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A COMPARATIVE ASSESSMENT OF THE BACTERIAL PROFILE AND THEIR ANTIBIOTIC SUSCEPTIBILITY PATTERN IN CLINICALLY DIAGNOSED URINARY TRACT INFECTION (UTI) IN PREGNANT AND NON-PREGNANT WOMEN IN A TERTIARY CARE HOSPITAL OF PUNJAB

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ABSTRACT

Objectives: Urinary tract infection (UTI) is defined as the presence of microbial pathogens in the urinary tract and women of the reproductive age group (20-45 years) are the most vulnerable population. In the present study, an attempt has been made to compare the bacterial profile of the patients with clinically diagnosed UTI in pregnant and non- pregnant women, also to assess the antibiotic susceptibility pattern of uropathogens. **Methods:** A total of 500 pregnant and non-pregnant women of Mohali district were considered as sample for the present study. Several local hospitals and laboratories were considered and necessary consent was obtained from authorities along with the patients. Urine samples were collected with UTI symptoms and cultured. Antibiotic susceptibility test was performed following standard procedure. **Results:** The analysis of urine cultures identified Escherichia coli (E.coli) as the predominant pathogen in 85% of the cases. Other notable pathogens included Klebsiella pneumoniae (7%), Proteus mirabilis (5%) and staphylococcus (3%). **Conclusion:** It might be concluded that gram negative organisms were responsible for more cases of UTI and E. coli was the main causative agent. E. coli was sensitive to commonly prescribed drugs, like ciprofloxacin, amikacin and imipenem.

KEYWORDS: Bacterial profile, Antibiotic susceptibility pattern, Urinary tract infection, Pregnant and non-pregnant women of Mohali.

INTRODUCTION

Urinary tract infection (UTI) is a serious health problem affecting millions of people each year. Infections of the urinary tract are the second most common type of the infection in the body. There are estimated at least 50 million urine tests carried out in the US alone each year. Approximately 50-80% of these is negative for infection or is unworthy of further investigation (Persaud *et al*., 2006; Zeighami *et al*., 2008; Dyer *et al*., 1998). People of all ages can have UTIs. But women are more prone to get them than men because of factors such a shorter urethra, the lack of prostatic secretion, pregnancy and simple faecal flora contamination in the urinary system. About 80-90% of UTIs are caused by *E.coli*. These bacteria normally live in intestines, but they sometimes get into the urinary tract. Some UTIs are caused by other, less common types of bacteria (Hillebrand *et al*., 2002; Kutlay, 2003; Mikhail and Anyaegbunam, 1995).

The microbes that cause UTIs in pregnant individuals are the same as those that cause UTIs in non-pregnant patients but the pressure of the gravid uterus on the bladder, which produce a stasis in urine flow, as well as several hormonal and immunological changes in a typical pregnancy, make pregnant woman at higher risk of UTI. As a result, pregnant women should regularly check their urine during pregnancy. Pregnancy causes some changes in pregnant women due to mechanical and hormonal changes that lead to ureteral dilatation and urinary stasis which in turn contribute to an increased risk of developing urinary tract infection (UTI). According to the recorded data by Bahnson *et al*. (1986) 86% of the infections in pregnant women occurred in the age group of 25-35 years. UTIs occurs when bacteria (disease producing microorganism) enter into the urinary tract from the skin or rectum, and travel up the urethra to the bladder, producing an infection (cystitis) with

symptoms. The rise of antibiotic resistance is a global concern. If not properly treated, UTIs can lead to severe complications, including kidney infections, renal scarring, and even sepsis. These complications can have long-term health implications, making early detection and effective treatment essential. The present study was planned with the aim to compare the bacterial profile of the patients with clinically diagnosed UTI in pregnant and non- pregnant women, also to assess the antibiotic susceptibility pattern of uropathogens.

MATERIALS AND METHODS

Study Area

In the present study, to understand the prevalence of urinary tract infections among the pragnent and non-pregnant women of Mohali district. Several local hospitals and laboratories were considered and necessary consent was obtained from authorities along with the patients.

Patients and sampling

Urine sample from pregnant and non-pregnant women with UTI symptoms were taken. Samples were transported to the lab in a refrigerated (2-8ºC) condition. The approved clean-catch midstream approach was used in this study to gather urine samples from participants in sterile screw wide mouth capped containers. Then, using a sterile standard loop (0.001 ml), all the samples were cultivated on Blood agar, MacConkey agar, and Sabouraud Dextrose agar (SDA) and were incubated at 37ºC for 24 hours. Pregnant women who were interviewed face-to-face would provide information on their age, educational attainment, and gestational age, place of residence, employment and overall information about the pregnancy. The urine samples were centrifuged and then sediment was inspected under a microscope to look for yeast, crystals, red blood cells, pus, and epithelial cells.

Urine Specimen Collection for Culture

A "clean catch" midstream urine sample was collected in sterile clean leak proof bottles from each patient. To avoid contamination of the specimen, all participants were required to first cleanse the urethral area with a castile soap towelette (Professional Disposables International, Inc., Canada). In addition, female participants were required to wide open the labia apart before sample collection. The MSU was then collected into a wide mouth clean sterile urine container. In patients with urinary catheters, urine specimens were collected from fresh catheters using a syringe and then transferred to a sterile specimen tube.

Specimen collection: - The urine retained in the bladder for at least 4 to 6 hours. were collected, and operated in strict accordance with the National Clinical Laboratory Practice. A midstream urine specimen was collected by aseptic methods.

Data recording

During urine sampling, necessary patient- information was collected to the number of aspects during the further study. Data recorded were age, sex, nature of work, physiological condition, history of UTI intake of diet, water etc.

Microscopic examination

The microscopic examination of urine is a diagnostic test that helped identify the presence of bacteria, white blood cells, red blood cells and crystals in the urine.

Sample Isolation and Identification

Each urine sample was given a unique identification number, and each observation was noted as well. Gram stain was used to study the cell morphology of pure bacterial isolates. The isolation was further characterized biochemically. In the biochemical analysis Catalase test, Oxidase test, Coagulase test and Sugar fermentation tests were done.

METHOD

Antibiotic Susceptibility Test (Ast)

The Kirby-Bauer disc diffusion technique was used for antibiotic susceptibility testing (Nandini and Sujatha *et al*., 2023). Bacterial colony of the pure culture is mixed with normal saline to make the absorbance equivalent to 0.5 McFarland standard unit. A lawn culture was prepared using the bacterial suspension. The appropriate antibiotic disc depending on whether the test organism plated was Gram negative or Gram positive was then placed firmly onto the surface of the dried plates, using sterile forceps. The plates were left at room temperature for 1 hour to allow diffusion of the different antibiotics from the disc into the medium. The plates were further incubated at 37ºC for 18-24 hours. Interpretation of results was done using the zone sizes. The susceptibility of the antibiotic was analyzed according to CLSI guidelines.

The Kirby-Bauer method, also known as the disk diffusion method, is a standard test used to determine the susceptibility of bacteria to antibiotics.

1. Selecting bacterial isolates: First the bacteria causing the infection are isolated from the patient's specimen, such as blood, urine, or wound swab.
2. Preparing bacterial inoculum: The isolated bacteria were grown in a nutrient-rich medium until they reach a specific growth phase to ensure uniformity in growth.
3. Preparation of antibiotic discs: Small paper discs impregnated with standardized concentrations of different antibiotics were placed onto the surface of an agar plate evenly spread with the bacterial inoculums.
4. Incubation: The plates were then incubated at a specific temperature (usually 35-37ºC) for a defined period (typically 18-24 hours) to allow bacterial growth and antibiotic diffusion.

5. Measurement of zones of inhibition: After incubation, the plates were examined for zones of inhibition around each antibiotic disc. The diameter of the zone was measured and interpreted according to CLSI guidelines.
6. Interpretation of Results: The diameter of inhibition zone was compared to standardized breakpoints to determine the susceptibility of the bacteria to each antibiotic.
7. Reporting Results: The results were reported as a list of antibiotics tested and the susceptibility profile of the bacteria, indicating which antibotics were likely to be effective for treatment.
8. Quality Control: it was essential to perform quality control measures to ensure the accuracy and reliability of the test results. This included using control strains with known susceptibility pattern and monitoring the performance of the culture media and antibiotic disk. (Bauer, A. W., Kirby, W. M., Sherris, J. C., & Turck, M.(1996). This method is widely used in clinical microbiology laboratories for guiding antibiotic therapy and surveillance of antibiotic resistance.

RESULTS

The study examined a total of 500 patients diagnosed with UTIs at Sohana Hospital, Mohali over a period of six months (January 2024 to June 2024). In the present study, patients visiting the local hospitals and laboratories complaining about urinary tract infection in the symptomatic mode recorded a total of 500 in number from every district. Further, they are classified according to gender and analyzed accordingly. A total of 201 pregnant and 299 non-pregnant patients of Mohali district complained with symptomatic UTIs. Overall, it was observed that female patients were complaining more about symptomatic UTIs as given in Table 1. All these patients then requested to sample urine by clean catch method and accepted to do the same. Samples then were labeled to record for required data that investigated further.

Table No. 1: Gender-wise distribution of patients with pregnant and non pregnant women in Mohali district.

Total	Pregnant women	Non-pregnant women
500	201 (40.2%)	299 (59.8%)

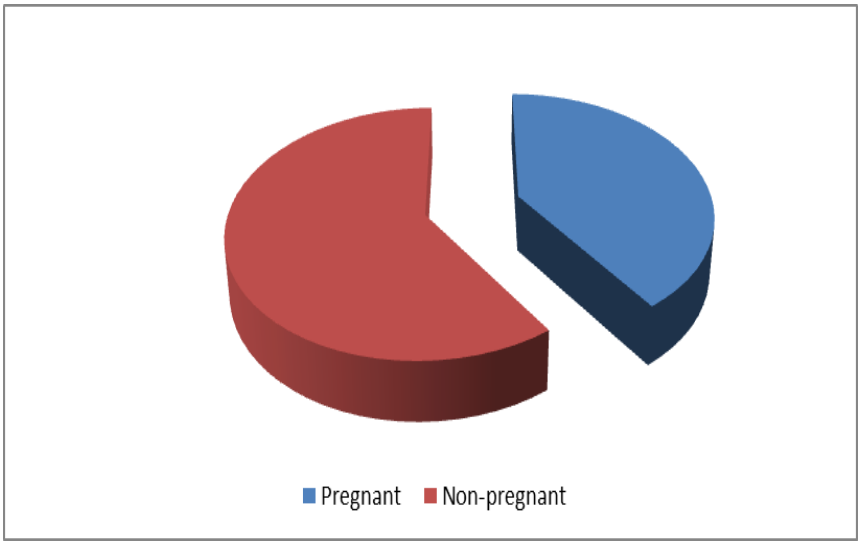

Table 2: Distribution of causative pathogens.

Pathogens	Pregnant women	Non-pregnant women
Escheriarichia. Coli	35%	50%
Klebsiella pneumonia	2%	5%
Proteus mirabilis	2%	3%
Stapphylococcus	1%	2%

In Table 2, the distribution of causative pathogens was shown. The analysis of urine cultures identified Escherichia coli (E.coli) as the predominant pathogen in 85% (35% in pregnant and 50% in non-pregnant women) of the cases. Other notable pathogens included Klebsiella pneumoniae (7%; 2% in pregnant and 5% in non-pregnant women), proteus mirabilis (5%; 2% in pregnant and 3% in non-pregnant women), and staphylococcus (3%; 1% in pregnant and 2% in non-pregnant women).

DISCUSSION

This study determined the prevalence, etiology, factors associated with bacterial UTI. Our study demonstrated E.coli as the most prevalent bacterial uropathogens. This high possibility of UTIs in females is due to the inherent virulence of E. coli for urinary tract colonization such as its abilities to adhere to the urinary tract and also association with other microorganisms moving from the perineum areas contaminated with fecal microbes to the moist warmth environment of the female genitalia. In this study Escherichia coli and S. aureus were the major causes of both CA-UTIs and N-UTIs among patients attending hospitals in Mohali. This study has demonstrated that hospitalization, married individuals, duration of catheter, diabetes mellitus, genitourinary tract abnormalities, and female gender were the most important factors associated with UTIs. Appropriate measures might help to reduce UTIs due to these associated factors. We recommend routine UTIs screening of patients of the following category: hospitalized, genitourinary tract abnormalities, indwelling catheter, diabetic, female gender, and married individuals. If these routine checks were put in place, prevention of UTI could be realized at lower cost. Our study has shown that among gram negative urinary isolates, E. coli was sensitive to imipenem, amikacin and ciprofloxacin. It was considerably resistant to amoxicillin/clavulanic acid. Klebsiella spp. was sensitive to imipenem and gentamicin while resistant to cefotaxime and amikacin. Proteus spp. was sensitive to ciprofloxacin, amoxicillin/clavulanic acid and amikacin while resistant to cefotaxime and imipenem. Both Klebsiella spp. and Proteus spp. were sensitive to trimethoprim/sulfamethoxazole. As we know, urinary tract infections (UTIs) are prevalent in both inpatient and outpatient settings; hence, it is essential to screen, diagnose, and to give immediate treatment in both of the cases. (Gupta et al., 2017). UTIs also remained the common bacterial infection account for 0.9% of all ambulatory visits and needed immediate attention (Foxman, 2014). Rowe et al. (2014) also reported the UTI was more common in older adults and that generally remained as asymptomatic bacteriuria and demanded proper detection followed by management. In the present study, all patients investigated were recorded with symptomatic UTI, although asymptomatic UTI patient also been remained available. Geerlings (2016) reported all UTIs were not uncomplicated, but some of them even remain complicated UTIs (symptomatic) and also represented themselves with increased risk of developing complications. In the present study, once the patients were grouped into the male and female. According to Fasugba et al., (2015) as per review report E. coli causing UTI was more prevalent in a patient with many strains showcase resistance towards ciprofloxacin male. The present investigation maximum level of positive urine infected bacterium was Escherichia coli (35%). The rate of isolation and pattern of major uropathogens of the present study are in accordance with a few studies carried out on both chromogenic and conventional media. Ciragil et al. (2006) have been noted 20 to 30% of UTI urine samples resulted in significant growth with main infective bacteria like Escherichia coli in both community and hospital acquired infections (Salvatore et al., 2011). Urinary tract infections caused by Klebsiella pneumoniae appeared to be rising and have been become a real health problem, especially in hospital settings (Cristea et al., 2017). The Staphylococcus aureus (3%) was positive urine infected bacterium, a similar laboratory-based study conducted in France found that Staphylococcus aureus accounted for only 3% of isolates from UTI specimens (Goldstein, 2000). The most of the investigation were done on Enterococci spp. support the similar results which could be attributed to the dominance of E. faecalis in the body flora of the human (Silverman et al., 1998). This finding was similar with the study of Tayebi et al. (2014), Jombo et al., (2011) in which Enterococcus spp. was 8.7% and 12.4%, respectively. The most common organism isolated in these patients was Escherichia coli (35), Klebsiella pneumonia 2%), Staphylococcus aureus (1%) and Proteus mirabilis (2%).This findings pattern was similar with the study of Savitha and Thangamariappan, (2011).

CONCLUSION

In conclusion, our study has shown that gram negative organisms are responsible for more cases of UTI and E. coli is the main causative agent. E. coli is sensitive to commonly prescribed drugs, like ciprofloxacin, amikacin and imipenem. The ongoing development of new antimicrobial approaches, such as the use of pilicides and mannosides in conjunction with antibiotics, would provide new treatment options, while the identification of new vaccine candidates and optimized vaccination protocols would promise relief to individuals who suffer from recurrent or chronic UTI.

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