ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(1): 747-750
www.allresearchjournal.com
Received: 26-11-2015
Accepted: 29-12-2015

Javed Iqbal
Department of Post-Graduate Studies and Research in Biological Sciences, Rani Durgavati, University Jabalpur, Madhya Pradesh, India

Durgesh Mishra
Department of Post-Graduate Studies and Research in Biological Sciences, Rani Durgavati University Jabalpur, Madhya Pradesh, India

Fozia Kouser
School of Nursing and Biomedical Sciences, Baba Ghulam Shah Badshah University, Rajouri, Jammu & Kashmir, India

Correspondence
Javed Iqbal
Department of Post-Graduate Studies and Research in Biological Sciences, Rani Durgavati, University Jabalpur, Madhya Pradesh, India

Study of antibiotic sensitivity pattern in catheter associated urinary tract infection in hospital environment

Javed Iqbal, Durgesh Mishra and Fozia Kouser

Abstract
To assess the change in the bacterial profile and pattern of antibiotic resistance of catheter associated urinary tract infections (CAUTIs, the most prevalent form of nosocomial infections) in hospital environment. Susceptibility pattern was done by disk diffusion method. All the isolated organisms were put into appropriate media for antibiotic susceptibility test by Kirby-Bauer disc diffusion technique. All the bacterial isolates of CUTI were 100% sensitive to Imipenem. *E. coli* were found to be 60.6% sensitive to Nitrofurantoin, 57.6% to Gentamicin, 45.4% to Ceftriaxone and 42.4% to Azithromycin whereas in other antibiotics, the percentages of sensitivity were less. The sensitivity patterns of Klebsiella spp. were found 100% to Gentamicin, 66.7% to Nitrofurantoin and Ceftazidime each. Moreover, this study concludes that *E. coli* and other isolates were more sensitive to Imipenem, Gentamicin and Nitrofurantoin compared to other antibiotics tested and therefore these may be the drugs of choice for the treatment of Gram negative isolates of Cathereter associated UTIs in our region.

Keywords: CAUTI, antibiotic sensitivity, urinary tract infection

Introduction
Nosocomial infections acquired during hospitalization depend on the characteristics of the microorganisms, with a high risk of being acquired when the healthcare environment is contaminated (Medina *et al.* 1997) [10]. The most common pathogen transference occurs between the hands of health professionals and patients or by the presence of bacteria and fungi on inanimate surfaces and equipment. Previous data have shown that drug resistant bacteria and fungi strains are of interest in hospitals On the other hand, hospitals have the potential for pathogen spread because they have contact with; medical furniture, instruments, clothing, skin, physical facilities, air, medical staff and drainage, although the infections caused by such nosocomial pathogens involves a contaminated environment which should have applied strict safety biosecurity procedures. A significant proportion of hospital infections result from cross contamination and transmission of microorganisms from; surfaces, hands of health care workers and medical equipment which has become contaminated with a variety of pathogenic and nonpathogenic organisms (Kramer *et al.* 2006;.Bauer *et al.* 1990) [7, 1]. Common human pathogens, such as *Escherichia coli*, *Enterococcus* spp, *Acinetobacter* spp, *Staphylococcus aureus* and noroviruses can survive for long periods on hospital surfaces or fomites that can potentially transmit infectious organisms (Kramer *et al.* 2006) [7]. In addition to this, several studies have shown that hospital infections are also caused by fungi, such as *Candida* spp. and various species of *Aspergillus*, *Cladosporium* and *Penicillium* (Faure *et al.*2002: Hashemi *et al.* 2004) [4, 5].Even in samples from the ventilator system (HEPA filter and common filter), air canal, air and hospital instruments, fungi such as *Penicillium*, *Aspergillus*, *Cladosporium*, *Trichoderma*, *Stereptomyses*, *Chrysosporium* and *Rhizopus* have been isolated (Lajonchere*et al.*1994) [8].Therefore it is important to know the presence of these pathogens in different areas of a hospital and to implement monitoring programs in order to evaluate the effectiveness of aseptic techniques that can be applied and contribute to better preventive measures against infectious diseases caused by nosocomial pathogens. In hospitals there is little information about the prevalence of bacteria and fungi (Medina *et al.* 2007) [10].

Material and Method

Susceptibility testing

Susceptibility pattern was done by disk diffusion method. All the isolated organisms were put into appropriate media for antibiotic susceptibility test by Kirby-Bauer disc diffusion technique. Disc diffusion tests were performed and interpreted according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI. 2007) [13].

