

UTI during pregnancy: a clinical manifestation of severe health concern

Abstract

Urinary tract infection commonly abbreviated as UTI is an issue of health concern which is common among males and females. Despite the fact that the condition is common among males and females, the modified reproductive physiology of females enhances the rate of incidence and the prevalence is very high during pregnancy. The shorter urethra in females makes them highly susceptible to the condition and the degree of occurrence varies among pregnant and non-pregnant women. The hormonal and physiological changes during pregnancy enhance the rate of incidence. Higher levels of progesterone hormone have been affiliated to increased rate of UTI and the anatomical changes have also resulted in higher prevalence of UTI during pregnancy. The condition can affect the lower and the upper urinary tract leading to conditions like bladder and kidney inflammation. The former is referred to as cystitis and the latter is called as pyelonephritis. Though UTI is not life claiming the rate of mortality depends on the extent of infection. Severe pyelonephritis have been linked with pulmonary manifestations and the use of empirical treatment with antibiotics has resulted in the resilience of the pathogen. Excess use of antibiotics not just benefits the pathogen but has known to cause congenital consequences in the new born. UTI during pregnancy has also been related to severe birth complications. The current review attempts to comprehend the consequences of UTI among women during pregnancy and attempts to explore the associated clinical factors.

Keywords: UTI, urinary tract, lower and upper urinary tract, enterobacteria, biofilm, *E. coli*, *Klebsiella*

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Introduction

What is UTI?

Infection of the urinary tract leading to the clinical manifestation of urinary system or any of its parts is referred to as urinary tract infection (UTI). Role of microorganisms leading to appearance of the infection cannot be denied as several microbial perpetrators have been known to be associated with UTI. The infection can occur in the lower or the upper urinary tract which is clinically referred to as cystitis (in case of bladder inflammation), urethritis (in case of the inflammation of urethra) and pyelonephritis if the infection spreads to kidneys. The infection is not life threatening but severe cases of kidney inflammation as a consequence of UTI has known to be detrimental.¹ Symptoms of lower and upper urinary tract vary ranging from painful urination to appearance of blood in urine due to severe inflammation of the soft membranes within the tissues. Though the appearance of blood in urine often referred to as hematuria is a very rare clinical outcome, several cases have confirmed the traces of blood in urine in severe infection.² UTIs are common infections that occur when bacteria, often from the skin or rectum, penetrate the urethra and infect the urinary tract. Symptoms of the lower urinary tract that includes the bladder and urethra causes

- Dysuria, painful urination leading to burning sensation
- Pollakiuria, Frequent urination
- urgency urinary incontinence also known as overactive bladder is a medical condition where the urge to urinate is high despite having an empty bladder
- Hematuria, blood in urine³
- The following symptoms are common in case of upper urinary tract infection

f) High fever

g) Chills also known as shivering can occur in the presence or absence of fever, that causes the involuntary muscles to contract that help the body to generate heat to raise its core temperature

h) Lower back pain

i) Nausea and vomiting.⁴

Uncomplicated UTIs are among those common bacterial infections that are known to invade and infect the lower urinary tract and this is quite common among health individuals and females are more prone to this condition compared to males due to their reproductive physiology which makes them more vulnerable for the clinical manifestation.⁵ Many uncomplicated UTIs resolve spontaneously without treatment, but patients often seek therapy for getting rid of symptoms. Treatment aims to prevent the infection from spreading to the kidneys or to an upper tract disorder such as pyelonephritis, which can impact the delicate nephron structures and eventually lead to complications such as hypertension and can also cause life claiming consequences that depends on the extent of infection.⁶ Several studies have validated the fact that UTI causing bacteria ascend from the perineum and rectum to the periurethral area, increasing the risk of UTIs in women. Shorter urethra in women makes them more susceptible for the infection. In addition to *E. coli*, other perpetrators responsible for causing UTI are *Klebsiella*, *Enterococcus*, *Enterobacter*.^{7,8} Scientific demonstrators have confirmed the role of urinary catheters as a significant factor for enhancing the risk of UTI as well as urethral manipulation. UTIs are also common after kidney transplants, with immunosuppressive drugs and vesicoureteral reflux being key contributing factors. Additional risk factors include the use of antibiotics, which can lead to the development of resistant bacterial strains, and diabetes mellitus. In addition to the above cited reasons, menopause and sexual intercourse have known to increase the risk of UTI. Multiple sex partners and

poor hygiene significantly increase the occurrence of UTI. One of the most vulnerable periods among women that enhance the incidence of UTI is during pregnancy as several studies have emphasized on the susceptibility of women to UTI during pregnancy.^{9,10}

