Chapter 1

INTRODUCTION

Urinary tract infection (UTI) is an infection caused by the presence and growth of micro organisms anywhere in the urinary tract. It is usually due to bacteria from the digestive tract which climb the opening of the urethra and begin to multiply to cause UTI (Rahimkhani et al., 2008 ; Okonko et al., 2009). In contrast to men, women are more susceptible to UTI, and this is mainly due to short urethra, absence of prostatic secretion, pregnancy and easy contamination of the urinary tract with fecal flora (Haider et al., 2010). Pregnant women are at increased risk for UTIs, beginning at week 6 and peaking during weeks 22–26, owing to the anatomical and physiological changes that occur during pregnancy, which increase the liability to UTI. Relaxation of ureteric smooth muscle by progesterone predisposes to upper urinary tract dilation, and bladder displacement superiorly and anteriorly, by the growing uterus can also lead to bladder emptying impairment, thereby stasis of urine; moreover, the increased condensation of glucose and amino acids found in urine during pregnancy increases the possibility of UTIs. In addition, an already short urethra (~3–4 cm in females) and difficulty with hygiene owing to a distended pregnant belly increase the risk for bacterial infections during pregnancy (Johnson, 2021). Additionally, the physiologic increase in plasma volume during pregnancy decreases urine concentration. Up to 70 percent of pregnant women develop glycosuria, which encourages bacterial growth in the urine. Increases in urinary progestins and estrogens may lead to a decreased ability of the lower urinary tract to resist invading bacteria. This decreased ability may be caused by decreased ureteral tone or possibly by allowing some strains of bacteria to selectively grow (Romero, 1989). These factors may all contribute to the development of UTIs during pregnancy.UTI in pregnancy are a large and under-emphasized risk factor for pregnancy morbidity and adverse birth outcomes in low- and middle-income country (LMIC) settings (Gilbert et al., 2013). UTI may present in pregnancy with symptoms of acute cystitis or pyelonephritis , or may be more insidious in women with asymptomatic bacteriuria (ASB). Screening and treatment of ASB by urine culture is recommended for all women at least once in early pregnancy in high-income countries, by the Infectious Diseases Society of America (Nicolle et al., 2006), Canadian Task Force on Preventive Care and National Institute of Health and Clinical Excellence of the United Kingdom (LONDON RCOG press 20008). In low-income countries, screening and treatment of UTI or ASB is

challenging due to the costs and logistics of performing urine culture. Recently, the World Health Organization (WHO) made context-specific antenatal care recommendations for screening and treatment of ASB in LMIC (WHO , Genava 2016), recommending urine culture in settings with capacity, or mid-stream urine Gram stain, and treatment of ASB.

UTIs are the second common health problems among pregnant women 'after anemia' (Amiri *et al.,* 2015). In Egypt, Mohammad et al., (2013) conducted a study of frequency and risk factors of UTIs among pregnant women in Suez Governorate and revealed that the frequency of UTIs during pregnancy was 30.29%. Altaf *et al.* ,(2017) conducted a study of incidence of UTIs among antenatal patients in India and reported that the incidence of UTIs in pregnant women was 30%. Moreover, Onyango *et al.,* (2018) conducted a study of UTIs among pregnant women at Nairobi, Kenya and revealed that prevalence of UTIs in pregnant women was 15.7% regardless of the women's age, parity, and gestation. Incidence of ASB in pregnancy is very common in Bangladesh (Ullah et al., 2007). Among the healthy pregnant mothers attending a tertiary care hospital in Dhaka, 30% had asymptomatic bacteriuria. (Khatun, 1985). About 30% of women with untreated asymptomatic bacteriuria during pregnancy develop pyelonephritis, which may lead to delivery of premature or low-birth-weight infants (Gilstrap, 1981). This risk is reduced by 70 to 80 percent if bacteriuria is eradicated.

In pregnancy, UTIs include two groups : asymptomatic bacteriuria (ASB) and symptomatic bacteriuria (SB). ASB is defined as the persistent presence of bacteriuria within the urinary tract of women who have no symptoms. Jain *et al., (* 2013) conducted a prospective cohort study in India, which revealed that the prevalence of ASB was 17% in early pregnancy and 16% in the third trimester. Baker *et al.,* (2015) reported that the prevalence of ASB is doubled in pregnancy to 2–15%, and if left untreated, ~40% of those infected will develop an acute symptomatic UTIs. Moreover, a systematic review and meta-analysis conducted by Ghafari *et al.,* (2016) among Iranian pregnant women revealed that the overall prevalence of ASB was 13%. Consequences of neglected ASB can be significant, including elevated risk of pyelonephritis, premature labor, fetal death, and pregnancy-induced hypertension.

Symptomatic bacteriuria includes cystitis and pyelonephritis. Cystitis is an infection of the bladder, in which, there are symptoms of local infection that include

frequency, dysuria, urgency, suprapubic pain, and hematuria besides presences of significant bacteriuria. Cystitis occurs in ~1–4% of pregnancies. Pyelonephritis is an infection of the parenchyma of the kidney, in which there are symptoms of chills, fever, flank pain, vomiting, malaise, and back pain markedly in the costovertebral angle in addition to significant bacteriuria. Pyelonephritis occurs in 0.5–2% of pregnant women (Johnston *et al.,* 2017; Lowder *et al.,* 2018). A study conducted by Ranjan *et al.*,(2017) reported that the prevalence rate of UTIs among pregnant women in Bhimavaram was 35%. Another study was conducted by Yasmin *et al.,* (2018) revealed that the prevalence rate of UTIs among pregnant women in Katihar district, Bihar, was 28%.

Moreover, risk factors of bacteriuria during pregnancy rise with parity, low socioeconomic status, sexual activity, diabetes mellitus, chronic urinary retention, sickle-cell trait or disease, previous UTIs history, neuromuscular dysfunction bladder, structural disorders of urinary tract, renal stones, and catheterization (Cibulka *et al*., 2022). UTIs can lead to serious obstetric complications, including poor maternal and fetal outcomes such as anemia, preeclampsia, renal failure, septicemia, intrauterine growth retardation, acute respiratory distress, and prematurity (Lawani *et al.,* 2015; Willy *et al.,* 2015). A study conducted by Amiri *et al.,* (2015) regarding the prevalence of UTI among pregnant women and its complications in their newborns during the birth in the hospitals of Dezful city, Iran 2012–2013, revealed that weight and height of newborn infants of mothers with UTIs were significantly lower compared with newborns of healthy women. So, it is important to reduce the risk of infection and complications in pregnant women by creating awareness regarding the causes and symptoms of UTIs and prevention of the factors causing it, especially by educating women before and during pregnancy.

So, they must routinely be screened for and treated accordingly if ASB is found to be present. But it is not a common practice in Bangladesh and screening for ASB in pregnancy is not considered as an essential part of antenatal care (ANC) like routine checkup for albumin and sugar in urine. In some cases, it is generally done only in the first visit of ANC (Khanum et al., 2016, BERDEM).

The present study was designed to identify the common risk factors associated with UTI during pregnancy and determine the bacterial profile and antibiogram of uropathogens among pregnant women in BBMH, USTC, Foy's lake , Chattogram.

Aims and Objectives

General objectives

To determine the prevalence of urinary tract infection among symptomatic and asymptomatic pregnant women attending antenatal care in Bangabandhu Memorial Hospital in USTC in Chattagram Metropolitn Area.

Specific objectives

1. To determine the overall prevalence of urinary tract infection (UTI) among pregnant women.

2. To identify the risk factors associated with UTIs pregnant mother.

3. To identify isolated bacterial uropathens associated with UTI pregnant mother and determine their drug susceptibility pattern to selected antimicrobial agent.

