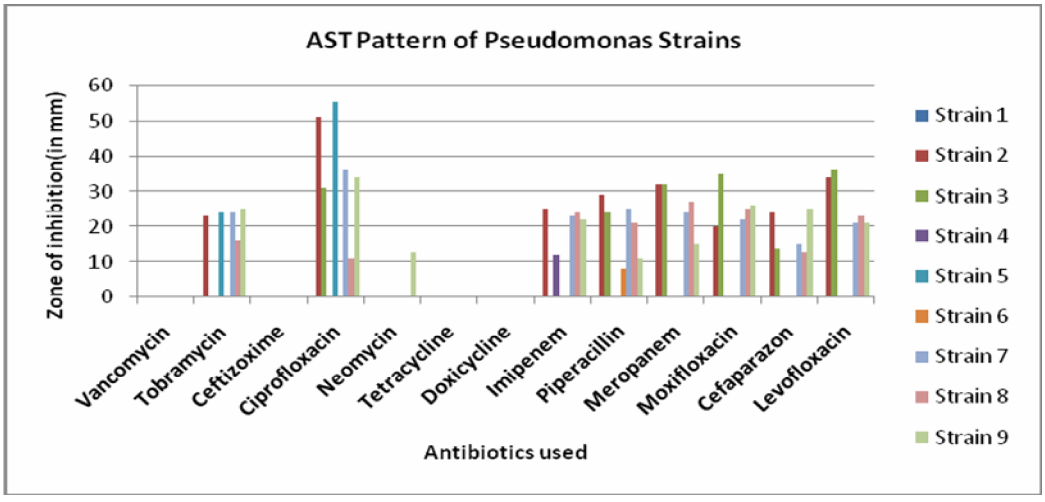


Fig.10 Sensitivity pattern of *Rhodococcus* strain

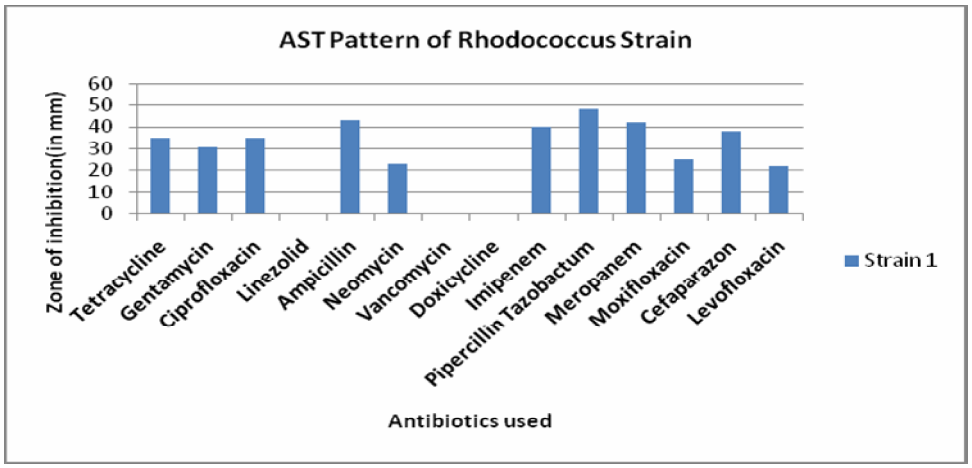


Fig.11 Sensitivity patterns of *Salmonella* strains

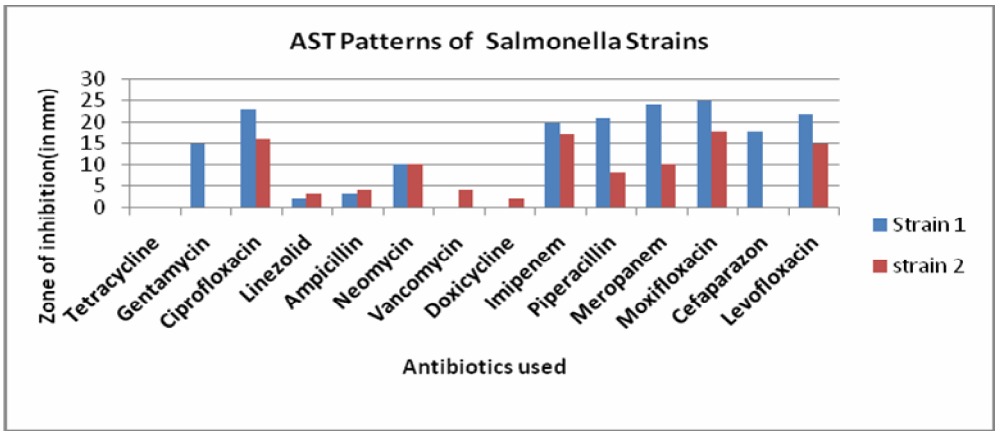


Fig.12 Sensitivity patterns of *Staphylococcus* strains

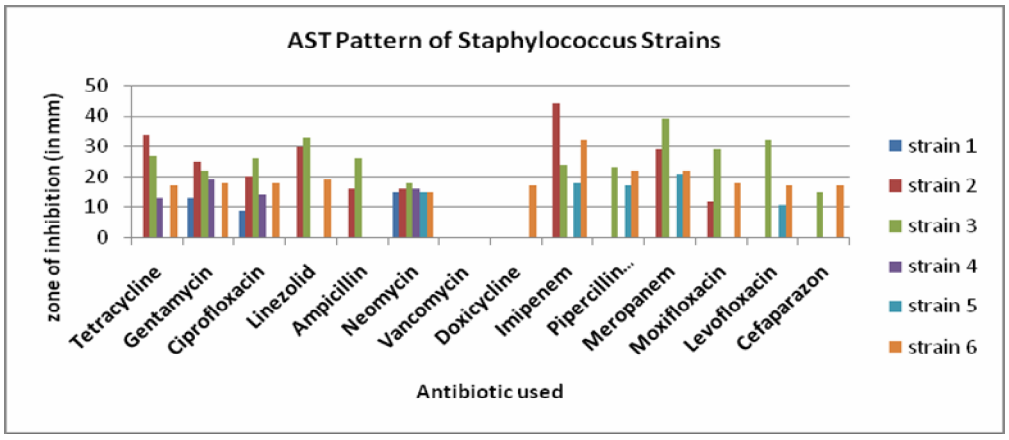
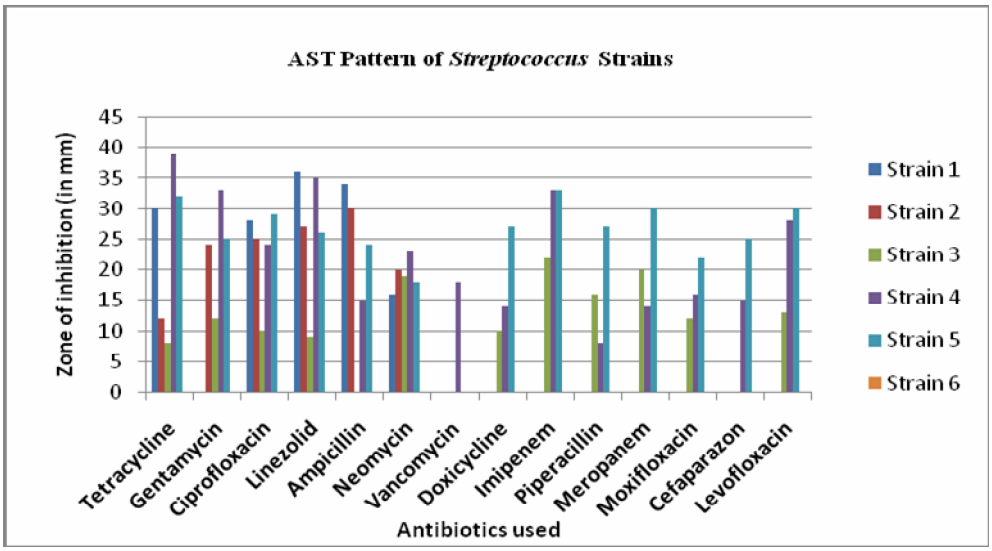


Fig.13 Sensitivity patterns of *Streptococcus* strains



Strain three was resistant to Vancomycin and Doxicycline but was sensitive to Meropanem.
Strain four was resistant to most of all antibiotics except to Gentamycin.

Strain five was resistant to tetracycline, Linezolid, Ampicillin Vancomycin, Doxicycline moxifloxacin and Cefaparazon but was sensitive to Meropanem.

Strain six was resistant to Ampicillin and Vancomycin but was sensitive to Imipenem.
Six different strains of *Streptococcus* sp. were isolated from clinical samples and their antibiotic sensitivity patterns tested using Kirby Bauer disk diffusion method. The antibiotic sensitivity testing revealed that: Strain one was resistant to Gentamycin, Vancomycin Neomycin, Doxicycline, Imipenem, Pipercillin Tazobactum, Meropanem, moxifloxacin, Cefaparazon and Levofloxacin.

Strain two was resistant to Vancomycin, Doxicycline, Imipenem, Pipercillin Tazobactum, Meropanem, Cefaparazon and Levofloxacin but was sensitive to Ampicillin.

