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PREVALENCE OF URINARY TRACT INFECTION AND ANTIBIOTIC RESISTANCE PATTERN IN SAUDI ARABIA POPULATION

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Abstract

Urinary tract infections (UTIs) cause a significant amount of morbidity and mortality. Enterobacteriaceae are the most common pathogens that causes UTIs, of these, *E. coli* is the most common organism. Organism responsible for the hospital acquired infection may have tendency to develop multiple drug resistance.

The antibiotic resistance is a global problem and requires taking measures to combat this growing problem. One example is by quantifying prevalence of resistant pathogens. The aim of this study was to evaluate the prevalence of urinary tract infection (UTI), antibiotic resistance pattern in Saudi Arabia population with regards to the data available worldwide and explore the reasons for antibiotic resistance in the region briefly.

Key words: Urinary Tract Infection (UTI); Enterobacteriaceae; *E. coli*; Antibiotic Resistance.

1. Introduction

Urinary tract infections (UTIs) are one of the most common bacterial infections encountered in many parts of the world. UTIs are often associated with significant morbidity and mortality (Ramesh *et al*., 2008). It is estimated that 150 million cases of UTI occur on a global basis per year resulting in more than 4 billion pounds (6 billion dollars) in direct health care expenditure (Harding and Ronald, 1994). UTI is described as a bacteriuria with urinary symptoms (Zelikovic *et al*., 1992). Bacterial infections of the urinary tract have been reported in hospital and community situations (Raz, 1993; Adjei, 1993). In the community the prevalence has been reported in all age groups and in both sexes. Young, otherwise healthy, women are commonly affected with an estimated incidence of 0.5-0.7 infections per year (Hooton *et al*., 1996). Of the women affected 25%–30% will go on to develop recurrent infections not related to any functional or anatomical urinary tract abnormality. Although uncomplicated infections do not result in long term sequelae, for example renal scarring, they cause significant morbidity, particularly when recurrent.

2. Causative Organisms of UTI

UTI has become the most common hospital-acquired infection, accounting for as many as 35% of nosocomial infections, and it's the second most common cause of bacteremia in hospitalized patients (Weinstein *et al*., 1997). UTI may involve only the lower urinary tract or may involve both the upper and lower tract. *Escherichia coli* are the most prevalent causative organism of UTI and are solely responsible for more than 80% of these infections. The other bacteria which are also responsible for urinary tract infections are *Proteus, Klebsiella, Pseudomonas, Enterococcus* and *Staphylococcus* Sps. There are usually no germs (bacteria) in normal urine. However, sometimes bacteria from outside or inside the body can get into the urinary system and cause inflammation and infection. Any part of the urinary tract may be infected: Pyelonephritis (infection of the kidneys) is potentially more serious (Nicolle, 2008). Cystitis, often referred to as a bladder infection, is the most common type of UTI. UTI are generally easily and effectively treated with a short course of antibiotics (Hooton *et al*., 1996). Females are more susceptible to UTIs than males, although the prevalence in elderly men and women is similar (Harrington and Hooton, 2000). Females have a shorter and wider urethra. The anatomical relationship of the women's urethra and vagina makes it liable to trauma during sexual intercourse as well as bacteria been massaged up the urethra into the bladders during pregnancy / child birth (Arthur *et al*., 1975; Duerden *et al*., 1990).

UTI are more common among females who are sexually active. Some form of birth control increases the risk of UTIs. Kidney problems and some chronic illness, especially those that weaken the immune system may increase the risk of developing UTIs, such as diabetes. Long-term catheter use - patients with a urinary catheter have a higher risk of UTI (if used for a long time). The Infectious Diseases Society of America recommends using catheters for the shortest time possible to reduce the risk of a UTI. According to the National Health Service (NHS), UK, 1 in every 3 women will have a UTI before she is 24 years old, and about half of all females will have at least one UTI during their lifetime. Approximately 1 in every 2,000 otherwise healthy men develops UTI every year ("Urinary tract infection", University of Maryland Medical Center).

The urinary tract has several systems to prevent infection (Amdekar *et al*., 2011). Most commonly, a urinary tract infection occurs when gastrointestinal bacteria (bacteria in the gut) enter through the urethra and start multiplying in the bladder. Our defense system is designed to keep such germs out, but sometimes they fail, and bacteremia may take hold and multiply into an infection. People with diabetes or problems with the body's natural defense system are more likely to get UTI (Lane and Takhar, 2011).