Chapter 2

Literature Review

Urinary tract infection (UTI) may be defined as the pathogens in the urinary tract. UTI is an inflammatory response of the urothelium to bacterial invation that is usually associated with bacteriuria and pyuria. Anatomically, urinary tract is divided into an upper portion composed of kidneys, renal pelvis and ureters and lower portion made up of urinary bladder and urethra. UTI may involve only the lower urinary tract or both upper and lower tract (Fatima and Mussaed 2018).

UTIs are generally classiefied into their anatomical locations or in terms of their severity and /or complexity.

1. Lower UTI, a term which encompasses cystitis and urethritis , is generally a benign condition that causes the typical symptoms of dysuria, suprapelvic pain ,frequency of micturation, urgency, hesitancy and incomplete voiding. Systemic manifestations such as fever are uncommon and long term sequelae are rare.
2. Upper UTI or pyelonephritis is an invasive infection of renal parenchyma, classically presents with the triad of fever, renal angle tenderness, nausea and vomiting (Rane et al.,2013).

Urinary tract infection can be either symptomatic or asymptomatic.

Patients with significant bacteriuria and have at least two symptoms referable to the urinary tract infection (dysuria, urgency,frequency,incontinence, suprapubic pain, flank pain or costo vertebral angle tenderness, fever (temp. $\geq$ 38oC) and chills are said to be symptomatic. Asymptomatic bacteriuria (ABU) is a condition which is characterized by presence of bacteria in two consecutive clear-voided midstream urine specimens both yielding positive cultures ($\geq$105cfu/ml) of the same uropathogen , in a patient without classical symptoms of UTI (Loh and Sivalingam, 2007).

2.1 Epidemiology and public health issues

Urinary tract infection (UTI) are most frequent in infants, young women and the elderly which around a third of women by the age of 24 years having suffered a UTI requiring treatment and around 50% of women having had an episode of UTI in their lifetime. Overall, UTIs are around twice as common in women as in men. (Dasgupta et **al., 2013).** UTIs are among the most common bacterial infections that affect the urinary tract. They are common, affect men and women of all ages, and vary dramatically in their presentation and sequelae. In the USA, they are responsible for 8.6 million health care visits and an estimated cost of 1.6 billion dollars each year. UTIs are one of the most common medical complications that affect ~13–33% of pregnant women worldwide. They are also accountable for 10% of all admissions to hospital during pregnancy in general (Foxman, 2014 ; Fatima and Mussaed, 2018) .

One study was conducted in Sylhet, Bangladesh, showed one in eleven women had a UTI in pregnancy and approximately half of cases were asymptomatic. The prevalence of UTI was 8.9% (4.4% symptomatic UTI, 4.5% asymptomatic bacteriuria). Risk factors for UTI in this population included maternal under nutrition (mid-upper arm circumference <23 cm: aOR= 1.29, 95% CI: 1.03–1.61), primiparity (aOR= 1.45, 95% CI: 1.15–1.84), and low paternal education (no education: aOR= 1.56, 95% CI: 1.09–2.22). The predominant uro-pathogens were *E. coli* (38% of isolates), *Klebsiella* (12%), and staphylococcal species (23%), Group B streptococcus accounted for 5.3% of uro-pathogens . Rates of antibiotic resistance were high, with only two-thirds of *E. coli* susceptible to 3rd generation cephalosporins (Anne et al., 2020).

Another Bangladeshi study recruiting from ANC clinics reported a 5% bacteriuria rate, with 1% of women presenting with UTI symptoms (Razzaaque et al.,1977). Reports from urban and rural Rajshahi district, Bangladesh reported that 4–12% of women presenting to antenatal care had asymptomatic bacteriuri (Ullah et al., 2012).

2.2 Risk Factors

Multiparty, less paternal education and maternal under nutrition were significant risk factors for urinary tract infection (UTI) . Poor hygiene practices may be more common in first time mothers of young age and those with low Socio-economic condition (SEC) predispose them to urinary tract infection (Schnarr et al.,2008). Low paternal education is a marker for low SES, a frequently reported risk factor for UTI (Schnarr J et al. 2008). Maternal undernutrition, defined as MUAC (Mid upper arm circumference) < 23 cm, is an important and under-recognized cause of immunodeficiency globally (Katona and katona - Apte ,2008). Protein energy malnutrition may impair immune function (i.e. antigen-presenting cell and cell mediated T-cell function), and increase risk of maternal infections, including UTI (Raiten et al., 2015). Other relative risk factors , like sexual activity, diabetes mellitus, chronic urinary retention, sickle-cell trait or disease, previous UTIs history, neuromuscular dysfunction bladder, structural disorders of urinary tract, renal stones and catheterization (Cibulka *et al*., 2022).UTIs can lead to serious obstetric complications, including poor maternal and fetal outcomes such as anemia, preeclampsia, renal failure, septicemia, intrauterine growth retardation, acute respiratory distress, and prematurity (Lawani *et al.*, 2015; Willy *et al.* 2015). A study conducted by Amiri *et al.* (2015) regarding the prevalence of UTI among pregnant women and its complications in their newborns during the birth in the hospitals of Dezful city, Iran, 2012–2013, revealed that weight and height of newborn infants of mothers with UTIs were significantly lower compared with newborns of healthy women. So, it is important to reduce the risk of infections and complications in pregnant women by creating awareness regarding the causes and symptoms of UTIs and prevention of the factors causing it, especially by educating women before and during pregnancy **.**

2.3 Pathogenesis

Pregnant women are at increased risk for urinary ract infection (UTIs). Beginning in week 6 and peaking during weeks 22 to 24, approximately 90 percent of pregnant women develop ureteral dilatation, which will remain until delivery (hydronephrosis of pregnancy). Increased bladder volume and decreased bladder tone, along with decreased ureteral tone, contribute to increased urinary stasis and ureterovesical reflux (Patterson and Andriule,1987). Additionally, the physiologic increase in plasma volume during pregnancy decreases urine concentration. Up to 70 percent of pregnant women develop glycosuria, which encourages bacterial growth in the urine. Increases in urinary progestins and estrogens may lead to a decreased ability of the lower urinary tract to resist invading bacteria. This decreased ability may be caused by decreased ureteral tone or possibly by allowing some strains of bacteria to selectively grow(Romero et al., 1989).These factors may have significant role for the development of UTIs during pregnancy.

2.4 Types of UTI

There are three major sorts of urinary tract infection (UTI) in pregnancy. They are asymptomatic bacteriuria, acute cystitis and acute pyelonephritis.

2.4.1 Asymptomatic bacteriuria

It happens when microscopic organisms is found in a voided urine test. It's caused by bacterial colonization of the urinary tract (Ernst,2018). Asymptomatic bacteriuria happens in 2 to 7 percent of pregnant women (Bimoch et al.,2010). ABU is a condition which is characterized by presence of bacteria in clear-voided midstream urine specimens which yielding positive cultures (≥105 cfu /ml) of the uropathogen, but without classical symptoms of UTI.

