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Antibiotic Resistivity of microorganisms associated with Urinary Tract Infection (UTI)

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ABSTRACT

UTI is found during the medical practise at present times which occur from the age group of neonate to geriatric. UTI can be symptomatic and without any symptoms and can lead to serious situations if left untreated. In the whole world each year approximately 150 million people are diagnosed with UTI.Various microorganisms such as fungi and viruses cause UTI, but bacteria are the main cause, accounting for more than 95% of infectious diseases. Among Gram-negative pathogens, E. coli is generally a UTI (up to 85%) causing microorganism, causing it frequently.This is followed by the Gram-positive bacteria (up to 10%), Staphylococcus saprophyticus. Women who have UTI their quality of life is affected and they can face some serious consequences like developing renal damage. This is leading to pay attention to women's reproductive health needs, and education related to health for safe use of family planning techniques.Different types of antibiotics are available for UTIs and which type should be used it is depend on the type of infection whether it is severe or primary. UTI treatment includes the antibiotics such as amoxicillin, cephalosporin, tetracycline, nitrofurantoin but mostly fluoroquinolones are used. Among the uropathogens antibiotic resistance is being increased; due to which there should be a local hospital build having full knowledge of the microorganisms due to which UTI is caused and also about their antibiotic resistivity.

Keywords: -*Urinary tract infection, Escherichia coli, Antibiotic resistance, Uropathogens, Fluoroquinolone*

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INTRODUCTION

Urinary tract infections (UTIs) are classified among the most common diseases causing infection because of which approximately 10% of population are infected in their whole life.After upper respiratory tract infection UTIs are considered as most common infections [1]. UTI is found during the medical practise at present times which occur from the age group of neonate to geriatric. UTIs are found frequently in women than in males which could be owing to anatomical predisposition or urothelial mucosa adhesion to the mucopolysaccharide lining or other host variables [2]. UTIs in childhood are common with a rate of 30%. In girls it can occur at 3-5% and in boys it can occur at 1-2% or sometimes more than that.In developing countries UTI is commonly encountered disease which occurs at an estimated incidence of at least 250 million [3, 4].

The dependency of clinical manifestations is on part of the urinary tract which is infected, type of organism, rigidity of infection, and ability developed by patient's immune response [5].Cause of most UTIs are bacteria of retrograde ascent from the faecal flora through the pathway of urethra to the kidney and bladder most importantly within females having short and wide urethra and can easily get transferred by uropathgens. Urethra and vagina structures' makes it prone to trauma at the time of sexual activity though the bacteria have been responsible for taking urethra and inside the bladder at the time of child birth or pregnancy. Majority of UTIs don't seem to be threatening lives and is not responsible for causing any irreversible damage. But, when there is involvement of kidneys, a risk of irreparable tissue damage arises [6].

Among the uropathogens antibiotic resistance is being increased, due to which there should be a local hospital build having full knowledge of the microorganisms due to which UTI is caused and also about their antibiotic resistivity. This information would be useful for the database of the region. Patients with diabetes and neurological abnormalities are frequently seen with the UTI, which interfere with urinary flow. Catheterization and cystoscopy instrumentation is commonly involved in nosocomial UTI [7].When there are uropathogens present inside the tract that can be referred as UTI. There is an estimation which state that symptomatic UTIs occur in 7 million visits at the outpatient clinics, 100,000 hospitalizations annually, and1 million visits to emergency departments [3].

Classification of UTI:-

Bladder infection occurring in lower urinary tract,

Kidney

Bacterial urine

UTI can be symptomatic and without any symptoms and can lead to serious situations if left untreated. [1] [3, 4]

UTIs are considered uncomplicated if their occurrence is seen in a genitourinary tract which is normal.

And considered as complicated if they occur in genitourinary tract, the tract which having structural or functional disabilities and it include indwelling urethral catheters, and appear to be asymptomatic very frequent[3,4].

There are also Acute UTIs which are associated with problems of recurrent infections and substantial morbidity.

According to the studies 25% of women in whom first UTI is appeared, they are likely to get another attack within six months [6]. There is an estimation that women around 20 to 30 percent to their late 30s will experience UTI once in a lifetime. Among all hospital acquired infections 35-40% is constituted by UTIs which occur 2–3 times 100 hospitalizations [8].

Common symptoms of UTI can be:-

Burning with urination

Promotes urination without vaginal discharge or severe pain.These symptoms range from mild to severe and last up to 6 days in healthy women.

Symptoms of upper urinary tract infection include fever, nausea or flank pain, and vomiting which add to the symptoms of a lower urinary tract infection.

