STUDY OF PREVALENCE OF URINARY TRACT INFECTIONS IN PATIENTS OF UJJAIN, MADHYA PRADESH (INDIA)

Microbiology

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ABSTRACT

Background: Urinary tract infections (UTI's) define a condition in which urinary tract is infected with a pathogen causing inflammation. Urinary tract infections are one of the most prevalent infections affecting people of all age group from neonates to adults and are major cause of morbidity and several disorders in patients. In serious cases urinary tract infection lead to kidney failure, septicemia, bacterial endocarditis, prostatitis and infertility. **Aim:** The objective of this work was to study the prevalence of urinary tract infections among patients of Ujjain and to identify prominent bacterial pathogens responsible for causing UTI. **Methods:** A total of 500 urine samples were collected aseptically and cultured on Blood agar and Mac'conkey agar. The bacterial isolates were identified based on their colony morphological characteristics, Gram stain reaction and their biochemical tests. **Result:** After overnight incubation a total of 307 out of 500 patients tested positive for UTI suggesting that (61%) of patients suffered from UTI infections. It was seen that (89%) of bacterial isolates causing UTI were Gram negative and (11%) were Gram positive. The identification of pathogens indicated that *E. coli* is most prevalent uropathogen followed by *K. pneumoniae*, *P. aeruginosa*, *E. faecalis*, *S. aureus* and *P. vulgaris*. **Conclusion:** The study shows that prevalence of UTI is higher in females as compared to males. It was also been seen that UTI infections were prevalent in urban as well as in rural patients, however, the incidence of infection was slightly high in urban patients. This study is important as constant survey and identification of uropathogens is essential for effective treatment of UTI.

KEYWORDS

Uropathogens, UTI, Prevalence of UTI, *E. coli* , *K. pneumoniae*

INTRODUCTION

The urinary tract system functions to remove waste products and extra water from human body and it consists of two kidneys, two ureters, a urinary bladder and a urethra.^[1,2] Urinary tract infections occur due to colonization and infection of urinary tract by microorganisms and they are clinically defined by a combination of symptoms and presence of more than 100,000 CFU/ml of bacteria after urine culture. Important symptoms of UTI are dysuria, pain in abdomen and back, fever and micturition. UTIs are one of the most common bacterial infection and account for about 25% of total infections occurring in men and women. They are one of the most prevalent infectious diseases and put substantial clinical and financial burden.^[3] Most of the urinary tract infections are caused by bacteria and most common causal organism of UTI are members of Enterobacteriaceae family.^[2, 4] Urinary tract infection can be community induced or nosocomial.^[5,6] Urinary tract infection can occur in lower urinary tract (urethra and bladder) and can infect the upper urinary tract (kidney and ureter) if it not treated timely. If UTI is not treated timely then it causes serious damage to health and can even cause death.^[2,6] The important bacteria which are responsible for causing UTI include gram negative bacteria like *E. coli*, *Klebsiella*, *Pseudomonas*, *Proteus* etc. Some gram positive bacteria like *S. aureus* and *E. faecalis*. The predisposing factors responsible UTI include sexual contact, urinary catheter and diabetes.^[7] It has been estimated that women are more susceptible to UTIs due to poor hygiene, sexual intercourse, use of contraceptives and easy excess of bladder while males are susceptible to UTIs due to kidney stone and prostate problems. UTI affects people of all age group and sex; however occurrence of UTI is high in females.^[2] UTI is usually treated by broad spectrum antibiotics but their inappropriate and non judicious use has resulted in increase in number of multidrug resistant bacterial pathogens.^[8] In recent years resistance of bacterial cultures to multiple drugs is on the rise and has become major constraint in the treatment of infectious diseases. Studies have also shown that reoccurrence of UTI is a common phenomenon. Drinking plenty of water and cleanliness has been shown to prevent occurrence of UTIs.^[9] Hence, effective treatment of UTI, include antibiotic therapy along with education and awareness of patients.

This study was conducted to determine the prevalence of UTIs in patients of Ujjain City and identify important bacterial pathogens

responsible for causing UTIs. This study will help in efficient treatment of UTI patients and designing awareness programs for reducing occurrence of treatment of UTI in community.