Whereas symptomatic patients are characterized by presence of bacteria in clear-voided midstream urine specimens which yielding positive cultures (≥105cfu/ml) of the uropathogen, and have at least two symptoms referable to the urinary tract infection (dysuria, urgency, frequency ,incontinence, supra-pubic pain, flank pain or costovertebral angle tenderness, fever (temp≥ 38oC) and chills. (Anick et al. 2011). Incidence of ASB in pregnancy is very common in Bangladesh.(Ullah et al., 2007) . If asymptomatic bacteriuria is untreated in pregnancy, the rate of subsequent UTI is

approximately 25% (Gilstrap et al., 2009). Due to both the high rate and potential seriousness of pyelonephritis, it is recommended that all pregnant women be screened for ASB at the first prenatal visit. This is most often done with a clean catch urine culture. Treatment of ASB decreases the rate of clinical infection to 3% to 4%. (Patricia J et al. 2021) The rate of asymptomatic bacteriuria in non-pregnant women is 5% to 6% which compares similarly to estimated rates in pregnancy of 2% to 7%. ASB is seen more frequently in parous women and women of low socioeconomic status.(Patricia et al.,2021) Women who are carriers for sickle cell trait also have a higher incidence of ASB. (Giistrap et al., 2001)

2.4.2 Urethritis

It is characterized by urethral colonization resulting in dysuria and polyuria. Approximately 50% of pregnant women suffering from this complication do not have significant asymptomatic bacteriuria, and in 30% of them, urine cultures are negative. From a practical standpoint, only 20% of symptomatic patients have urine culture with more than 108 colonies/ml of urine. Another important detail is that some etiological agents involved in urethritis are normal floras commonly found in the vaginal cavity and that cause genital infections - some cannot be detected in routine urine cultures, such as Chlamydia trachomatis and Mycoplasma hominis. However, the potential invasiveness of these bacteria in the urinary tract is low (Duart et al., 2008).

2.4.3Cystitis

Cystitis is an infection of the bladder, in which, there are symptoms of local infection that include frequency, dysuria, urgency, suprapubic pain, and hematuria besides presences of significant bacteriuria. Although dysuria and polyuria may suggest UTIs, these symptoms may concomitantly be present in pregnant women with other conditions, such as bacterial vaginosis (Nicolle et al., 2006). In addition, hemorrhagic cystitis during pregnancy can be confounded with bleeding issued from a process that could be bacterial, viral, fungal, immune (allergic) and radiotherapy. Cystitis is associated with preterm delivery and should be treated as soon as detected (Fakhoury et al., 1994). Cystitis occurs in ~1–4% of pregnancie (Mahmoud 2019). Up to 30 percent of patients with untreated asymptomatic bacteriuria later develop symptomatic cystitis (Kass, 1970). Over a six-year period, Harris and Gilstra(Harris

et al., 1981) found that 1.3 percent of obstetric patients who delivered at a single hospital developed acute cystitis with no symptoms of pyelonephritis.

2.4.4 Pyelonephritis

Pyelonephritis is an infection of the parenchyma of the kidney, in which there are symptoms of chills, fever, flank pain, vomiting, malaise, and back pain markedly in the costovertebral angle in addition to significant bacteriuria. Pyelonephritis occurs in 0.5–2% of pregnant women (Johnston *et al.*,2017 ; Lowder *et al.,* 2018). Acute pyelonephritis during pregnancy is a serious systemic illness that can progress to maternal sepsis, preeclampsia, hypertention, renal failure, and premature delivery. The diagnosis is made when the presence of bacteriuria is accompanied by systemic symptoms or signs such as fever, chills, nausea, vomiting and flank pain. Symptoms of lower tract infection (i.e.frequency and dysuria) may or may not be present. Many studies have reported that pyelonephrities is more common the second half of pregnancy with an incidence peak during the last two trimester of pregnancy(Gilstrap et al.,1981). **W**ithout treatment, as many as 20 to 35 percent of pregnant women with asymptomatic bacteriuria will develop a symptomatic urinary tract infection (UTI), including pyelonephritis, during pregnancy (Smaill and Vazquez 2019 ; Moore et al., 2018.) This risk is reduced by 70 to 80 percent if bacteriuria is eradicated (Thomas et al., 2015). Pyelonephritis occurs in 2 percent of pregnant women; up to 23 percent of these women have a recurrence during the same pregnancy (Gilstrap et al., 1981) Early,aggressive treatment is important in preventing complications from pyelonephritis (Delzell et al., 2000).

2.5 Bacteriology

Organisms causing UTI in pregnancy are the same uropathogens which commonly cause UTI in non-pregnant patients. *Escherichia coli* is the most common organism isolated. An 18-year retrospective analysis found *E. coli* to be the causative agent in 82.5% of cases of pyelonephritis in pregnant patients (Wing et al,. 2013) Traditionally, *E. coli* has been the dominant uropathogen owing to its possession of toxins, adhesins, pili and fimbriae that allow adherence to uroepithelium. These protect the bacteria from urinary clearance and allow bacterial multiplication and uroepithelial tissue invasion. (Bahati et al.,2021). Some recent studies however indicate that *klebsiella* which has traditionally been a nosocomial organism is an

emerging dominant community acquired uropathogen (Taye et al., 2018 ; Manjula et al., 2013 ; Caneiras et al., 2019; Kaduma et al., 2019) . This has been attributed to its emerging and inherent virulent factors that include capsule, lipopolysaccharide, Siderophore, types 1 and 3 fimbriae, biofilm formation, and antibiotic resistance. Other bacteria which may be seen include *staphylococcus, streptococcus, proteus* and *enterococcus* species. Gram-positive organisms such as group B *streptococcus* and *staphylococcus. Saprophyticus* are less common causes of UTI. Other less common organisms that may cause UTI include *enterococci, gardnerella vaginalis* and *ureaplasma ureolyticum.*

Group B *streptococcal* (GBS) vaginal colonization is known to be a cause of neonatal sepsis and is associated with preterm rupture of membranes, and preterm labor and delivery. GBS is found to be the causative organism in UTIs in approximately 5 percent of patients (Mead and Harris,1978). Evidence that GBS bacteriuria increases patient risk of preterm rupture of membranes and premature delivery is mixed (Moller et al.,1984).

2.6 Laboratory Diagnosis

Urinary tract infection is common, and it is not surprising that urine specimens make up a large proportion of those samples submitted to the routine diagnostic laboratory. Many of these specimens will show no evidence of infection and several methods can be used to screen out negative samples. Those that grow bacteria need to be carefully assessed to quantify the degree of bacteriuria and hence clinical relevance. To influence treatment, a final report should be produced within 24 hours of specimen receipt, with turnaround times continuously monitored.

The laboratory investigation of microbial causes of UTI involves examining specimens to detect, isolate, and identify pathogens or their products using microscopy, culture techniques, and biochemical methods (Cheesbrough, 2006).The diagnosis of UTIs begins with the screening of patients with symptoms suggestive of UTIs by a physician (Bell et al.,2016). Determination of the number and types of bacteria in the urine is an extremely important diagnostic procedure (Braunwald et al., 2001). Thus, only patients who have significant bacteriuria obtained from appropriate urine samples (a clean-catch midstream and catheter samples of urine) are included in the microbiological analysis (Wazait et al., 2003; Kahlmeter, 2003; Haryniewicz et al., 2001). Bacteiruria refers to the presence of bacteria in the urine. It

is regarded as significant when the urine contains 105 organisms or more per ml of pure isolate .

The traditional and emerging methods used in the laboratory diagnosis of UTI.

Urine samples for analysis are most commonly obtained as "clean catch" mid-stream voided urine samples. The nitrite and leucocyte esterase tests are the two standard dipstick analyses used for urinalysis (Kumer et al., 2014). The nitrite test is positive for those bacteria that can reduce nitrate to nitrite and detects bacteria at concentrations >105 cfu /mL, and the leucocyte esterase test detects an enzyme produced by leucocytes whose level increases in the urine during infection. Positive nitrite and esterase tests can indicate UTIs, especially in the presence of diagnostic symptoms. However, it is not recommended to treat a positive nitrite or positive esterase test alone as an indication of UTI. The main drawback of these tests lies in their poor negative predictive values. They cannot be used to rule out infections because Gram-positive pathogens such as *Enterococci* and Staphylococcus do not produce nitrites, and leucocyte esterase levels may not be high enough to be detected early in an infection. Therefore, these dipstick tests are no longer employed at point-of-care; rather, they are used in the clinical laboratory along with other tests (Kumer et al., 2014 ; Davenport et al., 2017).

Clinical labs may also perform microscopic analysis of the urine to detect white blood cells or bacteria. Pyuria and bacteriuria are helpful for UTI diagnosis when symptoms are present. In the absence of symptoms, bacteriuria may be a result of contamination or asymptomatic bacteriuria. Asymptomatic bacteriuria is present in 5% of healthy premenopausal women, 2–10% of pregnant women, and in 10–15% of older women (Chu et al., 2018). It can occur in school children, patients with catheters, institutionalized elderly patients, and patients with complications such as diabetes or spinal cord injuries. Treatment for asymptomatic bacteriuria is recommended only for pregnant women (Nicolle et al., 2019).

The most common cause of UTIs across all age groups is *Escherichia coli*. Other common uropathogens are the *Enterobacteriaceae* family, Proteus, Klebsiella, *Staphylococcus Saprophyticus* and *Enterococcus* sp. Group B Streptococcus is frequently isolated from pregnant women (Chu et al.,2018). Common pathogens are easily identified with the use of chromogenic agar during urine culture Bacterial counts for the dominant species at above 105 cfu /mL were traditionally considered diagnostic.

The type of media used for urine cultures is Cystine lactose electrolyte-deficient (CLED) agar. This media is now used by most laboratories to isolate urinary pathogens because It gives consistent results and allows the growth of both Gram-negative and Gram-positive pathogens. The indicator in CLED agar is bromothymol blue and therefore lactose-fermenting colonies appear yellow. The medium is electrolyte-deficient to prevent the swarming phenomenon of Proteus species (Cheesbrough, 2006). Urine culture should be incubated overnight at 35oC - 37oC in ambient air before being read (Wilson and Gaido , 2004). All positive cultures with SB are then identified at species level by their colony characteristics, gram-staining reaction and by the pattern of biochemical profiles using standard procedures (Cheesbrough, 2006).

.

2.7 Pharmacological management

2.7.1 General Principles of antimicrobial use

Choosing the right antimicrobial is an essential part of managing pregnant patients with urinary tract infections. It is not only important to choose the right drug, but also consideration should be given to selecting the right dose and treatment duration. By effectively treating urinary tract infections it is hoped to reduce the risk of maternal sepsis, pyelonephritis, preterm labour and also adverse outcomes for the fetus. Consideration should also be given to potential teratogenicity when choosing an antimicrobial.

Recently evidence has developed suggesting a link between the use of sulfa derivatives and nitrofurantoin and congenital disabilities when these medications are prescribed in the first trimester. These studies have had limitations; however, it is currently recommended to avoid the use of these medications in the first trimester when alternatives are available (Obstet and Gynecol, 2017). Because the potential consequences of untreated UTI in pregnancy are significant, it is reasonable to use these medications when needed as the benefit strongly outweighs the risk of use. Additional cautions exist with respect to these 2 classes of antibiotics. Patients with G.6 P deficiency should not be prescribed sulfa derivatives or nitrofurantoin as these medications can precipitate hemolysis. In the late third trimester, trimethoprim-sulfamethoxazole should be avoided due to the potential risk for development of kernicterus in the infant following delivery (Patricia et al.,2021).

2.7.2 Asymptomatic Bacteriuria

According to the American College of Obstetricians and Gynecologists, screening of ASB is recommended in all pregnant women (Macejko and Schaeffer,2007) Urine cultures are recommended early in pregnancy in order to detect ASB. If discovered, antibiotic treatment is given for three to seven days. Early detection and treatment of ASB can prevent the development of a UTI by 80% to 90% (Warren et al.,1999). The safest antibiotics to use during pregnancy for the treatment of ASB are nitrofurantoin, amoxicillin, amoxicillin with clavulanate, and cephalosporin (Fitzgerald, 2007). The development of resistance to amoxicillin is common among uropathogens and should be monitored. In the U.S., up to 33% of the uropathogens that cause UTIs are resistant to amoxicillin (Macejko and Schaeffer, 2007). Therefore, amoxicillin should be used only if susceptibility results are known. Tetracyclines and fluoroquinolones are contraindicated during pregnancy and should be avoided throughout all the developmental trimesters (Colgan et al., 2006).

2.7.3 Pyelonephritis

Pyelonephritis is a serious condition usually requiring hospitalization. Once an evaluation has been completed, treatment consists primarily of directed antibiotic therapy and IV fluids to maintain adequate urine output. Fever should be treated with a cooling blanket and acetaminophen as needed. Commonly, second or third generation cephalosporins are used for initial treatment. Ampicillin and gentamicin or other broad-spectrum antibiotics are alternatives. Patients shouled be monitored closely for the development of worsening sepsis.

2.8 Prevention

2.8.1 Hydration status : has been linked to the risk of urinary tract infection. A study examined nursing home residents and administered a drinking schedule to participants to increase their fluid intake, which decreased UTIs requiring antibodies by 56 percent (Katie et al., 2019)

2.8.2 Role of Vitamin **C:** Some evidence shows that increasing your intake of vitamin C could protect against urinary tract infections.

An older 2007 study of UTIs in pregnant women looked at the effects of taking 100 mg of vitamin C every day .The study found that vitamin C had a protective effect,

cutting the risk of UTIs by more than half in those taking vitamin C, compared with the control group (Gonzalo et al., 2020)

2.8.3. **Drinking unsweetened cranberry juice** : is one of the most well-known natural remedies for urinary tract infection.

In a 2016 study, women with recent histories of UTIs drank an 8-ounce (240-mL) serving of cranberry juice every day for 24 weeks. Those who drank cranberry juice had fewer UTI episodes than the control group .(Kevin et al., 2016)

A 2015 study showed that treatment with cranberry juice capsules equivalent to 8-ounce servings of cranberry juice could cut the risk of UTIs in half (Betsy et al.,2015).

2.8.4. Wiping from front to back: Wiping from front to back after utilizing the washroom avoids microbes from the butt-centric locale from spreading to the vagina and urethra (Laurent, 2011).

2.8.5 The use of probiotics has been linked to many things, from improved digestive health to enhanced immune function (Sarah King et al.,2014).

One study found that *Lactobacillus*, a common probiotic strain, helped prevent UTIs in adult women (Peter et al.,2013). Another study found that taking both probiotics and antibiotics was more effective at preventing recurrent UTIs than using antibiotics alone (Mohammad et al.,2019).

Chapter 3

Materials and Method

3.1 Type of study : Hospital based cross sectional, observational study.

3.2 Place of study : Bangabandhu Memorial hospital, Foy's Lake, Chattogram.

3.3 Study period : The study was carried out from from January to June 2021.

3.4 Study population : 104 patient data forms were collected. A total of one hundred four informed and consented pregnant mother with or without the symptoms of urinary tract infection were screened by attending physician or gynecologist and included in the study.

3.4.1 Inclusion Criteria :

- Mothers who are pregnant
- Mothers who are willing to participate
- Age between 18 to 45 years .
- Pregnant mother attending hospital as antenatal visit irrespective of age, parity and gestion.

3.4.2 Exclusion criteria:

- Mothers who are not willing to participate
- Mothers who are not accessible at the time of information collection
- Mothers who were on treatment with antimicrobials.

.

3.5 Sampling technique : Non probability purposive type of sampling.

3.6 Sample size : One hundred and four (104) urine speciemens were collected from the pragnent mothers attending for antenatal visit at Bangabandhu Memorial Hospital, Foy's Lake ,Chattogram.

3.7 Data collection technique :

A set of questionnaire was used for each cases. All the relevant information and socio-demographic data were systematically recorded in pre-designed data sheet.

3.8 Methods

All the pregnant mothers irrespective of age, parity, gestation, with or without the symptoms of urinary tract infection (UTI) , attending antenatal clinic for regular check-up were randomly enrolled in the study. A continuous 104 pregnant mothersn with or without the indications of UTI were included in this consideration. Pregnant mothers having a renal illness or on antimicrobial treatment within 72 hours were excluded due to the truth that the antimicrobial must have restrained or devastated the pathogens. Socio-demographic information such as age, occupation, education level, family status and residence environment and term of development were collected from the pregnant mothers utilizing standard surveys and kept secret amid the investigate. With all asceptic precautions, clean-catch midstream urine samples about 15-20 ml were collected from each pregnant mother into a sterile ,wide-mouthed screw- capped container by standered technique for culture and sensitivity test. After inoculating in UTI agar media by calibrated wire loop (0.01ml). Identification of organisms were done as per standered laboratory methods of identification. A specimen was considered positive for UTI if a single organism was cultured at a concentration of ≥105 CFU / ml in both symptomatic and asymptomatic pregnant mothers. Antimicrobial sensitivity pattern of the isolates were tested against different microbials.

3.9 Interviews

Face to face, structured interviews were conducted on a total of 104 patients. Information was gotten approximately age, pariry, gestation, education status, occupation and living environment , history of urinary tract infection, any knowledge about UTI or not. Some of them were willingly explain every problem they were facing during UTI and some didn't cooperate well. Most of them were unknown about UTI. Interviews were taken from both the outdoor and indoor section of Gynae and Obstetric department who came to this hospital for antenatal visit.

3.10 Statistical Analysis

Epidemiological data were entered into a spreadsheet program (Microsoft Office Excel 2010) and transferred to STATA-13 software for data summary and analysis. Any factor having p value $\leq$ 0.20 inthe univariable analysis was selected for multivariable logistic regression analysis to see the independent association of a risk factor with the occurrence of UTI. A p value less than or equal 0.05 was considered statistically significant in the final multivariable model.

3.11 Ethical Considerations

The research project was approved and ethically cleared by Research and Ethics committee of CVASU. Ethical approval was also obtained from Bangabandhu Memorial Hospital, Foy's Lake, Chattogram. Informed written consent was obtained from the study participants. Urine culture and sensitivity results were reported to the physician for appropriate treatment.

CHAPTER-4

RESULTS

4.1 Urinary Tract Infection in Pregnant Women

A total of 104 pregnant women with or without the symptoms of urinary tract infection (UTI), attending at the Bangabandhu Memorial Hospital, USTC for antenatal visit were enrolled in the study. Among them 31(29.81%, 95% CI: 21.23-39.56) women were reported with UTI after having their urine samples positive for bacteriological culture testing. Furthermore, 9(18.75 %, 95 % CI: 8.94-32.62) of the 104 participants were diagnosed with UTI without any symptoms, which were categorized as asymptomatic cases and 22 (39.29%, 95 % CI: 26.5-53.2) respondents were symptomatic UTI patients.

4.2 Isolated Organisms in Samples

Among the 104 samples of the participants, 13.4% (14, 95% CI: 7.5-21.5) were positive to *Escherichia coli*, 7.6% (8, 95% CI: 3.3-14.5) were positive for *Klebsiella spp*., Both *Staphylococcus aureus* and *Enterococcus* were found in 3.8% (4, 95% CI: 1.05-9.5) of samples, and *Pseudomonas spp.* was found in 0.9% (1, 95% CI: 0.02-5.2) of pregnant women.

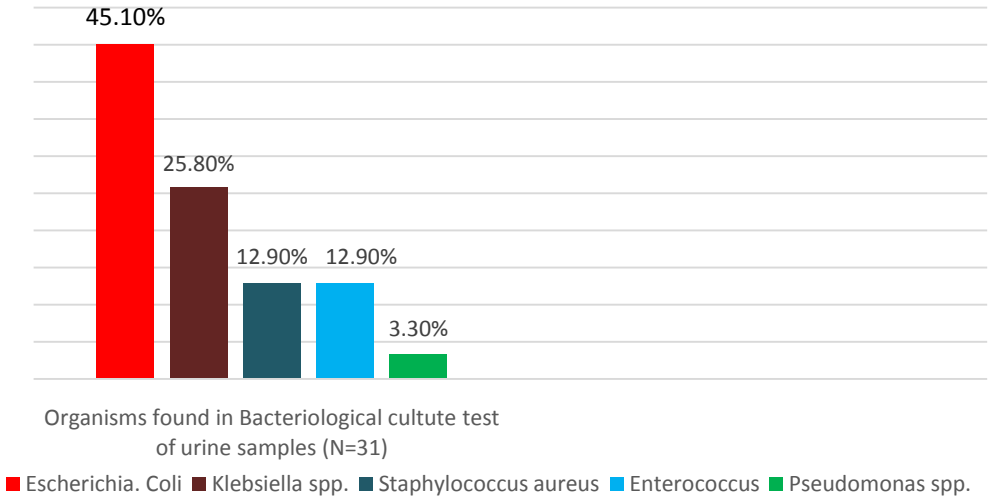


Figure 4.1: Distribution of different organisms based on their Bacteriological culture test performance.

4.3 Antimicrobial resistance profile of UTI organisms

Among the 14 *E .coli* samples, highest number of isolates were sensitive to both imipenam (93%) and amikacin (93%). On the other hand, highest number of *Klebsiella spp.* were sensitive to amikacin (87.5%), gentamycin (87.5%) and imipenam (87.5%). In case of *S. aureus*, all the isolates were sensitive to amikacin (100%), cefuroxime (100%), ciprofloxacin (100%) and nitrofurantoin (100%). Similarly, all *Enterococcus* showed sensitivity to imipenam (100%). Furthermore, the single *Pseudomonas spp.* isolate was sensitive to amikacin, ceftriaxone, co-amoxiclave, imipenam and nitrofurantoin.

In this study we found that, 28.6% *E.coli* were resistant to ciprofloxacin, co-amoxiclave, and gentamycin respectively. In case of *Klebsiella spp,* one fourth were resistant to ceftriaxone, cefuroxime and ciprofloxacin. Meanwhile, the single *Pseudomonas spp.* isolate was resistant to ciprofloxacin and gentamycin.

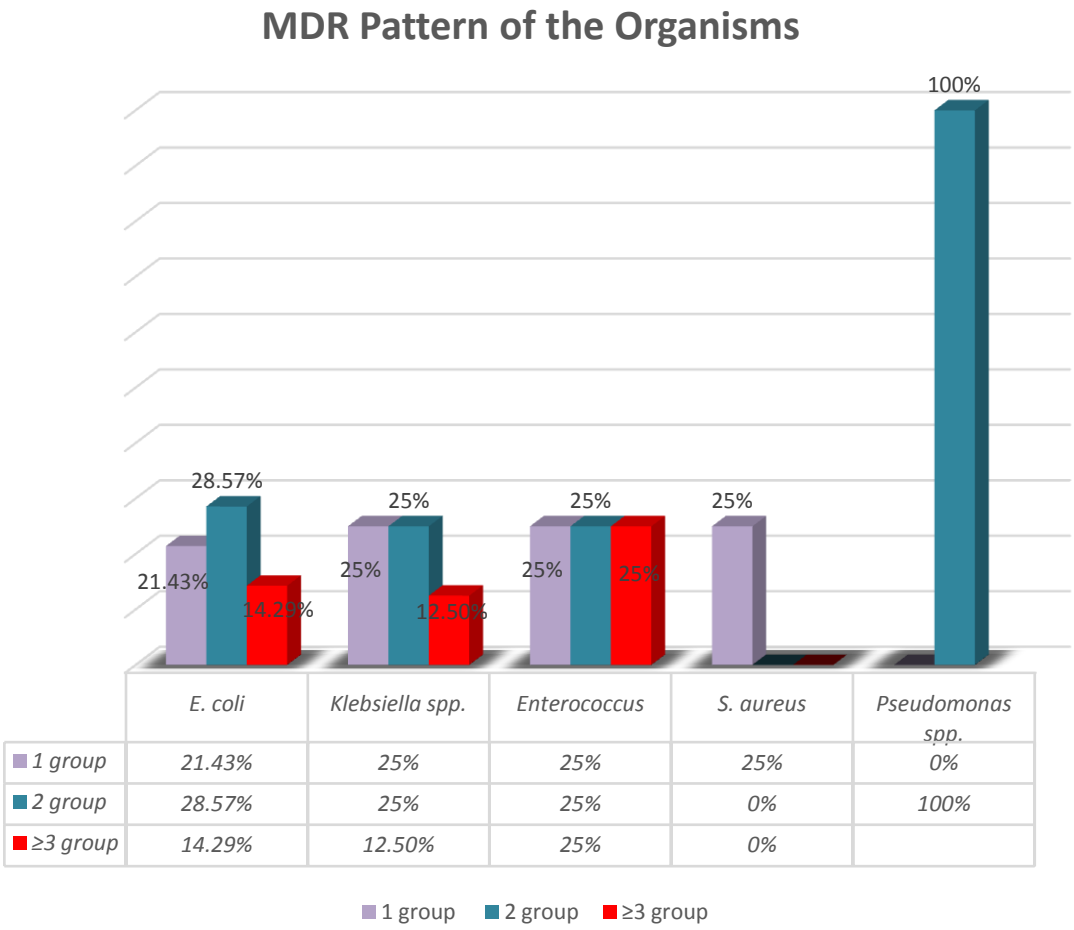
Antimicrobial susceptibility patterns of the isolates were interpreted following the guidelines of Clinical and Laboratory Standard Institute (CLSI). The susceptibility patterns of the isolates are shown in Table 4.1.

Table 4.1 Antimicrobial resistance pattern of UTI causing bacterial isolates

Antibiotics	*E. coli*			*Klebsiella spp .*			*Staphylococcus aureus*			*Enterococcus*			*Pseudomonas spp .*		
	S % (n)	I% (n)	R% (n)	S% (n)	I% (n)	R % (n)	S% (n)	I% (n)	R % (n)	S% (n)	I% (n)	R % (n)	S% (n)	I% (n)	R% (n)
Amikacin	93% (13)	0% (0)	7% (1)	87.5 % (7)	0% (0)	12. 5% (1)	100 % (4)	0% (0)	0% (0)	75 % (3)	0% (0)	25 % (1)	100% (1)	0% (0)	0% (0)
Ceftriaxone	78.5 % (11)	7.0 % (1)	14.5 % (2)	75% (6)	0% (0)	25 % (2)	50% (2)	25 % (1)	25 % (1)	75 % (3)	25 % (1)	0% (0)	100% (1)	0% (0)	0% (0)
Cefuroxime	64.3 % (9)	14.3 % (2)	21.4 % (3)	62.5 %(5)	12. 5 (1)	25 % (2)	100 % (4)	0% (0)	0% (0)	50 % (2)	0% (0)	50 % (2)	0% (0)	10 0% (1)	0% (0)
Ciprofloxacin	57.1 % (8)	14.3 % (2)	28.6 % (4)	50% (4)	25 % (2)	25 % (2)	100 % (4)	0% (0)	0% (0)	75 % (3)	0% (0)	25 % (1)	0% (0)	0% (0)	100 % (1)
CO-Amoxiclave	64.3 % (9)	7.1 % (1)	28.6 % (4)	75% (6)	12. 5% (1)	12. 5% (1)	50% (2)	25 % (1)	25 % (1)	75 % (3)	25 % (1)	0% (0)	100% (1)	0% (0)	0% (0)
Gentamycin	71.4 % (10)	0% (0)	28.6 % (4)	87.5 % (7)	0% (0)	12. 5% (1)	75% (3)	0% (0)	25 % (1)	50 % (2)	25 % (1)	25 % (1)	0% (0)	0% (0)	100 % (1)
Imipenam	93% (13)	7% (1)	0% (0)	87.5 % (7)	0% (0)	12. 5% (1)	75% (3)	25 % (1)	0% (0)	10 0% (4)	0% (0)	0% (0)	100% (1)	0% (0)	0% (0)
Nitrofurantoin	71.4 % (10)	7.1 % (1)	21.5 % (3)	75% (6)	25 % (2)	0% (0)	100 % (4)	0% (0)	0% (0)	50 % (2)	25 % (1)	25 % (1)	100% (1)	0% (0)	0% (0)

4.4 Multidrug Resistance Pattern (MDR) of UTI causing bacteria

Among the all *E. coli* 14.29% isolates showed resistance against more than three groups of antimicrobials, 12.50% in case of klebsiella spp. and 25% for *enterococcus.*



	E. coli	Klebsiella spp.	Enterococcus	S. aureus	Pseudomonas spp.
1 group	21.43%	25%	25%	25%	0%
2 group	28.57%	25%	25%	0%	100%
≥3 group	14.29%	12.50%	25%	0%	

Figure 4.2 Multidrug Resistance Pattern (MDR) of UTI causing bacteria

4.5 Factors associated with UTI

In Unuvariable logistic regression, history of catheterization [p= 0.003], clinical symptoms like, anaemia [p=0.009], frequent urination [p=0.200], lower abdominal pain [p=0.006], urgency and dysuria [p=0.038 and 0.206 respectively] were found to be significantly associated with UTI among pregnant women and were to be a candidate for multivariate logistic regression analysis**.** (Table 4.2)

The result of multivariate analysis revealed that pregnant women with UTI had a history of lower abdominal pain which was 4.9 times more observable then other symptoms. The odds of having UTI among pregnant women who have previously indwelling catheter were 19.1 times higher than the odds in pregnant women who have not previously indwelling catheter [p=0.023] **(Table 4.3)**.

Table 4.2: Output of univariable logistic regression analysis to identify the effect of different related factors on UTI

Variable	Category (N)	No. of UTI patients	Prevalence (95%CI)	p-value (chi square)	OR (95% CI)	p value (univariable logistic regression)
Sanitation	Well cleaned (11)	2	18.18%	0.046	Ref	
	Moderately Hygiene (28)	7	25.0%		1.49 (0.25-8.67)	0.651
	Dirty (65)	22			2.30 (0.45-11.58)	0.312
Parity	Primiparity (31)	8	25.81%	0.561	Ref	
	Multiparity (73)	23	31.51%		1.32 (0.51-3.39)	0.562
Trimester	After 12 weeks (71)	19	26.76%	0.319	Ref	
	Up to 12 weeks (33)	2	36.36%		1.56 (0.64-3.78)	0.321
Previous history of UTI	No (87)	24	27.59%	0.263	Ref	
	Yes (17)	7	41.18%		1.83 (0.62-5.37)	2.67
History of Catheterization	No (95)	23	24.21%	<0.0001	Ref	
	Yes (9)	8	88.89%		25.04 (2.97-210.99)	0.003
History of diabetes	No (94)	27	28.72%	0.459	Ref	
	Yes(10)	4	40.00%		1.65 (0.43-6.32)	0.462
History of anaemia	No (94)	24	25.53%	0.003	Ref	
	Yes(10)	7	70.00%		6.80 (1.62-28.43)	0.009
Frequent urination	No (85)	23	27.06%	0.195	Ref	
	Yes (19)	8	42.11%		1.96 (0.70-5.48)	0.200
Lower abdominal pain	No (82)	19	23.17%	0.004	Ref	
	Yes (22)	12	54.55%		3.97	0.006

					(1.48-10.63)	
Urgency of urination	No (94)	25	26.20%	0.028	Ref	
	Yes (10)	6	60.00%		4.14 (1.07-15.89)	0.038
Dysuria	No (96)	27	28.13%	0.194	Ref	
	Yes (8)	4	50.00%		2.55 (0.59-10.95)	0.206
Fever	No (101)	30	29.70%	0.892	Ref	
	Yes(3)	1	33.33%		1.18 (0.10-13.55)	0.892

Table 4.3: Multivariable logistic regression model of risk factors for the UTI

Factor	Category	OR	95% CI	P
History of Catheterization	No	Ref	-	0.023
	Yes	19.1	1.50-242.6	
Lower abdominal pain	No	Ref	-	0.020
	Yes	4.9	1.27-19.01	

Chapter 5

Discussion

Urinary tract infections (UTI) are the most common bacterial infections during pregnancy . Untreated UTI can be associated with serious obstetric complications. The present study was conducted to determine the prevalence of UTI among pregnant women, their risk factors, bacterial agents and their antibiotic susceptibility pattern . UTI can be both symptomatic and asymptomatic. A total of 104 pregnant women were enrolled In this study. Of these, thirty (31) urine samples gave significant growth amounting to 29.81% prevalence (95% CI: 21.23 - 39.56), which is nearly similar to K. Perveen (2011), Uttara Adhunik Medical College, who reported prevalence of 26.0%. The prevalence rate was also showing similarity with the study done by M Shaheen (2016), Menoufia University, Egypt. And it was 32.0%. UTI can be both symptomatic and asymptomatic. In present study, prevalence of asymptomatic bacteriuria(ASB) was 18.75 % (95 % CI: 8.94-32.62) and symptomatic bacteriuria (SB) was 39.29% (95 % CI: 26.5 - 53.2) which was near to similar. A study done by Shankar (2018), showed the prevalence of ASB was 17% which was incongruent with current study. It is also observed that prevalence of ASB was 21.2% in Ethiopia (Tadesse , 2018), 29.5% in Nigeria (Izuchukwu, 2017). The different levels of ASB across different states within the country and different countries might be due to the differences in related factors, such as the sample size, geographical differences, social habits prevalent in the community, and the health-related practices (Tadesse , 2018). In our study, a big amount of women with bacteriuria were asymptomatic. The availability of asymptomatic cases have relevance with respect to screening procedures in LMIC. A symptomatic approach to UTI will miss the majority of cases and the opportunity for intervention-treatment to prevent maternal morbidity and adverse pregnancy outcomes. While urine culture is standard of care in high income countries (HIC), it is typically costly and requires laboratory resources, infrastructure, and personnel and is not feasible in many low middle income countries(LMIC) settings. The diagnostic accuracy of urine dipstick and gram stain for diagnosis of ASB is poor, with particularly low sensitivity (Rogozinska et al.,2016; Ajayi et al.,2010). Lower cost, feasible, and accurate point of care methods/diagnostics for screening for ASB are urgently needed to improve detection and management of UTI in LMICs.

The majority of the isolates were gram negative *E.coli* (45.10%), followed by *klebsiella* spp. Which was (25.80%) and then *enterococcus* spp.(12.90%).The gram positive *staphylococcus aureus* was (12.90%) and *pseudomonas aeruginosa* was (3.30%). Simillar result was observed in a study done by S. khanum,2016, BERDEM where *E.coli* was the predominant isolated pathogen followed by *klebsiella spp*. Which was 50.4% and 20.0% respectively. This is similar to most other studies throughout the world where *E. coli* has been consistently the predominant organism causing UTI (Enayet, 2022 ; Okonko et al., 2009) The major contributing factor for isolating higher rate of *E. coli* is due to urine stasis in pregnancy which favors for E. coli strain colonization (Imade et al., 2010 ; Moghadas , 2009). The high ratio of *E.coli* is also due to the presence of this bacteria in the feces, thus it cause autoinfection . In addition, after gaining entry to the bladder *E. coli* are able to attach to the bladder wall and form a biofilm that resists the body's immune response. Other studies of UTI etiology in Bangladesh have similarly reported a predominance of gram negatives, particularly *E. coli*, which comprised 59–75% of isolates, and *Klebsiella* species, which ranged from 6 to 11% of isolates (Haque et al., 2015 ; Majumder et al., 2014]. In a 5-year, large, prospective study of pregnant women in a tertiary care hospital in India, *E. coli* and *klebsiella* were the most common uro-pathogens (42 and 22% of isolates, respectively) (Rizvi et al., 2011).
According to our study, 14.29 % of *E. coli* isolates causing UTI in pregnant women demonstrated multidrug resistant pattern (resistance to equal or more than three antimicrobial groups), 12.50 % for *Klebsiella spp.*, and 25% for *Enterococcus*. In the instance of Chelkeba et al. (2022), a higher percentage was observed where *E. coli*, *Klebsiella* species, *Staphylococcus aureus*, and Coagulase negative *staphylococci* have multidrug resistance proportions of 83%, 78%, 89%, and 78%, respectively. However, the study by Chelkeba et al.(2022). included a large range of sample sizes.

The majority of *E.coli* isolates were susceptible to both imipenam (93 %) and amikacin (93 %). On the other hand, the most *Klebsiella spp.* were sensitive to amikacin (87.5%), gentamycin (87.5%), and imepenam (87.5%). In the instance of *S. aureus*, all isolates were sensitive to amikacin (100%), cefuroxime (100%), ciprofloxacin (100%), and nitrofurantoin (100%). Similarly, imepenam sensitivity was found in all *Enterococcus* strains (100%). Furthermore, amikacin, ceftriaxone,ll effective against the single *Pseudomonas spp*. isolate. This finding is comparable with a study conducted in a Tertiary Care Hospital, Bangladesh (Khanum et al.,

2016), Dessie, Ethiopia (Ali et al., 2018), Addis Ababa, Ethiopia(Wabeet al., 2020; and Chelkeba et al., 2022).

The study found that 28.6% of *E.coli* were resistant to ciprofloxacin, co-amoxiclave, and Gentamycin in this study. One-fourth of *Klebsiella spp*. tested positive for ceftriaxone, cefuroxime, and ciprofloxacin resistance. Meanwhile, ciprofloxacin and gentamycin resistance was found in a single *Pseudomonas spp*. sample. This is in line with a study carried out IBN SINA Diagnostic Center, Badda, Bangladesh (Alam et al., 2017) and in Hussain Memorial Hospitals, Lahore, Pakistan (Asmat et al., 2020).

The high resistance to ciprofloxacin, amoxicillin, and gentamycin found in this study could be due to the easy availability of antibiotics in local pharmacies and frequent antibiotic prescriptions by doctors without antimicrobial susceptibility testing.

In this population, catheterization was a major risk factor for UTI, as was the presence of lower abdomin pain in the respondents. According to Ali et al., 2022, the risk of UTI was 3.2 times higher in pregnant women who previously had to use an indwelling catheter than in pregnant women who had never used one. Other studies (Chowdhury et al., 2021; Wabe et al., 2020; and Edae et al., 2020) were supporting our findings that catheterization history increased the risk of UTI with pregnant women.

Lower abdomen pain was the most common symptom among pregnant women with UTI, according to our study and this finding was in harmony with Tabassum et al., (2021); Asmat et al.,(2021)and Acherjya et al., (2018). A common symptom was lower abdomen pain (Ali et al., 2022).

Poor hygiene habits are more common in young first-time mothers and those with low socioeconomic position, making them more susceptible to urinary tract infections (Schnarr et al., 2008) but in further analysis, our study did not find it significant. However, several of the impacts of this study's univariable analysis were shown to be insignificant in multivariable models, which could be due to the study's low power due to the small number of data.

Chapter 7

Conclusion

This study was undertaken to evaluate the prevalence of urinary tract infecton (UTI) in pregnant women, associated risk factores ,bacteriological profile and antibiotic sensitivity pattern in BBMH in USTC. The incidence of urine culture positivity was 29.81% where incidence of asymptomatic bacteriuria(ASB) and symptomatic bacteriuria(SB) was 18.75% and 39.29% respectively. *E.coli* was the predominant isolates among the study groups which showed highest sensitivity to imipenam and amikacin. In our study ,*E.coli* isolates demonstrated multi drug resistant pattern. In the study, second highest predomiant organisms were *Klebsiella spp*. Which showed sensitivity to amikacin ,gentamycin and imepenam. The high resistance to ciprofloxacin, amoxicillin, and gentamycin found in this study. More than half of the isolated bacteria had multiple drug-resistant features. Therefore, periodic and continuous urine culture for screening and diagnosis is mandatory to reduce the consequence of UTI and multidrug resistance bacteria in pregnancy.

Chapter 8

Limitations and Recommendation

Limitations of the study

1. The study population was selected from one selected hospital in chattagram, so that the result of the study may not reflect the exact picture of the country.

2. The study was conducted at a very short period of time.

3. Small sample size was also a limitations of the present study. Therefore, in a future further study may be under taken with large sample size.

Recommendation

Further large scale study should be conducted to identify low-cost, feasible, and accurate methods for UTI screening and to address high rates of antibiotic resistance in low middle income countries (LMIC).

References

Acherjya G. K., Keya Tarafder, Rina Ghose, Din Ul Islam, Mohammad Ali, Nazma Akhtar, Rajashish Chakrabortty, Satya Ranjan Sutradhar, Pattern of Antimicrobial Resistance to *Escherichia Coli* Among the Urinary Tract Infection Patients in Bangladesh, *American Journal of Internal Medicine*. Volume 6, Issue 5, September 2018 , pp. 132-137. doi: 10.11648/j.ajim.20180605.17

Alam, J., Juliana, F.M., Rahimgir, M., Hossain, M.N., Fatema, B. and Asaduzzaman, M., 2017. Resistance pattern of ciprofloxacin against common uropathogens in selected area of Dhaka city, Bangladesh. *IOSR Journal of Nursing and Health Science (IOSR-JHNS)*, *6*(5), pp.52-57.

Ali, A.H., Reda, D.Y. and Ormago, M.D., 2022. Prevalence and antimicrobial susceptibility pattern of urinary tract infection among pregnant women attending Hargeisa Group Hospital, Hargeisa, Somaliland. *Scientific Reports*, 12(1), pp.1-10.

Ali, I.E., Gebrecherkos, T., Gizachew, M. and Menberu, M.A., 2018. Asymptomatic bacteriuria and antimicrobial susceptibility pattern of the isolates among pregnant women attending Dessie referral hospital, Northeast Ethiopia: A hospital-based cross-sectional study. *Turkish journal of urology*, *44*(3), p.251.

Altaf N, K.S. Saraswathi and Shyamala, R. 2017. Incidence of urinary tract infection (UTI) among Antenatal Patients Attending Tertiary Care Hospital. Int.J.Curr.Microbiol.App.Sci. 6(9): 2092-2096. Doi.

Amiri, M., Lavasani, Z., Norouzirad, R., Najibpour, R., Mohamadpour, M., Nikpoor, A. R., Raeisi, M., and Zare Marzouni, H. (2015). Prevalence of urinary tract infection Among Pregnant Women and its Complications in their newborns during the birth in the hospitals of Dezful City, Iran, 2012 - 2013. *Iranian Red Crescent medical journal*, *17*(8), e26946.

Anne C.C. Lee , Mullany, L.C., Koffi, A.K. Urinary tract infections in pregnancy in a rural population of Bangladesh: population-based prevalence, risk factors, etiology, and antibiotic resistance. *BMC Pregnancy Childbirth* 20**,** 1 (2020)

Anick B, Santos F, Ferreira E, Perreault S. Urinary tract infections during pregnancy. Urinary tract infections.(2011) Oct 3:360.

Asmat U, Mumtaz MZ, Malik A. Rising prevalence of multidrug-resistant uropathogenic bacteria from urinary tract infections in pregnant women. J Taibah Univ Med Sci. 2020 Nov 11;16(1):102-111. doi: 10.1016/j.jtumed.2020.10.010. PMID: 33603638; PMCID: PMC7858016.

Asmat U., Muhammad Z. Mumtaz, Arif Malik,Rising prevalence of multidrug-resistant uropathogenic bacteria from urinary tract infections in pregnant women,Journal of Taibah University Medical Sciences,Volume 16, Issue 1,2021,Pages 102-111,ISSN 1658-3612,

Bahati J, Stephen BM, Joseph N, Asiphas O, Musa K, Taseera K. Prevalence and bacteriology of culture-positive urinary tract infection among pregnant women with suspected urinary tract infection at Mbarara regional referral hospital, South-Western Uganda. BMC Pregnancy Childbirth. 2021 Feb 23;21(1):159. doi: 10.1186/s12884-021-03641-8. PMID: 33622283; PMCID: PMC7903640.

Baker KK, Das P, Dutta A, Swain T, Sahoo S, Das BS,. (2015) Menstrual Hygiene Practices, WASH Access and the Risk of Urogenital Infection in Women from Odisha, India. PLoS ONE 10(6): e0130777. Published: June 30, 2015

Besty F, Cronenwett AE, Spino C, Berger MB, Morgan DM. Cranberry juice capsules and urinary tract infection after surgery: results of a randomized trial. Am J Obstet Gynecol. 2015 Aug;213(2):194.e1-8. doi: 10.1016/j.ajog.2015.04.003. Epub 2015 Apr 13. PMID: 25882919; PMCID: PMC4519382.

Bell JS , Davies EL,, Bhattacharya S. Preeclampsia and preterm delivery: A population-based case–control study. Hypertension in pregnancy. 2016 Oct 1;35(4):510-9.

Bimoch P , Neha S, S. Padhi , 2010 Bateriological profile and antimicrobial sensitivity pattern of endotracheal tube aspirates of patients admitted in ICU. April 2021 Journal of Dr NTR University of Health Sciences 9(3) DOI: 10.4103/JDRNTRUHS 118 20

Braunwald E, Fauci AS, Kasper DL, Hauser SL, Longo DL and Jameson JL (2001). Principles of Internal Medicine, McGraw-Hill, New York USA, 15 Ed. 2: 620-625.

Caneiras C, Lito L, Melo-Cristino J, Duarte A. