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Investigation of Bacterial Pathogens Responsible for Urinary Tract Infection in Human Subjects

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A Urinary Tract Infection (UTI) is a bacterial infection that affects any part of the urinary tract. It is second most common type of infection in the body and serious health problem affecting millions of people each year. Women are especially prone to UTI's than men. According to epidemiological data, 35-45% of all acquired infections occur in the urinary tract and 80% are associated with bladder. Individual susceptibility to infection is shown by an abnormal colonization of microorganisms at periurethral region. Uroepithelial cells have greater ability to bind infectious microbes by surface adherence. We evaluated totally 1105 cases with symptoms and sign of UTI were enrolled for the study. We analyzed a database comprising 1105 patients. A mid-stream urine samples were collected from symptomatic out-patients and in-patients from different age groups (less than 15 years, 15-40 years, above 40 years) of both sex. The percentage of urine sample showing significant bacteriuria and to find out: different bacterial flora associated with UTI; most predominant and common bacterial flora associated with UTI was found out. In our study among the total patients only 357 cases were culture positive. The organisms responsible to cause UTI was *E.coli* (80%), other organism were *Staph aureus* (7%), *Klebsiella* (4%), *Enterococci* (3%), *Pseudomonas aeruginosa* (3%), *Enterobacter* (2%) and *Proteus vulgaris* (1%). The investigation also showed that most predominant organism isolated was *E.coli*. The highest rate of UTI cases were females compared to males.

Key words: Bacteriuria, cystitis, urinary tract infection, uropathogenic bacterium

INTRODUCTION

UTI is one of the most common infections especially for young, sexually active women. Approximately 50% of adult women report that they had UTI at some time during their life (Flower, 1986; Foxman and Frerichs, 1985).

The outcomes of different assessment propose that the *E.coli* is accountable for the large percentage of UTI (53.24%). The proportion of infection in married male was 10%, whereas in single unmarried was 9%, compared with a proportion of 55% in married female and 26% in unmarried female (Khleifat *et al.*, 2006).

Klebsiella pneumoniae is a rare cause of UTI in patients with long term catheterization, bacteremia, nosocomial and wound infections (Bint-e-Masood *et al.*, 2002).

The main agents to cause of nosocomial UTI are *Staphylococci* and *E. coli*. The infection can be controlled by both intake of antibiotics and maintain sanitation (Ghadiri *et al.*, 2012).

While UTI can range from infection of the bladder (cystitis) to more serious infection of the kidney (pyelonephritis). Most patients with UTI have an uncomplicated cystitis, which is readily treated with a short course of antibiotics. However, bacteria present in a urine sample in a patient without symptoms, known as asymptomatic bacteriuria, is also common, especially in elderly men and women. This finding should not automatically result in a prescription for antibiotics, except in selected circumstances, such as in pregnant women (Hooton *et al.*, 1996).

Bacteria do not normally live in the urinary tract, which includes the kidneys, bladder and proximal urethra. When bacteria enter from urethra also reaches upper urinary tract and begins to multiply, it is known as ascending infection. When compared with male, UTI occur frequently in female. This is believed to be due mainly to the proximity of the urethral opening to the anus and the shorter length of the urethra before it opens into the bladder in women. The vast majority of UTI's are recent procedure involving the urinary tract, anatomic abnormality of the urinary tract and neurogenic bladder, pregnancy, diabetes, male gender, age 65 years or any blockage of the urinary tract. Diabetic patients are in high risk of UTI, due to the changes occur in the humoral immunity, also disorders involved in the suppression of immunity increases the risk of UTI (Foxman, 1990).

Men who engage in incentive anal intercourse are more likely to become infected, as are men who are uncircumcised or who have had vaginal intercourse with an infected partner. Men, women and children with certain

other health problems may also be prone to UTI. Febrile UTI's are considered the most common serious bacterial infections that occur in infancy and early childhood in the developed nations. The clinical management of UTI is complicated by the increasing incidence of infections caused by strains of *E.coli* that are resistant to commonly used antimicrobial agents. In recent studies in the United States, the rate of resistance to trimethoprim-sulfamethoxazole among *E. coli* isolates from women with UTI's ranged from 15-18% (Montini *et al.*, 2008).