MATERIAL AND METHODS

The objective of our work was to study the prevalence of UTI patients in Ujjain (M.P.) and to determine different types of bacterial pathogens responsible for UTI infections. The present study was done on patients of Ujjain (M.P.) during the period between 2016 to 2018. In this study 500 urine sample of clinically suspected patients was collected and tested. The details regarding patient's age, sex, literacy, socio-economic status, residential area (rural/urban) were recorded along with the sample. Both male and female patients having clinically suspected symptoms of UTI were included in the study. Mid stream, clean catch urine samples from all suspected UTI patients were collected in wide mouth sterile container. These samples were collected aseptically before starting of antibiotic treatment than sample were examined and processed within 24-28 hours.

The urine was examined macroscopically for the color and turbidity and wet mount of urine sample were prepared. The wet mounts were observed microscopically to identify the presence of pus cells, red blood cells, epithelial cells, Mo's, cast, crystals, parasites and yeast. All the findings were recorded.

A modified semi quantitative technique was employed using standard wire loop for culturing the urine sample. A standard bacteriological loopful of urine (0.01ml) was inoculated over the surface of Cystine Lactose Electrolyte Deficient (CLED) agar, MacConkey agar and blood agar plate respectively and the plate were incubated at 37°C aerobically for 24hrs.

After incubation colonies were counted. A bacterial count of 10^5 per ml was considered significant for UTI and counts in between 10^2 - 10^4 per ml were considered as suspected bacteriuria while counts less than 10^2 per ml were considered as nonsignificant bacterial growth.

The growth on the culture media was identified using colony characteristics (shape, size, color, appearance and morphology), gram stain, motility, catalase, coagulase, oxidase, indole methyl red, vogus

prauskar, phenylalanine, urease, TSI and citrate utilization test.^[10]

RESULTS & DISCUSSION

Prevalence of UTI

This study was conducted during 2016 to 2018. Urine samples were collected every month during this two year period. In this study total 500 urine sample were collected out of which 307 samples tested positive for UTI in bacteriological analysis of urine sample. This suggests that 61.4% of patients harbored bacterial uropathogens. The microscopic examination of urine showed that only one patient had infection of yeast cell.

Isolation and identification of uropathogens

The urine samples were plated on Cystine Lactose Electrolyte-Deficient (CLED) medium, MacConkey agar and blood agar and the bacterial colonies were identified by gram staining and biochemical tests. It can be seen that the most frequently present uropathogen was *E. coli* and (46.5%) of UTI patients were infected with this bacteria. *K. pneumoniae* and *P. aeruginosa* were also frequently detected and the result shows that (31.2%) of UTI patients were infected with *K. pneumoniae* and (7.1%) had *P. aeruginosa* infection. *E. faecalis*, *S. aureus* and *P. vulgaris* were detected in less frequency. *E. faecalis* was seen in (6.5%) patients, *S. aureus* in (4.5%) patients and *P. vulgaris* in (3.9%) of patients. These results suggest that *E. coli* is the most common cause of UTI followed by *K. pneumoniae* and *P. aeruginosa*. *E. faecalis*, *S. aureus* and *P. vulgaris*. The study done by Kumari *et al* in 2016 in Kurnool district (Andhra Pradesh) is similar to the study conducted in Ujjain district. The presence of higher percentage of *E. coli* shows that this bacterium has more resistance power due to geographical variations.

Fig.1: Bacterial uropathogens isolated from UTI patients of Ujjain during the study.

Relation of UTI with patient gender and age

The relation of patients with their gender and age was calculated and the results are shown in [Table 1] and [Table 2] respectively. The result [Table 1] shows that majority of UTI patients were female (73.2%) and males have comparatively less UTI infection (26.7%). The result also shows that the number of UTI patients were relatively high in the age group from 6 to 41 years. Some researchers in earlier studies have also shown that percentage of UTI was higher in females^[11,14]. On the other hand some studies show contrary results and in these studies prevalence of UTI was higher in males due to prostate enlargement.^[15] Thus, it appears that the percentage of UTI in males and females can vary depending on the place of study or physiological characters of the patients.

The result [Table 2] also shows that the number of UTI patients were relatively high in the age group from 6 to 41 years. However, UTI was less frequent in patients of age above 40 years. This finding was also consistent with the study done in 2019, where it was found that numbers of UTI patients were higher in age group of 31 to 40 years.^[12] Another study done in tertiary care hospital in 2016 indicated that age group between 21 to 30 years showed highest incidence of UTI.^[11] Similar incidence of UTI according to age was also observed in Tanzania in 2017 where higher occurrence of UTI was seen in age

group between 18 to 29 years.^[16] Thus it appears that incidence of UTI is less in patients above the age of 40 years and below the age of 6 years and it may be more in sexually active population.