Inclusion in the lower urinary tract infection symptoms can be seen of visible pus in the urine or bloody urine [9].

In the whole world each year approximately 150 million people are diagnosed with UTI [5,6]which results in health care expenses costing around 6 billion dollars.There are many factors such as, age, gender, race, genetic factors, nocturnal enuresis, circumcision in boys and sexual activity, on the basis of which the infection can occur at more or less level for any person. Other possible cases of UTIs can be micturition occurring infrequently and in children other than urine and faecal elimination and poor toilet habits, also incomplete emptying of the bladder [10]. Adding to this, women's pregnancy and men's prostate enlargement are also considered some reasons for this infection, however sexually active women are more prone to UTI. UTI are also increased if we take antibiotics in enormous amount, due to which it is responsible for damaging the periurethral flow which allows bacteria's getting colonized and infect the tract [10].

UTIs among pregnant women:-

UTI is a major obstacle during the time of pregnancy. If this pregnancy is accompanied by structural and neurological defects in the urinary tract, this leads to death. During pregnancy, the uterus exerts pressure on the ureter, increasing the incidence of urinary tract infections and stagnation of urine flow.During normal pregnancy, humoral and immunological differences can occur. The hormonal adjustment which occurs at the time of pregnancy leads to some issues like reduced bladder tone, faded peristalsis and renal pelvis and ureter dilations. Women have tendency to develop infections more frequent who use diaphragm and spermicidal foam infused condoms might also additionally purpose the boom of E.coli that mayinput the urethra [11, 12]

Women who have UTI their quality of life is affected and they can face some serious consequences like developing renal damage. This is leading to pay attention to women's reproductive health needs, and education related to health for safe use of family planning techniques [11, 13]

UTI is characterizable in women who are pregnant by[14, 15]:-

- restlessness
- side
- ache

- Sensitivity arising along with bacterial urine.
- preterm birth
- low birth weight

If UTI is not treated in pregnant women it can lead to increase the risk of pyelonephritis, transient renal failure, acute respiratory distress syndrome, sepsis, shock, and haematological abnormalities [14-17]. Pregnant women are generally considered to be UTI hosts for immunodeficiency due to the physiological changes that accompany pregnancy. The changes that occur increase the risk of infection, which can be either symptomatic or asymptomatic [18].

Susceptibility:-

Everyone experiences susceptibility to urinary tract infections, but there are several characteristics that increase exposure to urinary pathogens and increase susceptibility to the development of post-colonization symptoms. Factors that increase exposure to urinary pathogens include:

Presence of underlying conditions that affect the ducts, such as pregnancy, diabetes, and benign prostatic hyperplasia.

Host markers for susceptibility to disease include age, Kind.

The existence of urinary catheters and vaginal intercourse.

Pathogens are transmitted, causing infections in humans and increasing their ability to cause illness, which is explained by the characteristics of the bacterium [19, 20]

Bacteria's involved

Various microorganisms such as fungi and viruses cause UTI, but bacteria are the main cause, accounting for more than 95% of infectious diseases

- Gram negative organisms cause 80-85% of the infection.
- Gram positive organisms cause 15-20% of the infection [21, 22]

Among Gram-negative pathogens, E. coli is generally a UTI (up to 85%) causing microorganism, causing it frequently, and its presence is observed in the gastrointestinal tract and is a tool for initiating UTI and are isolated from 50-90% of all uncomplicated UTIs[1, 8]This is because of the fact that it is the most common urinary tract pathogen involved in the community-acquired UTI. This is because it is the part of normal flora of the human intestine, which easily colonizes the urinary tract. Several E. coli strains isolated from sexually active patients and consistent with faecal isolates from partners indicate that UTI can be sexually transmitted [23].This is followed by the Gram-positive bacteria (up to 10%), Staphylococcus saprophyticus, as well as other Gram-negative bacteria such as Klebsiella pneumoniae, Serratia, Enterobacter, Pseudomonas, and Proteus accounts the other remaining infections [8, 21]. Other Gram-positive bacteria are E. faecalis, S. agalactiae, S. pyogenes, S. aureus, Bacillus subtilis resistant to various antibiotics [21]. Some bacteria's along with their role in causing the infection is mentioned (Table no 1).

Antibiotics used

Different types of antibiotics are available for UTIs and which type should be used it is depend on the type of infection whether it is severe or primary. UTI treatment includes the antibiotics such as amoxicillin, cephalosporin, tetracycline, nitrofurantoin but mostly fluoroquinolones are used. Antibiotics in combination such as fluoroquinolones, ampicillin+gentamicin, imipenem+cilastatin are used as they are effective against wide variety of microorganisms which cause the catheter induced infection [21].