There have been important advances in defining the bacterial virulence factors that increase bacterial infectivity. Other investigators have studied factors that lead to host susceptibility. However, it is the complex interaction between these bacterial virulence factors and the host response that determines the outcome of bacterial exposure. Advances in

cellular and molecular biology have improved our understanding of the bacteria-host association; nevertheless, it remains incompletely understood (Kucheria *et al*., 2005).

Uropathogenic *Escherichia coli* (UPEC) is the causative agent in 70%-95% of community acquired UTI and 50% of all cases of nosocomial infection (Kucheria *et al*., 2005).

3. Risk Factors and Causes for UTIs

Anything that reduces bladder emptying or irritates the urinary tract can cause UTIs. There are many factors which can put someone at risk. Some of them are summarized here:

3.1 Obstructions

Blockages that make it difficult to empty the bladder can cause a UTI. Obstructions can be caused by an enlarged prostate, kidney stones, and certain forms of cancer.

3.2 Gender

Women are more likely to get UTIs. This is because their urethras are shorter. UTIs in men are less common and more serious.

3.3 Sexual Activity

Pressure on the urinary tract during sex can move bacteria from the colon into the bladder. Most women have bacteria in their urine after intercourse. However, the body usually can get rid of these pathogens within 24 hours. Bowel bacteria may have properties that allow them to stick to the bladder.

3.4 Bathroom Hygiene

Wiping from back to front after going to the bathroom can lead to a UTI. This motion drags bacteria from the rectal area towards the urethra.

3.5 Spermicides

Spermicides can increase UTI risk. They may cause skin irritation in some women. This increases the risk of bacteria entering into the bladder.

3.6 Condoms

Latex condoms can cause increased friction during intercourse. They may also irritate the skin. This may increase the risk of UTI in some individuals. However, condoms are important for reducing the spread of sexually transmitted infections.

3.7 Diaphragms

Diaphragms may put pressure on the urethra. This can decrease bladder emptying. Some studies have seen a higher UTI risk in women who use diaphragms.

3.8 Diabetes

Diabetes may make patients more susceptible to UTI.

3.9 Loss of Estrogen

After menopause, a loss of estrogen changes the normal bacteria in the vagina. This can increase the risk of UTI.

3.10 Prolonged Use of Bladder Catheters

Catheters are used when someone cannot urinate normally. These thin, flexible tubes are inserted into the bladder. They allow urine to drain into a container. Long-term catheter use can increase the risk of UTI. They may make it easier for bacteria to get into the bladder. Treatment for a catheter-associated UTI may require removal of the device.

4. Treatment of UTI

UTIs are often treated with different broad-spectrum antibiotics when one with a narrow spectrum of activity may be appropriate because of concerns about infection with resistant organisms. Fluoroquinolone are preferred as initial agents for empiric therapy of UTI in area where resistance is likely to be of concern (Schaeffer, 2002; Biswas *et al*., 2006). This is because they have high bacteriological and clinical cure rates, as well as low rates of resistance, among most common uropathogens (Goldstein, 2000; Gupta *et al*., 2002; Tankhiwale *et al*., 2004). The extensive uses of antimicrobial agents have invariably resulted in the development of antibiotic resistance, which, in recent years, has become a major problem worldwide (Kumar *et al*., 2006).

The etiology of UTI and the antibiotic resistance of uropathogenes have been changing over the past years, both in community and nosocomial infection (Manges *et al*., 2006; Kahan *et al*., 2006).

5. Antibiotic Resistance

Antibiotics are invariably used for the treatment of UTIs, though resistance to antibiotics has been reported all over the world, particularly in developing countries (Lamikanra and Okeke, 1997). Treatment of UTIs is a challenge due to the increasing level of antimicrobial resistance (Belet *et al*., 2004). There is an increased emergence of antimicrobial resistance in the uropathogens, probably due to the empirical administration of anti-bacterial therapy, even before the availability of the urine culture results, is a matter of concern worldwide (Oladeinde *et al*., 2011). The prevalence of

antimicrobial resistance in patients with UTI is increasing and can vary according to geographical and regional location (Karlowsky *et al*., 2002).