UTI during pregnancy

Pregnancy is one of the vital phases women experience in their lifetime that leads to hormonal and anatomical changes which in turn make them vulnerable to a range of clinical manifestations and UTI is one such clinical condition leading to a range of health concerns. UTI during pregnancy is common due to anatomical changes and can pose a serious threat if unnoticed. It can lead to severe health consequences in both maternal and fetal health. The anatomical and physiological changes during pregnancy increase the risk of UTI and lack of proper treatment can lead to the inflammation of the kidneys that leads to pyelonephritis. In this condition the glomeruli that are known for their filtration capabilities get inflamed which can in turn compromise the normal functioning of the kidneys. This condition on a long run can lead to life threatening consequences. In addition to pyelonephritis, preterm birth, low birth weight and maternal sepsis are common clinical condition due to UTI during pregnancy. Hence there is a need to comprehend the epidemiology and risk factors associated with UTI [11]. UTIs during pregnancy can be due to several factors that are affiliated to physiological and anatomical changes that occur during gestation. Higher levels of progesterone is regarded as one of the vital hormonal factors responsible for the occurrence of UTI as progesterone leads to the relaxation of smooth muscle tissue throughout the urinary tract, including the ureters and bladder which reduces the ureteral tone and alters bladder dynamics, contributing to urinary stasis. This in turn allows the bacteria to ascend from urethra to bladder and then to kidneys because main perpetrator responsible for UTI is *E. coli* which is motile and has the tendency to invade various parts of the urinary system. Another reason for elevated incidence of UTI during pregnancy is due to the lack of complete void which causes the retention of urine within the bladder. The enlarging uterus can mechanically obstruct the ureters and urinary flow, which increases the incidence of UTI among pregnant women. Hormonal changes also affect the vaginal flora, potentially increasing the colonization of UTI causing pathogens. In addition to anatomical changes, physiological manifestation like decrease in cell-mediated immunity may weaken the body's ability to fight bacterial infections which can further worsen the condition. As a matter of fact, these factors create a milieu conducive to the development of UTIs in pregnancy, highlighting the importance of proactive measures to prevent and manage these infections to protect maternal and fetal health.¹¹ World health organization estimates confirms the percentage of maternal deaths to be 10.7% due to UTI globally. Several studies have validated the estimates and have associated the health concerns in accordance with urinary tract which accounts to 28%. The most vital factor leading to bladder and kidney infection during pregnancy is related to asymptomatic bacteriuria (ASB). Asymptomatic bacteriuria is a condition where the number of organisms in a mid-stream urine is >100,000/ml. Untreated asymptomatic bacteriuria can subsequently ascend to symptomatic UTI which accounts to 25%. Studies have revealed the percent of asymptomatic bacteriuria among non-pregnant women to be around 6%. The number of pregnancies in women is also a significant factor which increases the risk of UTI and socio economic condition which denotes the status of living condition has been predisposing factor for the occurrence of UTI.¹²⁻¹⁴ Hence, there is a need to strictly follow the prenatal guidelines and it is highly recommended that every pregnant woman should be screened for the early detection of asymptomatic bacteriuria either in the first or the

second trimester. Mid-stream urine or a clean catch urine is required in order to screen for the detection of asymptomatic bacteriuria. It was a belief that early detection of symptomatic bacteriuria has curbed the prevalence of UTI up to 4%. However, recent studies do not provide evidence that treatment of ASB decreases rates of preterm birth and low birth weight. Further studies in this area are needed to elucidate the hidden facts.^{15,16} Occurrence of cystitis during pregnancy was around 2% and same was in case of pyelonephritis during the second trimester. Pyelonephritis is a common cause of serious infections, causing septic shock, in pregnant women. It is indeed the major cause of most medical hospitalizations during pregnancy. Antepartum admission due to UTI accounts to 3.5% and pyelonephritis during pregnancy leads to obesity. Studies have validated the increased incidence of UTI among patients with a history of diabetes and recurrent UTIs. In addition, smoking and low socio economic status has known to increase the prevalence of UTI during pregnancy.¹⁷

Hence it is quite obvious that the incidence of UTI is high among women due to their altered reproductive physiology and pregnancy enhances the rate of prevalence of UTI due to hormonal and physiological changes. As a matter of fact, lack of complete void during pregnancy due to anatomical changes has known to increase the susceptibility of women to UTI.