Some antibiotics used for the treatment of UTI are mentioned (Table 2.)

Treatment with antimicrobial agents

The main treatment for UTI is antibiotics. However, increased use of antibiotics increases antibiotic resistance and poses a threat to people with complex and recurrent UTIs [9]Antibiotic drug resistance is increasing due to the abuse and misuse of antibiotics [11].The resistance rates associated with prescription drugs used in UTI treatment vary by region of the world. It is important to study the epidemiology of UTI for effective empirical treatment [3]. For this reason, the goal of most studies is to identify the bacterial pathogens responsible for urinary tract infections.

Indiscriminate use of antibacterial agents results in the emergence of resistant mutants, which puts selective pressure on the bacterial population. Enterobacteriaceae and other non-lactose fermenters that cause UTI result in the production of several enzymes such as extended spectrum beta-lactamase (ESBL), metallobeta-lactamase (MBL), and AmpC-mediated beta-lactamase. Urinary pathogens, in addition to cephalosporins, increase resistance to antibiotics such ascotrimoxazole, quinolones, and nitrofurantoin [24]. In resource-constrained areas such as the Niger Delta region of Nigeria, these drugs are rarely affordable. For this reason, antibiotic resistance increases both mortality and morbidity [25].

Organized healthcare faces major challenges in controlling increased antimicrobial resistance. Important information about bacterial resistance trends by geographic location is provided by surveillance programs that have proven to be valuable tools. Currently, many areas are needed to analyse community-acquired UTIs and related antimicrobial resistance through area studies [26].
When there is a shortage of new medicines, we need to curb resistance before we run out of ways to fight it. In 2014, WHO published a report on global surveillance of antimicrobial resistance. This revealed that there was a large gap in monitoring and a lack of methodologies, data sharing and coordination standards. However, large gaps have been identified in Southeast Asia, Africa and the Eastern Mediterranean region(27).

Table no 1:- UTI causing Bacteria with its role

Bacteria	Role in UTI infection
E.coli	When the colonised E.coli produces the toxins, they may cause an inflammatory response, which is a possible pathway for creating symptoms leading to UTI
Klebsiella pneumonia	This bacteria is found in normal flora of skin, intestine and mouth, and when it travels from these locations to urethra it becomes the cause of UTI
Pseudomonas aeruginosa	This is mainly responsible for causing catheter associated urinary tract infections(CAUTIs), the reason for this is on the surface of indwelling catheters there will be a formation of biofilm
Staphylococcus aureus	There is increase in risk of S.aureus being carried in urine because of the presence of indwelling catheter and urinary tract instrumentation
Bacillus subtilis	It is found in the intestinal tract, it is rare that the bacteria will colonise, but when it colonize it produces toxin subtilisin and cause UTI
Enterococcus faecalis	This bacteria is mainly responsible for causing UTI in the patients admitted in the hospital

Table no 2:- Role of Antibiotics for the treatment of UTI

Antibiotics	Role in treating UTI
Streptomycin	It blocks the ability of 30S ribosomal subunits to make proteins, resulting in the death of bacteria responsible for causing infection
Gentamicin	This antibiotic is used in combination with other antibiotics for treating UTI
Azithromycin	These are mostly used for urinary problems caused by STD
Amoxicillin, Cephalexin	Many bacteria's have developed resistance against these drugs
Fluoroquinolones such as ciprofloxacin	Bacteria's show resistance against these, but these should not be given to pregnant ladies and children
Fosfomycin	It is used for infection in lower urinary tract, but should not be used for more complicated UTI
Nitrofurantoin	It is used occasionally and is used for treatment of cystitis only.

DISCUSSION AND CONCLUSION

It is seen that mostly E.coli is responsible for causing infection which is a gram negative bacteria.Other Gram-negative bacteria such as Klebsiella pneumoniae, Serratia, Enterobacter, Pseudomonas, and Proteus accounts the other remaining infections. Gram positive bacteria's are also responsible for causing infection such as *Staphylococcus saprophyticus, E. faecalis, S. agalactiae, S. pyogenes, S. aureus, Bacillus subtilis*. These bacteria's show resistance to the antibiotics against which antibiotics react and aid in the treatment of infection. But sometimes by this resistance a problem can be created of increasing resistance which can be proved to be harmful.
Antibiotic resistance can create issue but we can solve it by having proper knowledge of the bacteria identified, location at which this is found, region,its hospital at which the resistance is carried out.There should be more efficiency seen of antibiotics against different organisms.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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