Table 1: Prevalence of UTI in different genders

Patients Gender	UTI Patients
Male	26.7
Female	73.2

Table 2: Relation of UTI with Patients age

Age (years)	UTI Patients (%)
6-17	28.01
18-29	28.01
30-41	21.10
42-50	09.70
51-85	51-85

Relation of UTI with literacy, socio-economic status and residential area of patient

The correlation between UTI and the patients literacy, their socio-economic status and residential area was also calculated and result are shown in [Table 3, 4 and 5] respectively. It was surprisingly seen that percentage of UTI patients was slightly higher in patients who were literate and educated (44.9%). On the other hand, higher percentage of UTI patients were found in patient belonging to lower economic status (40.3%) and from urban residential area (58.9%). The percentage of UTI in patients of rural area was (41.4%). These results suggests that besides literacy and economic status awareness regarding UTI is more necessary, so awareness programme should be conducted to make people aware about cleanliness and personal hygiene. Similar study on the basis of patient's literacy level and residential status was done by Almkhtar *et al.*, in Iraq and they found that majority of women patients were illiterate and from rural areas.^[7] Another study carried out on pregnant women residing in both rural and urban area of Tanzania shows that prevalence of UTI was higher in rural area and their percentage was (12.5%).^[17] In slum women of District Varanasi in 2018, it was seen that prevalence of UTI is higher in urban slum area.^[18] Another study done in Berket El Sabae Family Health Center in Menoufia Governorate in 2015 shows result similar to our study. In this study it was seen prevalence of UTI was higher in urban area with (56.4%) but UTI patients were belonging to higher socio-economic status and their percentage of occurrence is (52.8%).^[19] Another study done in Tamilnadu India, observed that UTI mostly occurred in lower middle class and its percentage was (54.8%).^[9]

Table 3: Relation of UTI with patient's literacy level

Education Status	UTI Patients (%)
Illiterate	24.70
Primary	30.20
Secondary and above	44.90

Table 4: Relation of UTI with Patient's Socio-economic status

Socio-economic status	UTI Patient (%)
Annual income below 2.5 Lac	40.30
Annual income between 2.5-5 Lac	31.20
Annual income above 5 Lac	28.30

Table 5: Prevalence of UTI in patients of different area

Area	UTI Patient (%)
Urban	58.90
Rural	41.40

Seasonal variations in number of UTI patients

Relation of UTI with seasonal variation was studied. The urine sample were collected during different seasons, namely summer (March to June), winter (November to February) and rainy (July to October) during the tenure of work and percentage of occurrence of UTI patients was recorded. The results are shown in [Table 6]. It was seen that incidence of UTI was slightly less in rainy season in comparison to winter and summer where incidence of UTI was 37%. These results correlate with the results of earlier studies done in Mumbai in 2018, where high incidence of UTI was seen during summer season.^[20] High incidence of UTI in summer was also recorded during study in Iran and in United States in 2017.^[21,22] On the other hand results of other studies in Iran in 2015 and in Andhra Pradesh in 2017 show that frequency of UTI infection was high during winter season. In our study we found maximum frequency of UTI infection during summer and winter season which was higher than the frequency seen during rainy season.^[23,24]

Table 6: Seasonal variations in number of UTI patients

Season	UTI Patient (%)
Winter	37.10
Summer	37.40
Rainy	25.40

CONCLUSION

Urinary tract infections pose a major health problem for human society worldwide. The results of present study reveal that UTI occurs in all age groups and both gender but prevalence was higher in females with 73.2% and most common causative agent of UTI was *E. coli* followed by *K. pneumoniae*, *P. aeruginosa*, *E. faecalis*, *S. aureus* and *P. vulgaris*. The frequency of UTI was higher in summer and winter season. It was also observed that maximum UTI patients belong to age group from 6-41 year, they were literate mainly from urban areas and their socio-economic status is low. It thus appears that knowledge related to awareness, prevention and control of UTI is insufficient among patients of Ujjain. So health awareness programme for general public should be conducted and they should advise to drink plenty of water and maintain personal hygiene to avoid risk of UTI.

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