Pathophysiology

Major perpetrator of UTI is bacteria which typically enter the bladder through the urethra and females are highly susceptible because of smaller urethra. In the contrary, the infection may also occur through body fluids like blood and lymph. However, the usual entry of bacteria is through urethra and the prevalence is higher in women due to their altered reproductive physiology. Major causative agents of UTI among bacteria are *E. coli* which on entering the bladder adheres to the bladder walls because of their tendency of forming biofilms which is capable of resisting the host immune system.¹⁸ *E. coli* is the major perpetrator, followed by *Klebsiella* and *Proteus* spp., to cause urinary tract infection. *Klebsiella* and *Proteus* spp., are frequently associated with stone disease (deposition of stones in the urinary tract). The role of Gram positive bacteria such as *Enterococcus* and *Staphylococcus* cannot be denied as well. Research studies have reported increased resistance of urinary pathogens to quinolone antibiotics worldwide due to overuse and misuse of quinolones which has in turn made the UTI causing pathogens resilient (Figure 1,2 &3).¹⁹

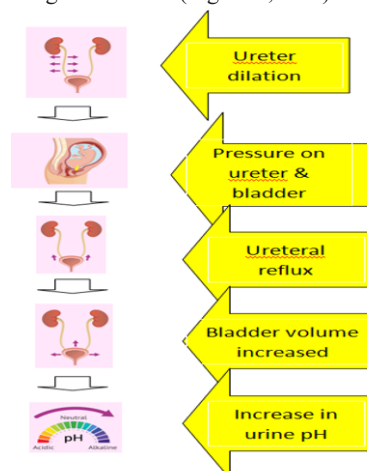


Figure 1 Causes on UTI in pregnant women.

The image has been taken from the source quoted in the reference but has been slightly modified from its original source.

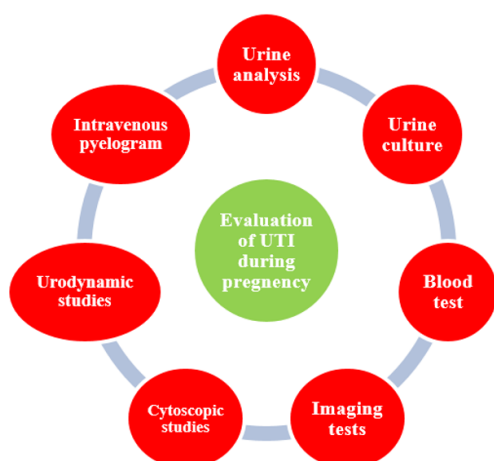


Figure 2 Diagnosis tests for UTI during pregnancy.

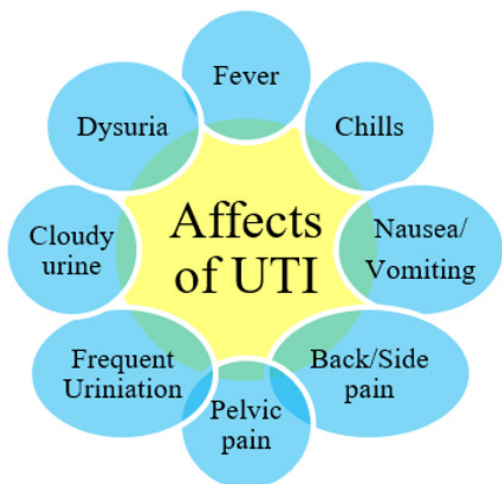


Figure 3 Affects of UTI.