Furthermore, many factors play a role in the emergence of resistance such as from poor utilization of antimicrobial agents, transmission of resistant bacteria from patient to patient and from Health-care workers (HCWs) to patients and vice versa, lack of guidelines for appropriate and judicious use of antimicrobial agents and lack of easy-to-use auditing tools for restriction. In addition, there is clear misuse of antimicrobial agents in the animal industry, and most agents are the same agents used in humans. Further, there are few antimicrobial agents in the pipeline of production, leaving clinicians with minimal tools to combat these infections. All these factors, together, have led to the inevitable emergence and rise of resistance (Aly and Balkhy, 2012).

Bacteria develop antimicrobial resistance through many mechanisms including mutations in penicillin binding proteins, efflux mechanisms, alterations in outer membrane proteins and the production of hydrolyzing enzymes such as extended spectrum β lactamase (ESBL) and carbapenemases (Paterson and Bonomo, 2005). These resistance mechanisms may be encoded on transferable genes which facilitate the spread between bacteria of the same species and between different species. Other resistance mechanisms may be due to alterations in the chromosomal DNA which enables the bacteria to withstand the harsh environment and multiply.

Many, if not most, of the Gulf Corporation Council (GCC) countries do not have clear guidelines for antimicrobial use and lack policies for restricting and auditing antimicrobial prescriptions. There are no guidelines for the use of antimicrobials in the animal industries either. Thus, it is not surprising that antimicrobial resistance has emerged in these countries (Memish *et al*., 2007). There are few reports studying prevalence rates of resistance among the different pathogens and mechanisms of resistance at the national level.

For treatment of UTIs and prevention of antimicrobial resistance, knowledge of the common organisms responsible for UTIs and their antibiotic susceptibility patterns in specific geographical locations will help physicians in choosing an appropriate empirical treatment. Much data are not available on the prevalence of UTI and antibiogram due to *E. coli*. UTI is a serious health problem affecting millions of people each year. The prevalence of asymptomatic bacteriuria reported in Saudi Arabia was 5.3% (Omar and ElHaj, 1992). The most common organisms causing UTI are *E. coli* while *Proteus*, *Klebsiella*, *Streptococcus* and *Staphylococcus epidermis* also commonly the causative agents (Bonadio *et al*., 2006). The predominant organisms associated with UTI in Saudi Arabia are Gram negative bacteria which are highly resistant to commonly used oral agents (Al-Harthi and Al-Fifi, 2008).

In recent years, bacterial resistance to different antibiotics has raised dramatically leaving physicians with few therapeutic options. Methicillin resistant *Staphylococcus aureus* (MRSA), extended-spectrum β-lactamase (ESBL) producing organisms and vancomycin resistant *enterococci* (VRE) have become common hospital problems. Since these rates of resistance to antibiotics differ from region to region, in making an appropriate choice of empiric or definitive therapy for UTI, it is useful to avail of information on prevailing levels of antimicrobial resistance among common urinary pathogens (Alzohairy and Khadri, 2011).

An accurate and prompt diagnosis of UTI is important in shortening the disease course and for preventing the ascent of the infection to the upper urinary tract and renal failure. Treatment of UTI cases is often started empirically. Therapy is based on information determined from the antimicrobial resistance pattern of the urinary pathogens. However, because of the evolving and continuing antibiotic resistance phenomenon, regular monitoring of resistance patterns is necessary to improve guidelines for empirical antibiotic therapy (Alzohairy and Khadri, 2011).

6. Bacterial Persistence

The pathogens causing urinary tract infections (UTI) are well known. *Escherichia coli* was the main etiologic agent in community as well as hospital acquired infections. *Escherichia coli* was the predominant pathogen in both the community-acquired urinary tract infection and hospital-acquired urinary tract infection (Alzohairy and Khadri, 2011). *Klebsiella* Sps was the second common organism in hospital acquired infection followed by *Pseudomonas* species. Analysis of the frequency of bacterial isolates according to the age of the patients revealed that *Escherichia coli* and *Klebsiella* infections are more prevalent in the age groups (>20-49 years) and *Pseudomonas* infections are more prevalent in children and the elderly (<20 years and >50 years) and *Salmonella typhi* were isolated from elderly (>60 years age) patient from community-acquired infection (Alzohairy and Khadri, 2011).