Strain three was resistant to mostly all antibiotics except Imipenem.

Strain four was sensitive to all antibiotics.
Strain five was sensitive to all except Vancomycin. Strain six was resistant to all antibiotics.

References

Ben, A.A., Carlet, J., Tabah, A., Willems, V., Philippart, F., Chafine, A., Garrouste, O.M., Misset, B. (2007). Multidrug resistant infections in the ICU: mechanisms, prevention and treatment. In: 25 Years of Progress and Innovation in Intensive Care Medicine. Kuhlen, R., Moreno, R., Ranieri, V.M., Rhodes, A.B. (Eds). Germany: Medizinisch Wissenschaftliche Verlagsgesellschaft. pp. 199–211.

Bonten, M.J., Mascini, E.M. (2003). The hidden faces of the epidemiology of antibiotic resistance. *Intensive Care Med.*, 29:1–2.

Koo, I. (2008). Got Milk Microbes? A Guide to Milk-borne Infectious Diseases. About.com. Retrieved from http://infectiousdiseases.about.com/bio/Ingrid-Koo-Ph-D-50107.htm.

Lipsitch, M., Bergstrom, C.T., Levin, B.R. (2000). The epidemiology of antibiotic resistance in hospitals: paradoxes and prescriptions. *Proc. Natl. Acad. Sci. USA,* 97: 1938–1943.

Mackie, McCartney. 2004. 4th edition. Practical Medical Microbiology. Churchill Livingstone, New York. pp. 58–129.

Salgado, C.D., O'Grady, N., Farr, B.M. (2005). Prevention and control of antimicrobial resistant infections in intensive care patients. *Crit. Care Med.,* 33: 2373–382.