Organisms causing UTI in pregnancy are the same uropathogens that commonly cause UTI in non-pregnant patients. *Escherichia coli* is the most common organism isolated from the patients' positive for UTI. An 18-year retrospective analysis found *E. coli* to be the causative agent in 60% to 82.5% of cases of pyelonephritis during pregnancy. In addition to *E. coli*, *Klebsiella pneumoniae* accounts to 11%, *Proteus* is responsible for 5%, *Staphylococcus*, *Streptococcus*, and *Enterococcus* species have also known to be associated with UTI among pregnant women. *Gardnerella vaginalis* and *Ureaplasma* are uncommon pathogens but may be isolated, especially in women with kidney related ailments. Group B *Streptococcus* (GBS) is mostly isolated from urine cultures during the third trimester of pregnancy and may be even more common than *E. coli*.^{15,20}

Assessment of UTI during pregnancy

The evaluation of a pregnant patient for UTI is a vital clinical measure to ensure the normal wellbeing. It include a clean catch urinalysis by collecting the mid-stream urine for urine culture. A few considerations are noteworthy regarding the collection of urinary specimens during pregnancy. Well-hydrated patients may excrete dilute urine, rendering some assessed parameters less accurate. Specimens collected from laboring or postpartum patients will have the traces of blood and the condition is often referred to as hematuria.

Due to reduced protein reabsorption, small amounts of protein may be excreted. Contamination, as may occur with mucous vaginal discharge, may also contribute to the presence of proteinaceous material in the urine of pregnant women. Urine dipstick screening during pregnancy has resulted in false positive result for infection and is not advisable. Presence of nitrites in the collected sample serves as a significant indicator of UTI. Traces of nitrites were often present in samples of patients with symptomatic UTI and this method has demonstrated a specificity of over 98%. A negative predictive value of 81.9 % and a positive predictive value of 86.6% have been used as a clinical landmark to evaluate the degree of UTI in pregnant patients. In addition, symptoms such as dysuria (specificity of 88%) and hematuria (specificity of 93%) proved effective in predicting UTIs.²¹ The possibility of contamination of urine sample during pregnancy is very common and can lead to wrong analysis. High body mass index is affiliated with an enhanced risk of contamination of urine culture.²² Skin flora is commonly seen growing from urine cultures from pregnant women. However, perineal cleaning, known as a clean catch, does not decrease the contamination compared to collecting a midstream urine specimen without perineal cleaning.²³

Pyuria is a common condition among UTI patients which is confirmed by the presence of pus cells in urine. Laboratory analysis for pyelonephritis includes complete blood count as it provides a comprehensive evaluation of patient. Serum creatinine levels also serve as vital clinical indicators of pyelonephritis during pregnancy. Studies have validated reduction in serum creatinine among pregnant UTI patients. Lactic acid and blood culture analysis can be done to diagnose the condition of sepsis among pregnant patients.²⁴

UTI complications during pregnancy

UTIs complications in pregnant women include sepsis, anemia, acute respiratory distress syndrome (ARDS), disseminated intravascular coagulopathy, preterm contractions and labor, and renal abscess. Intensive care unit (ICU) admission may be required under severe clinical manifestation. Research studies suggest that 7.5% of patients with pyelonephritis have bacteria in the blood (the condition is referred to as bacteremia), 13.3% have sepsis, and 1.9% have septic shock leading to severe sepsis. Preterm premature rupture of membranes (PPROM) is not unusual (6.3%), while preterm delivery (11%) and birth weight <2800 g (8.2%) are additional complications that may be seen due to UTI in pregnancy. Delivery within 72 hours has been noted in 7% of patients.²⁵ Lung manifestations are frequent clinical outcome among carrying women. Pulmonary complications are common, occurring in up to 10% of pregnant patients undergoing treatment for pyelonephritis. This is due to endotoxin-mediated alveolar damage and can cause pulmonary edema or ARDS. Urine output and oxygen status should be monitored in patients with pulmonary manifestation, and patients may require ICU admission for respiratory support depending upon their clinical condition. Endotoxin release may lead to anemia that can occasionally cause shortness of breath, which typically resolves spontaneously following treatment. This is the most common complication seen with pyelonephritis, occurring in up to 25% of patients. Endotoxin release may also cause uterine contractions, and patients should be under observation for preterm labor, preterm delivery, and preterm premature rupture of membranes PPRM.^{21,26} Prolonged infection among few patients is a common clinical sign which in turn depends upon the extent of infection and the load of pathogen responsible for UTI. Long lasting infection is very common among those patients who have the medical history of urinary obstruction or renal abscess. The kind of antibiotic administered is very vital because the nature of antibiotics

given to the woman varies among the trimesters and some of these antibiotics have been associated with congenital consequences. Antibiotic choice should be reevaluated, and culture results should be reviewed. Recurrent UTI accounts to 4% to 5% of pregnancies, where UTIs occur more than once. Data are limited regarding the management of recurrent UTIs in pregnancy. Insufficient evidence is available for recommendations after recurrent UTI treatment in pregnancy. Suppressive antibiotic therapy, either once daily or postcoitally with an antibiotic that the bacterial isolate was susceptible to, is commonly recommended in individuals who have had recurrent UTIs in pregnancy. This is typically continued throughout pregnancy. Examples of antibiotics used include nitrofurantoin 100 mg orally daily or cephalexin 250 mg to 500 mg by mouth daily.²¹

Treatment

Asymptomatic bacteriuria and acute cystitis during pregnancy can be treated through oral antibiotic therapy. Treatment for UTI in pregnancy should be started when the patient has a single organism bacterial colony count of $\geq 100,000$ (10^5) CFU/mL in a urine culture. According to the reports of the American College of Obstetricians and Gynecologists (ACOG), colony counts of 100,000 (10^5) CFU/mL of a single organism confirms UTI.¹ Empiric antibiotic therapy may be started if symptoms of UTI are present, including urinary frequency, dysuria, and hematuria but the identification of the pathogen responsible for the condition should be identified in order to get an effective treatment. Antibiotic choice depends on the trimester and the sensitivity of the organism which includes the course of a week's duration.²⁷ Demonstrative studies have validated the development of resistance among *E. coli* against antibiotics like amoxicillin and ampicillin. The main reason for the development of resilience against these antibiotics is due to their empiric treatment. Constant use of an antibiotic can lead to resistance in the organism over a period of time. Antibiotics like cephalosporins, nitrofurantoin, fosfomycin, and trimethoprim-sulfamethoxazole have been extensively used to counteract UTI causing pathogens. However, the use of fluoroquinolone are not recommended during later trimesters of pregnancy due to its role in causing teratogenic infections and congenital defects.^{28,29}

Recent studies suggest a connection between the use of sulfa drugs and nitrofurantoin and their role in causing congenital disabilities leading to birth defects especially in the first trimester. However, a potential alternative to these drugs are necessary before avoiding their use. As a matter of fact untreated UTI can be detrimental depending upon the extent of infection because of its tendency of spreading to the upper urinary tract. Infection of kidneys leading to pyelonephritis can be detrimental in some cases. Patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency should not be prescribed sulfa drugs or nitrofurantoin despite the fact that these are highly effective against Gram negative bacteria like *E. coli*, because these medications can precipitate hemolysis. In the late third trimester, trimethoprim-sulfamethoxazole should be avoided if possible due to the potential risk of developing kernicterus (also known as hyperbilirubinemia) in the infant after delivery.³⁰ Studies have also revealed the fact that the presence of Group B Streptococcus with a colony count $>100,000$ CFU/mL in urine culture needs to be immediately taken care of by recommending the same drugs that are used for treating UTI during pregnancy.

Intravenous antibiotic therapy has been found to be effective for counteracting group B streptococcus during pregnancy as it prevents the early onset of sepsis in infants at the time of birth. Severe consequences of kidney inflammation among carrying women cannot

be denied as pyelonephritis during pregnancy is a serious condition usually requiring hospitalization. Following the medical assessment, the treatment primarily comprises of directed antibiotic therapy and IV fluids to maintain adequate urine output. Cooling blanket are often used to subside the fever and acetaminophen is often recommended to get rid of fever. Second or third-generation cephalosporins are commonly used for initial treatment, in combination with aminoglycoside. Some studies have authenticated the significance of third-generation cephalosporins as third-line therapy.