It has been reported from Saudi Arabia that among the causative organisms of UTI, Enterobacteriaceae are the predominant pathogens, followed by Gram-positive cocci. *Escherichia coli* predominated across the two groups (community-acquired =48.1%, and hospital-acquired =43.2%) followed by *Klebsiella* species (community-acquired =19.2%, and hospital-acquired =20.8%), *Enterococcus faecalis* (community-acquired =10.8%, hospital-acquired =19.4%), *Pseudomonas aeruginosa* (community-acquired =7.2%, hospital-acquired =8.9%), *Proteus mirabilis* (community-acquired =3.6%, and hospital-acquired 4.4%) and *Staphylococcus aureus* (community-acquired =3.6%, hospital-acquired =1.4%). These findings are consistent with reports published from other countries (Vromen *et al*., 1999; Dromigny *et al*., 2002; Kahlmeter, 2003). The least value was obtained for *Salmonella typhi* (community-acquired =2.4%, and hospital-acquired =0.0%) (Alzohairy and Khadri, 2011).

7. Clinical Aspects

It is believed that 10%-20% of women with UTI have recurrent episodes. The risk factors include both genetic and behavioral factors. Women with recurrent infection have an increased occurrence of recurrent UTI in their first degree female relatives (Fenell *et al*., 1977). The commonest behavioral factor associated with recurrent UTI is use of spermicides as a contraceptive measure.

The European urology guidelines recommend managing recurrent UTI using antibiotics in two different regimens. The first is long term low dose prophylaxis and the other is self-start treatment. The second regimen has been used effectively as post-coital prophylaxis for women who suffer from intercourse associated recurrent UTI. Although there

are numerous antibiotics used worldwide the common ones include co-trimoxazole, nitrofurantoin, ciprofloxacin, and cephalosporins.

In recent years, data were expressed as number (n) and percentage (%) shown in the tables; Table 1 - Records of the total numbers of clinical isolates were grouped based on their country and species according to their gram staining classification; Table 2 - Data were represented as total number of isolates (n) and their percentage (%) (Aly and Balkhy, 2012).

Table 1: The data of selected clinical isolates reported by GCC countries (Adapted from Aly and Balkhy, 2012).

Country	Population	Population %	Reports (n)	Reports%	Isolates (n)	Isolates%
Bahrain	1,106,509	2.9%	3	9.1%	2841	7.6%
Kuwait	2,583,020	6.7%	9	27.3%	20339	54.5%
Oman	3,173,917	8.2%	3	9.1%	882	2.4%
Qatar	1,608,903	4.2%	2	6.1%	570	1.5%
Saudi Arabia	25,373,512	65.7%	14	42.4%	12174	32.6%
UAE	4,765,000	12.3%	2	6.1%	491	1.3%
GCC total	38,610,861	100.0%	33	100.0%	37295	100.0%

n=33 articles

GCC = Gulf Corporation Council; UAE = United Arab Emirates.

Table 2: The prevalence of resistant pathogens in clinical isolates from GCC countries (Adapted from Aly and Balkhy, 2012).

Country	Gram Negative				Gram Positive			
	Acinetobacter	*Escherichia coli*	*Klebsiella pneumoniae*	*Pseudomonas aeruginosa*	*Clostridium difficile*	Enterococcus	MRSA	*Streptococcus pneumonia*
Bahrain	N.R	14.0%	13.9%	N.R	N.R	76.5%	8.5%	N.R
Kuwait	16.7%	77.0%	36.2%	2.6%	70.0%	N.R	3.3%	66.3%
Oman	N.R	N.R	0.1%	0.3%	0.0%	N.R	58.3%	N.R
Qatar	N.R	1.1%	0.8%	0.6%	N.R	N.R	N.R	N.R
Saudi Arabia	83.3%	7.6%	48.3%	92.3%	30.0%	23.5%	29.9%	30.7%
UAE	N.R	0.3%	0.7%	4.2%	N.R	N.R	N.R	3.0%

GCC = Gulf Corporation Council; N.R = not reported; MRSA = methicillin resistant *Staphylococcus aureus*; UAE = United Arab Emirates.

Most recently, it is reported that the prevalence of UTI is more in diabetic females and diabetics with BMI above 30 kg/m (2). The other risk factors associated with UTI in general diabetic population were found to be microalbuminuria, hypertension and insulin therapy (Al-Rubeaan *et al*., 2013).