Principle

Antibiotic sensitivity test teaching kit allows classification of bacterial strains as susceptible, resistant, or intermediate to various antimicrobial agents. In this method, the antibiotic impregnated discs were placed on the Mueller Hinton agar plates on which the bacterial culture is spread. As the antibiotic impregnated disc comes in contact with the moist agar surface, water is absorbed in the disc paper and the antibiotic diffuses out in the surrounding medium. As the distance from the disc increases, there is a logarithmic reduction in the antibiotic concentration which creates a gradient of drug concentration in the agar medium surrounding each disc. Though the diffusion of drug occurs, the bacteria that are inoculated on the agar surface are not inhibited by the concentration of antimicrobial agents but continue to multiply until a lawn of growth is visible. No growth occurs in the areas where the concentration of drug is inhibitory thus forming a zone of inhibition. Thus when an organism is sensitive to any antibiotic, a clear zone appears around that specific disc where the growth has been inhibited (zone of inhibition) whereas if an organism is resistant no clear zone of inhibition appears. Inoculum of test bacterium in a suitable broth medium (e.g. peptone water). For preparation of inoculum, pure culture of the organism is inoculated into a Peptone broth medium and incubated at 37 °C for 2 hour.

Peptone broth used for antimicrobial susceptibility test

Peptone broth used for antimicrobial susceptibility test. In peptone broth, bacterial culture is poured and then kept for 2 hours at 37 ^{0}C temperature to increase its bacterial density, this prepared culture broth is used for antimicrobial susceptibility test.

Procedure

- A standardize inoculums is inoculated with the help of a sterile cotton swab on the surface of the agar plate
- Disc of antimicrobial agents are placed on the surface of agar plate
- The plates are incubated at 37 °C for 16-18 hours and susceptibility is determined on the basis of zone of inhibition
- A standard control strain is also tested for comparison

Interpretation: The diameter of the zoned of growth inhibition around each disc are measured and compared with zones of inhibition of standard control strain and results are interpreted as:

Sensitive: When zone diameter of test organism is greater than, equal to or not more than 4 mm less than that of control strain.

Moderately sensitive: If its zone diameter is at least 12 mm but reduced by more than 4 mm as compared to control strain.

Resistant: If it shown no zone of inhibition of growth or if the zone diameter is not more than 10 mm.

Standardization of the disc

In order to standardize the disc potency, representative discs were tested against the reference strains of *S. aureus*, *E. coli* and *P. aeroginosa*. The zone of inhibition was compared with standard value as recommended by (CLSI, 2007) [13].

Sources of collection of antibiotic disc

The antibiotic susceptibility testing discs were procured from local market manufactured by Himedia.

Preservation of antibiotic disc

As per manufacturer's instruction the discs were stored in refrigerator between temperature 2-8 ^{0}C. Prior to use, the antimicrobial discs were taken out of the refrigerator and placed at room temperature for 1 hour to minimize condensation resulting from the warm air reaching the cold container.

Long term preservation of organisms

A number of colonies were picked up from pure culture and put into a labeled sterile glass vial containing 3 ml of sterile 16% Glycerol broth. It was then shaken to mix well and form an even suspension and then put into the incubator overnight at 37 ^{0}C, then it was transferred to a freezer at -20 ^{0}C (Chees brough 2000) [3].

Results

Table 1: Distribution of microorganisms

Isolated organism	<1 week(Sample 68Patient's)	>1 week(Sample 32 Patient's)
E. coli	2	1
P. aeruginosa	3	1
Proteus species	1	Nil
Enterobacter species	1	1
Enterococcus species	1	Nil
Klebsiella species	Nil	2
Staphylococcus aureus	1	Nil
Staphylococcus saprophyticus	0	0
Candida albicans	4	4
Total	12(17.6%)	10(31.25%)

All the bacterial isolates of CUTI were 100% sensitive to Imipenem. *E. coli* were found 60.6% sensitive to Nitrofurantoin, 57.6% to Gentamicin, 45.4% to Ceftriaxone and 42.4% to Azithromycin whereas in other antibiotics, the percentages of sensitivity were less. The sensitivity patterns of Klebsiella spp. were found 100% to Gentamicin, 66.7% to Nitrofurantoin and Ceftazidime each