However, the risk of development of resilience among the pathogen against the antibiotics cannot be denied. Ampicillin and gentamicin and other broad-spectrum antibiotics are often recommended. Carbapenems have been found very effective among patients who have had cephalosporin antibiotic-resistant pyelonephritis in the past.²⁹

Antibiotic therapy may be shuffled based on bacterial sensitivities. Patients should be kept under close observation to check for the development of sepsis in response to UTI causing pathogens. Oral antimicrobial treatment has been found to be useful in pregnant patients admitted with upper UTIs. However, there is a need for a minimum of 48 hours of monitoring to check for any systemic inflammatory response and clinical indicators of infection. Parenteral antibiotics should continue until clinical symptoms improve, and a total of 7 to 14 days of combined parenteral and oral antibiotics should be completed. Suppressive therapy daily throughout the remainder of pregnancy may be considered.^{11,29} Cephalosporins are commonly recommended antibiotics for pregnant patients with UTIs; however, over a quarter of *E. coli* isolates have exhibited resistance to cephalosporins.

Women from developing countries are more commonly treated as outpatients for UTI during pregnancy, possibly due to low resources or lack of proper diagnoses. Following the treatment of a UTI during pregnancy, there is limited guidance on the recommended management. It is suggested to consider obtaining a repeat urine culture 1 to 2 weeks after completion of the initial treatment. Alternatively, patients can be observed for symptoms, and a repeat culture may be obtained only if symptoms reappear. There is insufficient evidence supporting the use of daily prophylaxis with antibiotics after an episode of cystitis during pregnancy.¹²

Alternative remedies to prevent UTI during pregnancy

As a matter of fact, there are various ways to counteract UTI in addition to use of drugs. Despite the fact of congenital complication as a consequence of drug use during pregnancy, the use of drugs has been a major means of minimizing UTI but there are other methods that are quite effective in preventing the contagion during pregnancy. Researchers have scientifically validated the measures employed for preventing UTI during pregnancy. The term measure is more appropriate than therapy because they are used to prevent the condition rather than curing the manifestation after occurrence. Life style changes and natural remedies play a very prominent role in preventing the infection during pregnancy. Some of the measure useful in preventing UTI during pregnancy are listed below which are non-drug related

- Increased intake of water
- Cranberry juice (found to be very effective in preventing UTI)
- Frequent urination (in order flush out the unwanted microbes capable of causing clinical manifestation)

- d) Proper hygiene
- e) Avoid caffeine and alcohol (these are bladder irritants)
- f) Additional supplements of vitamin C, beta carotene and zinc have found to be very effective³¹

Discussion

Several attempts have been made to counteract the impact of UTI causing organisms and studies have emphasized on various factors to evade the condition. Though the use of antibiotics have revolutionized the field of medicine and played a significant part in thwarting the condition, factors like personal hygiene and sex life are equally important as they do contribute to the clinical manifestation. UTI is a very common clinical condition among females due to their reproductive physiology and the scope of bladder invasion from the urethra is very often due to their shorter urethra. The condition is highly prevalent during pregnancy due to various biological and physiological changes. Following the diagnosis of acute cystitis, treatment should be initiated within a week's time which includes a specific course of antibiotics. Empirical treatment may be started on the basis of symptoms like dysuria, hematuria, urinary frequency, and nocturia, along with urinalysis results in consistent with UTI. Antibiotic treatment can then be amended based on urine culture results which in turn prompts for targeted therapy. Choice of antibiotic treatment is dependent not only on culture results but also susceptibility and safety profiles and includes nitrofurantoin, β -lactams, sulfonamides, and fosfomycin.³² Intravenous administration of 1 g of ceftriaxone or cefepime for every 24 hours has been found to be very effective against pyelonephritis. In addition, intravenous administration of ampicillin and gentamicin has been very effective in treating acute cystitis at varying concentrations. In the contrary, several studies have ruled out the use of nitrofurantoin and fosfomycin at tissue level in kidney as they have been found ineffective against pyelonephritis. Nevertheless, first line antibiotic therapy for asymptomatic bacteriuria and acute cystitis include the oral administration of 50mg of nitrofurantoin as its found to be effective but the fact of its inefficacy against pyelonephritis cannot be denied.¹⁵ Though *E. coli* has been known to demonstrate resistance against beta lactum antibiotics, oral administration of 500mg of amoxicillin for 5 to 7 days was found to be effective. Combination of amoxicillin and clavulanate at 500/125mg for 5 days was highly effective. Symptoms such as dysuria, frequency, urgency, and suprapubic pain among pregnant women may also be attributed to physiological changes, such as increased urinary frequency due to pressure on the bladder from the enlarging uterus. The differential diagnosis of UTIs during pregnancy includes various conditions that can persist with similar symptoms, demanding a comprehensive evaluation to ensure accurate diagnosis and appropriate management. Additionally, conditions such as pelvic inflammatory disease, vaginal infections, and sexually transmitted infections may impersonate UTI symptoms in pregnancy. More specifically, the differential diagnosis of pyelonephritis during pregnancy includes acute intra-abdominal diseases such as appendicitis, pancreatitis, cholecystitis, and kidney stones, as well as pregnancy-related complications such as preterm labor, chorioamnionitis, or placental abruption. The diagnosis of patients with UTIs during pregnancy mostly depends on the swiftness and efficacy of diagnosis and treatment. Untreated or inadequately treated UTIs in pregnancy can lead to dire complications which includes pyelonephritis, preterm birth, low birth weight, and maternal sepsis. These can significantly impact maternal and fetal health. However, with suitable management and timely administration of antibiotics, the prognosis for most pregnant individuals with UTIs