8. Important Findings on Review

Urinary tract infection (UTI) remains a worldwide therapeutic problem, not only as a nosocomial disease but also as a community-acquired infection (Bacheller and Bernstein, 1997; Hoberman and Wald, 1997; Orrett, 1999; Gupta *et al*., 2001). Early diagnosis and prompt antimicrobial treatment are required to minimize these complications (CQISUTI-1999). *E. coli* are the commonest cause of UTI with both community and nosocomial settings followed by *Klebsiella* species, *Enterobacter* species and *Pseudomonas* species respectively. These findings are similar to studies from the national survey of nosocomial UTI in the United States. *E. coli*, *Pseudomonas* and *Klebsiella* species lie among the top 5 pathogens (Shariti *et al*., 1996).

E. coli and *Klebsiella* infections are more prevalent in the age groups (>20-49 years) and *Pseudomonas* infections are more prevalent in children and the elderly (<20 years and >50 years). The frequency of UTI is greater in women as compared to men (Schaeffer *et al*., 2001). This might be owing to anatomic and physical factors (Kumar *et al*., 2006; Khan and Musharraf, 2004).

E. coli and *Klebsiella* Sps, were found to be resistant to ampicillin (75.4% and 90% respectively) while for ampicillin, *Klebsiella* Sps was more resistant than *E. coli* in this region. These results showed slightly higher resistance rate when compared to other studies done worldwide like in USA (39.1% and 8.6 % respectively) (Vromen *et al*., 1999) and Europe (29.8% and 14.1% respectively) (Kahlmeter, 2003). On the other hand, the rate of resistance against these antibiotics in countries like Senegal (77% and 55%), Spain, (65% and 33%), Taiwan (80% and 56%), and Israel (66% and 26%) is comparable with results found in Saudi Arabia (Dromigny *et al*., 2002; Daza *et al*., 2001; Lau *et al*., 2004).
It has been seen in a study that *E. coli* isolates are susceptible to (78%) nitrofurantoin. However, *Klebsiella* Sps (25%) and *Proteus mirabilis* (19%) are less susceptible to nitrofurantoin; similar findings were reported in several other

countries (Al-Sweih *et al*., 2005; Zhanel *et al*., 2000; Farrell *et al*., 2003). Whereas, this drug exhibited low resistance rate in the major part of the world (0-5.4%), despite of it's being used for many years (Honderlick *et al*., 2006). In another study, the overall imipenem resistance was 8% for *Klebsiella pneumoniae*, whereas, other isolates of uropathogens were found to be highly sensitive to imipenem (100%). So these results are comparable with other reports (Akram *et al*., 2007). It is highly stable against β-lactamase and has an unusual property of causing a post antibiotic effect on gram-negative bacteria (Neu, 1992), whereas Nitrofurantoin, Flouroquinolones, and Aminoglycoside showed sensitivity of 70-90% in both groups of UTI.

The total mean antibiotic susceptibility pattern i.e., Imipinem (98.8%), amikacin (53.2%), gentamicin (52.3%), ciprofloxacin (50.7%), co-trimoxazole (79%), and tetracycline (50.2%), was found to be high when compared to ampicillin (34.2%), norfloxacin (40.4%), nitrofurantoin (44.5%) and oxicillin (50%). Similar reports were published in different parts of the world. Resistance prevalence is relatively lower in the more developed countries such as in North America and Europe (3 to 19%) than in developing countries such as Chile (44%), Thailand (40%), Ethiopia (55%), India (45%) and Saudi Arabia (60%) (Murray and Hodel-Christian, 1991; Mouton *et al*., 1990; Dornbusch, 1990; Aseffa and Yohannes, 1996).

In a recent study, *Enterococcus faecalis* (55.5%) was found to be the most common Multi Drug Resistance (MDR) uropathogens followed by *E. coli (*53.6%) and *Pseudomonas aeruginosa* (58.3%). MDR was defined as resistance to 3 or >3 classes of the antimicrobials (≥3drugs). Similar data is presented in other reports. On the basis of reports by antimicrobial surveillance program, isolates from Canada, USA and Latin American countries show the lowest susceptibility rates to most antimicrobial agents followed by Asian-pacific isolates and European strains (Kahlmeter, 2003; Akram *et al*., 2007; Mathai *et al*., 2001; Kiffer *et al*., 2007).

In a study, the most active antibiotic against all gram negative isolates were Imipenem, amikacin, gentamicin and ciprofloxacin. In contrast to other isolates high resistance was found against ampicillin, norfloxacinn, nitrofurantoin, and co-trimoxazole. Although the prevalence of pathogens in different parts of the world is somewhat similar, antimicrobial resistance patterns reported from different regions are significantly different and antimicrobial resistance increases.