Table 2: Antibiogram of microorganisms in CUTI

Antibiotics	Diameter of zone inhibition in mm			
	E. coli	Klebsiella	Staphylococcus aureus	Pseudomonas
Amoxyclav(AMC)	23	21	20	21
Cefuroxime(CFM)	22	NT	NT	NT
Cefazolin (CZ)	NT	NT	NT	NT
Ciprofloxacin (CIP)	21	22	18	NT
Levofloxacin (LE)	NT	17	NT	NT
Lomefloxacin(LOM)	20	NT	18	NT
Meropenem(MRP)	NT	NT	NT	NT
Nitrofurantoin(NIT)	18	NT	20	NT
Norfloxacin(NX)	22	NT	19	19
Pipericillin/Tazobactam (PIT)	19	NT	20	NT
Amikacin (Ak)	21	NT	16	22
Ampicillin (AX)	22	ND	17	NT
Azithromycin (AZM)	NT	17	22	NT
Chloramphenicol(C)	19	19	18	NT
Clindamycin (CD)	NT	NT	NT	NT
Ceftriaxone (CTR)	23	NT	19	19
Erythromycin (E)	NT	NT	21	NT
Gentamycin (GEN)	NT	NT	20	20
Imipenem(IPM)	21	NT	NT	21
Linezolid (LZ)	NT	NT	NT	NT
Methicilln (MET)	NT	NT	19	NT
Ofloxacin (OF)	22	18	17	20
Teicoplanin(TEI)	NT	NT	NT	NT
Tetracycline (TE)	21	18	20	NT
Vancomycin (VA)	NT	23	21	18

NT= Not Tested

All the bacterial isolates of CUTI were sensitive to Ofloxacin. *E. coli* were found sensitive to Amoxyclav, Ceftriaxone, Tetracycline and Ofloxacin whereas in other antibiotics, the percentages of sensitivity were less. The sensitivity patterns of *Klebsiella spp* were found to Amoxyclav, Ciprofloxacin and Vancomycin each. *Staphylococcus aureus* were found sensitive to Gentamicin Azithromycin, Nitrofurantoin and Tetracycline Erythromycin Vancomycin each. *Pseudomonas* spp were found sensitive to Ofloxacin, Gentamicin, Imipenem, Amikacin and Amoxyclav each.

From the study, it can be assessed that Ofloxacin, Gentamicin, Imipenem, Amikacin and Amoxyclav are virtually sensitive against uropathogens causing CUTI, as they were effective against all isolated organisms, respectively. Amoxiclav, Ceftriaxone, Tetracycline were slightly better and showed activity in cases. The species of *Proteus*, *Enterobacter*, *Citrobacter*, *Enterococcus*, *Morganella* and *Serratia* were responsible for the patients who were catheterized for more than 2 weeks. Among them, *E. coli* was the mostly responsible. Tullu (1998) [12]. from India have shown that the significantly higher risk of acquiring urinary catheter related infection in patients with catheter in situ for more than 7 days and the isolated organisms were *E. coli*, *Pseudomonas*, *Enterobacter*, *Acinetobacter*, *Klebsiella* and MRSA. The organism mostly isolated from CUTI patient was *E. coli* (73%) followed by *S.saprophyticus* (11.1%), *Klebsiella* species (6.7%), *Enterobacter* species (4.4%), *Pseudomonas aeruginosa* (2.2%) and *Proteus* species (2.2%) (Table 2).

In a study, in India showed for in patients, parenteral therapy with newer aminoglycosides and third generation Cephalosporins were needed to be advocated as the organisms for nosocomial UTI exhibit a high degree of drug resistance. *Staphylococcus aureus* was 100% sensitive to Imipenem and 80% to Ceftazidime. It had good sensitivity against Ceftriaxone and Azithromycin (60%) each and 40% to other drugs used except Ampicillin, Cotrimoxazole. Rifampicin and Cefaclor, which were least sensitive.

Our study suggests Nitrofurantoin (81.12% susceptibility) or Vancomycin (73.43% susceptibility) as the first-line drug against CUTI before culture and sensitivity is done. Both were very active against *Escherichia coli* and *Staph aureus* particularly. Both are cost-effective and readily available in developing countries. Nitrofurantoin replaces Levofloxacin in case of pregnancy, since it has been shown to be very safe in pregnancy and also a recent study in India showed that Nitrofurantoin had the best *in-vitro* susceptibility profile against *E.coli* (Biswas D *et al.* 2006) [2]. The consistent and high-level susceptibility of *E. coli* to Nitrofurantoin may be influenced by Nitrofurantoin's narrow spectrum of activity, limited indication, narrow tissue distribution, and limited contact with bacteria outside the urinary tract (James AK *et a.*,2002)[6]. Recently some studies have found an increased microbial resistance to Piperacillin, Cephazolin, Amikacin, and Levofloxacin. Additionally, extended-spectrum β-lactamase (ESBL)-producing *E. coli* tended to be isolated more often in these studies (Shigemura K *et al.* 2011) [11]. In the present study Nitrofurantoin was effective against 93% isolates of *E.coli*, 89% isolates of *Staphylococcus aureus* and 76% of Klebsiella, compared to Vancomycin, but with an