is favorable. The prevalence of pyelonephritis during pregnancy has decreased from 30% to 4% since the 1960s and 1970s, when asymptomatic bacteria (ASB) began to be routinely tested. However, it is uncertain if asymptomatic bacteriuria treatment decreased the rates of preterm birth and low birth weight infants. Since several studies were conducted in the past, the same cannot be related to the current scenario to profoundly confirm the statistics. Therefore, recent studies have questioned the need for screening and treatment of ASB in pregnancy and found that the incidence of preterm birth and low birth weight infants may not be decreased by treatment of ASB in pregnancy.^{16,32}

Drug resistance among UTI causing pathogens during pregnancy has been an issue of serious concern because it enhances the degree of infection among the infected individuals. Several recent studies have confirmed the prevalence of Gram-negative organisms causing UTIs in pregnant women to be 67 %, while Gram-positive organisms to be 22 % respectively. Gram positive isolates resistant to ampicillin accounted to 95% were found to be *Staphylococcus aureus* and coagulase negative *Staphylococcus*. The most common Gram-negative organisms exhibiting antimicrobial resistance were *E. coli*, *Klebsiella*, and *Pseudomonas aeruginosa*.³³ Antimicrobial agents like nitrofurantoin, cephalexin, sulfamethoxazole-trimethoprim, and fosfomycin have found to be less effective due to emergence of resistance among the strains responsible for causing UTI. Misdiagnosis and empirical treatment also played its role in fortifying the pathogen because constant use of a specific drug enhances the ability of tolerance in the pathogen.^{34,35} As a matter of fact the development of multidrug resistant strains has limited the options of antimicrobial agents to counteract the impact of UTI causing microorganisms. Antibiotic resistance in UTI causing pathogens can also be due to genetic changes that would have resulted due to genetic drift or genetic shift which in turn confers the pathogen with the ability of resilience against antimicrobial agents. In addition, variation in the use of antibiotic and lack of proper information has also added up to the mechanism of resistance in UTI causing pathogens.³³

Conclusion

Urinary tract infection is a very common clinical manifestation in males and females but the altered reproductive physiology of females makes them highly susceptible to the condition. The symptoms and clinical signs vary depending upon the site of infection which could be in the upper or the lower urinary tract. It is believed that the UTI causing pathogens have the tendency of invading the bladder from the urethra in females due to the shorter length of urethra and the symptoms vary from frequent urination to painful urination with traces of blood in rare conditions. In addition to the reproductive physiology, certain phases in a woman's life like pregnancy make her vulnerable to the condition. Pregnancy is one of the crucial periods where the incidence of UTI is found to be higher when compared to a non pregnant woman. There are several factors during pregnancy that elevates the chances of UTI which include the hormonal and physiological changes. Hormonal changes include the higher secretion of progesterone and physiological changes include the changes in the thickness of the bladder tissues which prevent the process of complete void which in turn increases the risk of UTI. Several remedies are available in the form of antibiotic treatment which has the capacity of fighting the UTI causing pathogens but the darker side of development of antibiotic resilience as a consequence of continuous antibiotic use cannot be denied. However natural remedies are available those are non drug related but their efficacy against the pathogens in comparison to drugs is debatable.

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None

Conflicts of interest

The authors declare that there are no conflicts of interest.

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