Interestingly, the overall prevalence of UTI among pregnant women was (20%), which is relatively higher than what was recorded earlier (14.2%) in Saudi Arabia (Al-Sibai *et al*., 1989) despite of the medical advancement and improved health care over the past years. Moreover, lower rates (4.8% and 6.1%) were recorded in neighbor countries as UAE and Iran, respectively (Abdullah and Al-Moslih, 2005; Hazhir, 2007). The high rate reported in the recent study could be attributed to the type of the studied population whose ages lie within the most sexually active period of their lives (age mean 29.7 ± 6.5 SD) (Murry *et al*., 1998).

9. Conclusion and Future Perspectives

Urinary tract infection (UTI) remains a worldwide therapeutic problem, not only as a nosocomial disease but also as a community-acquired infection. Antibiotic resistance of urinary tract pathogens has increased worldwide.

Knowledge on local prevalence and antimicrobial resistance trends among urinary isolates is important in guiding clinicians appropriate for appropriate empirical treatment of UTI. *E. coli* is the most prevalent pathogen contributing to this infection, but resistance is seen nearly 70-80% of the strains to the commonly used antibiotics (Kapil, 2005). In the most recent study, *E. coli* accounted for 62.21% of all the positive cases. This is in accordance with the recent studies where the predominant organism isolated was *E. coli* (Mandal *et al*., 2012). Highest resistance was seen with Ampicillin (85.1%), followed by Piperacillin (66.03%) and least resistance to Nalidixic acid (5.6%) and Nitrofurantoin (5.6%) (Nivas *et al*., 2014). This is in accordance with other studies where a high percentage of *E. coli* isolates were resistant to Ampicillin and Ofloxacin (Manjunath *et al*., 2011; Gupta *et al*., 2007). Fluoroquinolones are considered highly effective in treatment of UTI because of concentrating ability in urine and high renal clearance (Piddock and Wise, 1989).

However due to wide spread use of Fluoroquinolones, there has been a report of evolving bacterial resistance to Fluoroquinolones (Al- Tawfiq, 2006). *E. coli* showed varied resistance among Aminoglycosides (56% to Gentamicin and 21.9% to Amikacin), this finding differs from the other study where resistance to Gentamicin and Amikacin was high (Mohanty *et al*., 2003), but another study showed 40% resistance to Gentamicin, 9% resistance to Amikacin (Gupta *et al*., 2002), 55.5% resistance to Trimethoprim Sulfate, 52.7% resistance to Augmentin and resistance to Cephalothin were 27.7%. The findings are similar with the other studies (Akram *et al*., 2007; Anuradha *et al*., 2007).

Tazobactam in combination with piperacillin has an excellent clinical efficacy in various infections (Niki, 2001). Tazobactam seems to be the most promising beta lactamase inhibitor, which has unlike clavulanic acid and sulbactam, its own antibiotic activity (Blahova *et al*., 1995). Resistance to Nitrofurantoin was 31.5%. In some studies Nitrofurantoin was found to be the most effective drug for UTI (Sahm *et al*., 2001; Biradar *et al*., 2013). Antimicrobial resistance pattern varies with time which might increase or decrease (Dyer *et al*., 1998). Antibiotic susceptibility studies will help in early detection of development of antibiotic resistance and preserve powerful antibiotics like Imipenem for the treatment of life threatening infections.

E. coli were the predominant pathogen in both the groups. *Klebsiella* Sps *was* the second common organism in hospital acquired infection followed by *Pseudomonas* Sps. The mean susceptibility was high for Imipenem, Amikacin, Gentamicin and Ciprofloxacin but low for Ampicillin, Norfloxacin, Nitrofurantoin, and Co-trimoxazole (46.7%). Therefore, regular monitoring is required to establish reliable information about resistance pattern of urinary pathogens for optimal empirical therapy of patients with UTI.

Infectious Diseases Society of America (IDSA) recently recommended that each hospital should determine the local establish mechanisms to resistance rates among uropathogens and that the standard antimicrobial regimens for empirical treatment of UTIs should be reassessed periodically in light of changing susceptibility pattern. Finally, we suggest that empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organism and sensitivities rather than on universal guidelines.

Current knowledge of the antibiotic resistance patterns of uropathogens in specific geographical locations is an important factor for choosing an appropriate empirical antimicrobial treatment rather than on universal guidelines.

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