In general problematic UTI arise in a patient having unusual urinary tract or that are caused by pathogen resistant to antibiotics:

- An estimated 50-80% of women develop UTI sometimes during their lifetime
- From 20-50% of women will have recurrent UTI's
- By age 70, 10% of women have a chronic UTI

UTIs are rare in men less than 50 years old. Recent studies, however suggest that the uropathogenic strains of *E. coli* belong to a small number of O:K:H serotypic groups, usually produce both hemolysin and aerobactin and associated pili that mediate their attachment to uroepithelial cells; that cause pyelonephritis in young women; can also cause uncomplicated infection (usually cystitis) in young men. Clinically, these infections often with symptoms of cystitis, but in some patients they mimic urethritis, causing urethral discharge and urethral leukocytosis. Men with Human Immunodeficiency Virus infection (HIV) who have CD4 lymphocyte counts of less 200 per cubic millimeter may also be at increased risk for urinary infection, presumably because of immunosuppression (Hooton *et al.*, 1996).

Promising organisms to cause UTI are *E. coli*, *Streptococcus*, *Staphylococcus*, *Klebsiella*, *Pseudomonas aeruginosa*, species of *Proteus* and *Salmonella* and *Enterococci* (Ghanghro and Laghari, 2010).

Prevention of detrimental effects of UTI is by early detection and treatment. Symptoms generally resolve one to three days after starting treatment with antibiotics but it is important to complete the full course of antibiotics prescribed, so that the infection does not recur (Levinson and Jawetz, 1996).

This study was carried out to examine: significant bacteriuria from urine samples of symptomatic patients; ratio of UTI in male and female; single isolate and mixed culture ratio for both sexes; percentage of causative organisms from single isolates of UTI and predominant organism responsible for UTI.

MATERIALS AND METHODS

Urine samples are most commonly collected by obtaining the midstream flow by the clean-catch technique. Urine collection from women by the clean-catch technique requires personal supervision for best results. The periurethral area and perineum are first clean with two or three gauge pads saturated with soapy water, using a forward to back motion, fold by a rinse with sterile saline or water.

The labia should be held apart during voiding and the first millimeter of urine passed into bedpan or toilet bowl to flush out bacteria from the urethra. The midstream portion of urine then collected in a sterile, wide-mouthed container that can be covered with a tight-fitting lid.

Instruction followed for obtaining clean-catch urine specimen in females:

- Instruct the patient to sit comfortably in the seat, swinging one knee to the side as far as the patient can
- Ask the patient to spread their self with one hand and continue to hold self spread while their clean their self and collect the specimen
- Instruct the patient to wash well and rinse well before collecting the urine sample. Using separate serial sponges soaked in 10% clean soap, wipe from the front of body towards the back. Wash between the folds of the skin as carefully
- After washed each soap pad, rinse with a moistened pad with the same front-to-back motion

After collection all the samples were inoculated into MacConkey Agar, Blood Agar, CLED agar, SDA and incubated at 37°C for 24 h. The bacterial colonies were identified by biochemically and morphologically.

RESULTS

A total of 1105 cases with symptoms and sign of UTI were enrolled into the study. The sample of mid stream urine were collected from Medical surgical units, in Pediatrics, General medicine, Obstetrics gynecology, Female medical and surgical wards, Intensive cardiac care unit, intensive care unit, Casualty and Critical care medicine.

Samples were collected from symptomatic patients from different age groups (less than 15 years, 15-40 years, above 40 years) Among the 1105 cases 43% were attended clinics with symptoms of Fever, chills and frequency of micturition in 41%, Flank pain, Lower abdominal pain in 36%, Dysuria in 10%, Pyuria in 10%, Oliguria in 1% and haematuria (Blood in urine) in 2% of the cases. Out of the

1105 cases 496 cases showed smear positive are shown in Fig. 1. The smear positivity was reported by more than 5 pus cells HPF⁻¹ in the direct microscopic examination of a wet film of uncentrifuged urine.

Figure 2 shows, the comparison of direct smear to identify the polymorphs were present in numbers (>5pus cells HPF⁻¹) indicative of infection in the urinary tract and culture of the urine to determine whether it contains a potentially pathogenic bacterium in numbers sufficient to identify it as the casuals infection organism (Significant Bacteriuria). There were 357 cases showed Direct smear positive out of 496 cases. Both Direct smear positive and Culture positive indicative of (>105/mL) significant bacteriuria were 357 cases. 139 cases showed direct smear positive and culture negative which indicates sterile pyuria.

