



Original Paper

Study of Microbial and Microscopic Characteristics of Urine in patients that suspected Urinary Tract Infections

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ABSTRACT

Objective: This study aimed to characterize the microscope and microbiological profile of microorganisms causing urinary tract infection and evaluate associated physical changes in urine properties. **Method:** A total of 80 urine samples from patients with suspected urinary tract infection were collected in sterile containers at private microbiology laboratories. Routine microscopic examination was performed, followed by culturing on blood agar and CLED agar (incubated for 18-24 hours at 37°C). Antimicrobial susceptibility testing was conducted using the Vitek 2 system and the Kirby-Bauer disc diffusion method. **Results:** The results showed a relative increase in the number of infections with *Escherichia coli* 40%, then *Staphylococcus aureus* 15%, and then with *Klebsiella pneumoniae* 12.5% and others. It was noted that the percentage of turbidity was very high, reaching 60% (indicative of significant pyuria / bacteriuria), while the net percentage was 40% for pathological cases. As for the color of urine, it ranged from yellow to white and then red with percentages of (32.5), (62.5), (5) respectively. **Conclusion:** The most common cause of urinary tract infections in the cases under study is still *Escherichia coli*. For precise diagnosis and customized antibiotic treatment, thorough urine microscopy, a standard culture, and susceptibility testing are crucial, reducing the risk of problems and resistant microbes. Also by visiting the doctor and conducting all analysis to treat bacteria that infect humans, maintaining personal hygiene.

KEYWORDS: Antimicrobial, Bacteria, Inflammation, Urinary Tract Infection, Vitek 2.

1. INTRODUCTION

Urinary tract infection is the extreme popular diseases affecting people through the existence of bacteria in the urine (1, 2). These bacteria infect many areas of the urinary system, including the ureters and bladder. Which may cause inflammation that leads to enuresis and dysuria, may cause the patient kidney failure or high blood pressure. The most important symptoms of infection are fever, burning sensation during urination, itching and ulcers in the genitals (3). Most of the problems of the urinary system are caused by the Enterobacteriaceae, which takes the largest space, *E. coli*, and then *Klebsiella*, *Enterobacter* and *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*. UTI is the most popular in men and women (4). Currently the problem of antimicrobial resistance has emerged, which is considered a threat in the treatment of diseases because it cause increase deaths and loss to the hospital, (ECDC 2018; WHO 2017) (5-7). Infections are progressively to be hard to Therapy, and finally may not lead to treatment. Therefore the treatment given to patients varies according to age, sex, and the causative agent for infection (8). The search for abilities of harmful bacteria to resistant withstand modern antibacterial therapies, will make it easier to select the best antibacterial therapy and develop an effective plan to prevent pathogenic bacteria (9) additionally, determining drug sensitivity styles may aid in determining UTI clinical treatment recommendations (10-11). The correct diagnosis for UTI gives good and quick results for the treatment of patients, which depends on a set of analysis (microscopic examination of urine, biochemical tests, in addition to culture media, so to obtain an acceptable result, more than one examination method must be used for the optimum diagnosis (12).

2. METHODS

2.1. Sample collection

Patients suffering from with a urinary tract infection were used in this study. (80) Samples of UTI patients were collected through dry, sterile containers in the morning and transferred directly to the microbiology laboratory in medical centers for examination (13).

2.2. Microscopic examination

Urine samples were examined by placing them in a tube , separating them through a centrifuge and observing if there was turbidity or fuzziness, which indicates the presence of infections and deposits of phosphate and calcium in addition to epithelial cells and red and white blood cells (14-15).

2.3. Isolation of bacteria

A sterile wire loop was used to inoculate and streak the urine sample onto blood agar as well as cystine-lactose-electrolyte-deficient agar (CLED). Vitek 2 system was use for final isolation diagnosis. Laboratory test procedures were used to culture the inoculation plates in an incubator at 37°C for 18–24 hours (16).

2.4. Statistical Analysis

The Statistical Analysis System- SAS (2012) (10) program was used to effect of difference factors in study parameters. Chi-square test was used to significant compare between percentages in this study

3. RESULTS

3.1. Color Disparity of Urine Samples

Physical and microscopic examination of the collected urine samples (n = 80) demonstrated distinct variations in urine coloration

among patients suspected of having urinary tract infections (UTIs). As detailed in Table 1, white (cloudy) urine constituted the highest frequency, followed by yellow urine, while red urine accounted for the lowest percentage (Table 1, Fig.1).

Table (1) Distribution of urine sample among suspected UTI patients

Color	No. of samples	Frequency (%)
Yellow	26	32.5
White	50	62.5
Red	4	5
Total	80	100

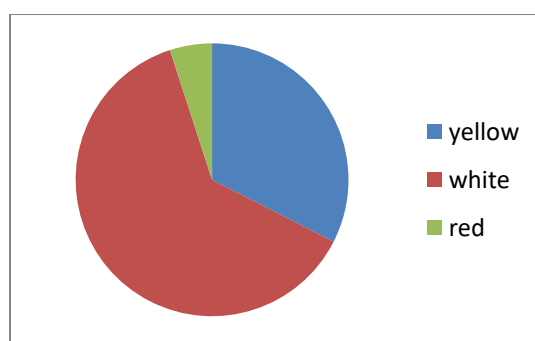


Figure (1): Distribution of urine sample

3.2. Appearance of Urine Samples

Evaluation of physical urine clarity showed that 60% (n = 48) of the samples were classified as turbid, while 40% (n = 32) were clear (Table 2, Fig.2).

Table 2 | Visual appearance and clarity of urine samples

Appearance	No. of samples	Frequency (%)
Clear	32	40
Turbid	48	60
Total	80	100

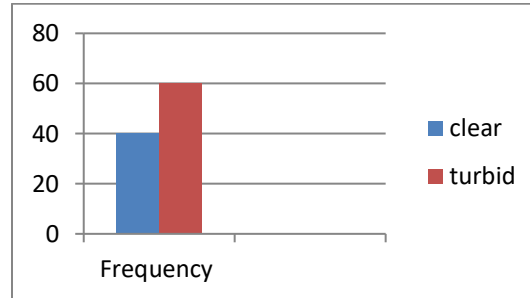


Figure (2): Visual appearance and clarity of urine samples

3.3. Gender Distribution

A demographic analysis of the research sample showed a glaring gender gap (Table 3, Fig.3). Female patients accounted for the vast majority of suspected UTI cases (73.75%) (n = 59), whereas male patients represented only (26.25%) (n = 21).

Table (3): Gender Distribution of UTI Patients

Gender	No. of patients	(%)
Men	21	26.25
Women	59	73.75
Total	80	100

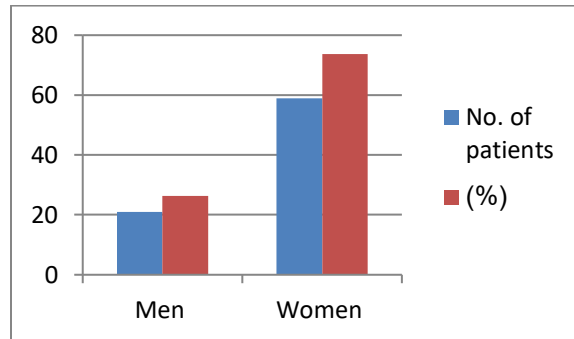


Figure (3): Gender Distribution of UTI Patients

3.4. Age Disparity among UTI Patients

The distribution of UTI cases across different age brackets demonstrated an increasing trend with age (Table 4, Fig.4). The highest frequency of infections was recorded in the adult age group (17–40 years) with (58.75%) (n = 47), followed by adolescents/children (6–16 years) with (36.25%) (n = 29), and pediatric cases (1–5 years) with (5.0%) (n = 4).

Table 4: Age distribution of UTI patients

Age (years)	No. of UTI	(%)
1-5	4	5
6-16	29	36.25
17-40	47	58.75

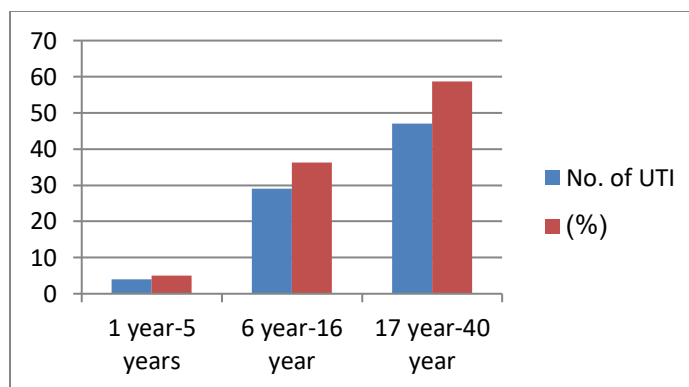


Figure (4): Age distribution of UTI patients

3.5. Bacterial Isolation and Microbial Profile

Microbiological identification of uropathogens isolated from urine cultures (n = 80) revealed a predominance of Gram-negative bacilli (Table 5, Fig.5). *Escherichia coli* was the most frequently isolated pathogen (40.0%), (n = 32), followed by *Staphylococcus aureus* (15.0%), (n = 12), *Klebsiella pneumoniae* (12.5%), (n = 10), *Proteus mirabilis* (8.75%), (n = 7), and *Enterobacter* spp. (6.25%), (n = 5).

Table (5): Isolation frequency of bacterial pathogens from urine samples

Bacteria	No. of bacteria	(%)
<i>Escherichia coli</i>	32	40
<i>Proteus mirabilis</i>	7	8.75
<i>Klebsiella pneumoniae</i>	10	12.5
<i>Staphylococcus aureus</i>	12	15
<i>Enterobacter</i>	5	6.25
Total	80	100

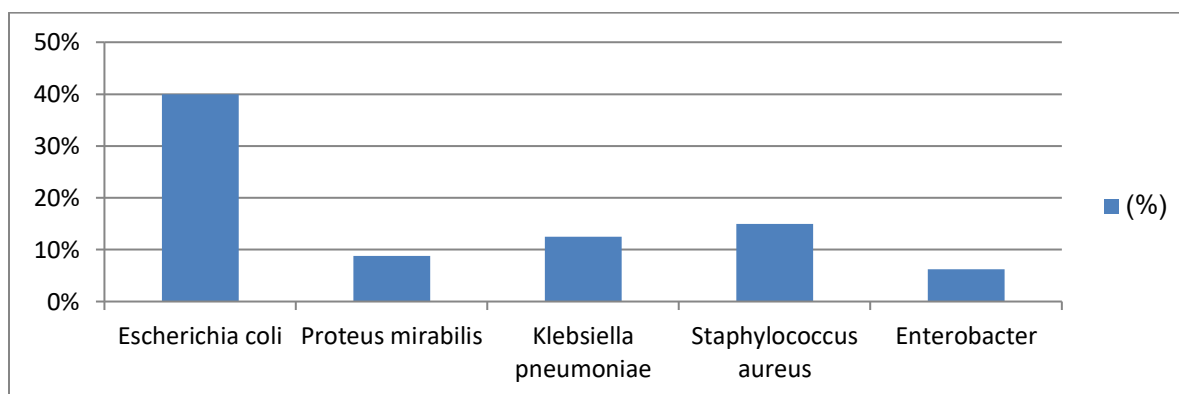


Figure (5): Isolation frequency of bacterial pathogens from urine sample.

4. DISCUSSION

In the present study, the physical and microscopic evaluation of the 80 collected urine samples revealed significant variations in coloration and clarity, providing immediate diagnostic clues regarding underlying urinary tract pathologies. The most common type of urine was white or cloudy (62.5%), followed by yellow (32.5%) and red (5.0%) which is indicative of gross hematuria that accept with (30) as shown in Table 1. One of the most important characteristics of active pyuria is the presence of white and cloudy urine, as evidenced by the results in Table 2, which showed that 60% of the urine samples were cloudy. This macroscopic appearance is mainly attributed to the presence of a dense infiltration and lysis of polynuclear neutrophils, caused by the proliferation of bacteria, as well as the presence of urinary epithelial cells, which have been shed, bacterial biomass and precipitation of mineral salts that has occurred because of the urinary alkalization caused by the presence of urea-producing bacteria, such as *Klebsiella pneumoniae* and *Proteus mirabilis*. On the other hand, 32.5% of the culture positive samples had a normal yellow color which suggests that it was at the early stage of infection, prior to the onset of any major leucocytic infiltration or diminished immune response. In the meantime, 5.0% red urine indicates mucosal erosion and vascular collapse, as a result of virulence factors that cause urinary tract infections, including alpha-hemolysin. It is interesting to note that 40.0% of the cultures produced clear urine, which does not mean that there was no infection, as stated in (31).

Demographic analysis of our group showed a significant gender disparity, with females accounting for 73.75% of suspected urinary tract infection cases compared to males who accounted for 26.25%, as shown in Table 3. This high proportion of infection between females and males is largely consistent with global epidemiological data and is primarily attributed to anatomical and physiological factors, including the significantly shorter female urethra, which reduces the distance traveled by bacteria causing urinary tract infections, as well as the proximity of the urethral opening to bacteria in the anal region, which is consistent with reference (32). In addition, hormonal changes, pregnancy, and sexual contact can increase the risk of infection in women (32). Analysis of the age distribution of the group Table 4 revealed significant variations in infection rates, with the highest rate recorded in the 17–40 age groups (58.75%), primarily attributed to active lifestyles, sexual activity, and temporary cessation of pregnancy. The 6-16 age group followed (36.25%), where urinary tract infections in children and Teenagers are often linked to Behavioral patterns such as Intentional urinary retention and hygiene factors. whilst the last group, aged 1 to 5 years, constituted 5.0%, this was mostly due to Congenital anomalies or fecal contamination, which is consistent with reference (33)

The presence of *E. coli* is associated with virulence factors specifically associated with UPE, such as the ability to attach to epithelial cells via type 1 and P fimbriae, to move using flagella, and to uptake iron using siderophores, which enables it to colonize efficiently in the presence of urinary shear forces. After *E. coli*, *S. aureus* accounted for 15.0%, and may have been due to secondary bacteremia, colonisation of the urinary tract via the catheter or anatomical abnormalities of the urinary tract. Other important isolates included *Klebsiella pneumoniae* (12.5%), *Proteus mirabilis* (8.75%) and numerous species of Enterobacteriaceae. (6.25%) is in line with (34) and shows good capsule formation, biofilm formation and urease enzyme activity which increase urine pH leading to stone formation and high inflammation in patients.

Finally, the implications of the results are very important in the context of accurate diagnosis and susceptibility testing for antibiotics. Reducing medication failures and limiting the spread of multidrug-resistant uropathogens are important aspects of good antimicrobial management, good hygiene and good infection prevention.

5. CONCLUSION

The results showed that microbes associated with urinary tract infections (UTIs) were found in who experience UTIs. These microbes were found to be less common in male UTI patients than in female UTI patients. The inflammation may be caused due to the proximity of the urethra to the anus in females, due to exfoliation of epithelial cells and due to poor personal cleanliness. Moreover, *S. aureus*, *E. coli* were the most common UTI pathogens identified in this study.

6. Acknowledgments

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Conflict of interest: none to declare

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