advantage of better activity against *Pseudomonas* (61% susceptibility). In our study *E. coli* showed highest sensitivity to Ceftriaxone, Amoxyclav, Amikacin, along with good sensitivity to other drugs.

Conclusion

One can truly affirm that the choice of drugs in the treatment of CUTI is quite narrow today due to the wide scale resistance that the common CUTI pathogens. The truth revealed from the study will help the physicians to prescribe the drugs cautiously for the betterment of the patients. Moreover, this study concludes that *E. coli* and other isolates were more sensitive to Imipenem, Gentamicin and Nitrofurantoin compared to other antibiotics tested and therefore these may be the drugs of choice for the treatment of Gram negatve isolates of cathereter associated UTIs in our region. For Gram-positive isolates Imipenem, Azithromycin, Vancomycin, and Ceftazidime may be the drug of choice. It is one of the few studies comparing the CUTI ever done which will act as an evidence for the future research. It is recommended that, antibiotics should be used after doing a routine microscopy and culture/ sensitivity of urine in order to inhibit acquisition and spread of drug resistance by the bacteria. Antimicrobial policy should be adopted at both the tertiary level hospital and national level supervised by monitoring cell for taking necessary steps to minimize the drug resistance.

References

1. Bauer TM, Ofner E, Just HM, Just H, Daschner FD. An epidemiological study assessing the relative importance of airborne and direct contact transmission of microorganisms in a medical intensive care unit. J Hosp Infect. 1990; 15(4):301-9.
2. Biswas D, Gupta P, Prasad R, *et al*. Choice of antibiotic for empirical therapy of acute cystitis in a setting of high antimicrobial resistance. Indian J Med Sci. 2006; 60:53-58.
3. Cheesbrough M. Summary of the clinical and laboratory features of microorganism in *District Laboratory* Practice in Tropical Countries, Part 2, Cambridge University press, UK, 2000, 106-266.
4. Faure O, FrickerHidalgo H, Lebeau B, Mallaret MR, Ambroise Thomas P, Grillot R. Eight-year surveillance of environmental fungal contamination in hospital operating rooms and haematological units. J Hosp Infect. 2002; 50(2):155-60.
5. Hashemi SJ, Sarasgani MR, Zomorodian K. A comparative survey of serum androgenic hormones levels between male patients with dermatophytosis and normal subjects. Jpn J Infect Dis. 2004; 57(2):60-2.
6. James AK, Laurie J, Clyde T.Trends in Antimicrobial Resistance among Urinary Tract Infection Isolates of Escherichia coli from Female Outpatients in the United States. Antimicrob Agents Chemother. 2002; 46(8):2540-2545.
7. Kramer A, Schwebke I, Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. BMC Infect. 2006; 6:130.
8. Lajonchere JP, Feuilhade de Chauvin M. [Contamination by aspergillosis: evaluation of preventive measures and monitoring of the environment]. Pathol Biol (Paris). 1994; 42(7):718-29.
9. Mazzali M, Jefferson JA, Ni Z, Vaziri ND, Johnson RJ. Microvascular and tubulointerstitial injury associated with chronic hypoxiainduced hypertension Kidney Int. 1997; 63(6):2088-93.
10. Medina M, Martinez Gallego G, Sillero Arenas M, Delgado Rodriguez M. [Risk factors and length of stay attributable to hospital infections of the urinary tract in general surgery patients]. EnfermInfecc Microbiol Clin. 1997; 15(6):310-4.
11. Shigemura K, Tanaka K, Adachi M. Chronological change of antibiotic use and antibiotic resistance in *Escherichia coli* causing urinary tract infections. J Infect Chemother, 2011.
12. Tullu MS. Urinary catheter related nosocomial infections inpaediatric intensive care unit, Indian Journal of Medical Microbiology. 1998; 44:35-39.
13. Clinical and Laboratory Standards Institute. M100-S17. Performance standards for antimicrobial susceptibility testing; 16th informational supplement. Clinical and Laboratory Standards Institute, Wayne, PA, 2007.