Figure 3 explains the Male and Female ratio in Culture positive cases from different clinical units with the clinical

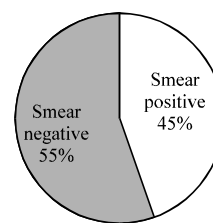


Fig. 1: Patients urine sample report

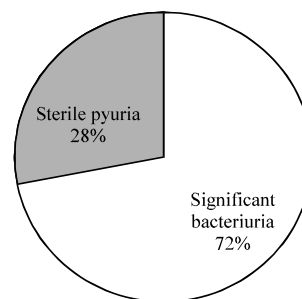


Fig. 2: Association between microscopical examination and culture isolates of the urine to identify significant Bacteriuria

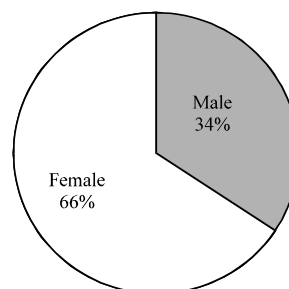


Fig. 3: Male and Female ratio in culture positive cases from different clinical units

diagnosis of UTIs. 357 cases of UTI around 66% were female and 34% cases were Male. The ratio was 2:1 predominant cases of UTI were female.

Figure 4 explains the Single isolate and mixed culture ratio in male Culture positive cases from different clinical units with the clinical diagnosis of UTI's. 122 cases of UTI around 87% were single isolate and 13% cases were mixed culture.

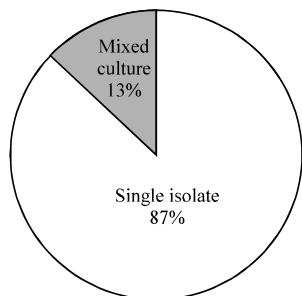


Fig. 4: Single isolate and mixed culture ratio in male culture positive cases from different clinical units

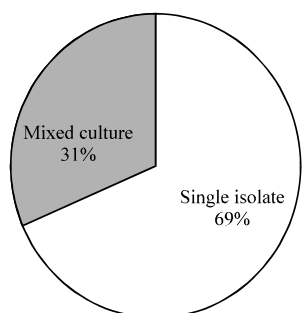


Fig. 5: Single isolate and mixed culture ratio in female culture positive cases from different clinical units

Figure 5 explains the Single isolate and mixed culture ratio in male Culture positive cases from different clinical units with the clinical diagnosis of UTI's. 235 cases of UTI around 69% were single isolate and 31% cases were mixed culture.

Figure 6 explains the percentage of causative organisms from single isolates for UTI.

DISCUSSION

This prospective study enrolled 1105 patients with of UTI from Medical and Surgical units. Both female and male of age groups categorized as less than 15 years, 15-40 years, above 40 years. Among sexually active young (15-40 years) women the incidence of symptomatic UTI was high and the risk is strongly associated with gynecological problems.

The symptoms of frequency of micturition with fever and chills and lower abdominal pain are associated with lower UTIs. These symptoms are due not only to inflammation of the bladder but also to multiplication of bacteria in the urine and urethra. The commonest condition is cystitis due to infection of the bladder with an uropathogenic bacterium. In urine culture *E.coli* was most commonly (69%) isolated organism. The women were mainly infected by *E.coli* with symptoms of acute UTI, compared to males (Guvén, 2004).

The great percentages of female children were infected with multi-drugs resistance *E.coli* among the whole *E.coli* populations or closely related bacteria (Laghari and Shah, 2012).

In our study among the total cases of 1105, only 357 cases were culture positive in which the predominant organisms isolated was *E.coli* (80%), other organism were *Staph aureus* (7%), *Klebsiella* (4%),

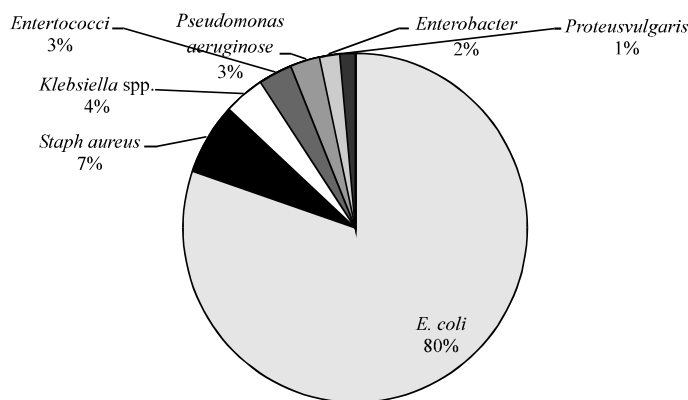


Fig. 6: Percentage of causative organisms from Urinary tract infected patients

Enterococci (3%), *Pseudomonas aeruginosa* (3%), *Enterobacter* (2%) and *Proteus vulgaris* (1%).

CONCLUSION

A total of 1105 cases with symptom and signs of UTI were included in this study. The sample of mid stream urine from all the cases were subjected. The result of the study showed that most predominant organism isolated was *E.coli*. The highest rate of UTI cases were females compared to males.

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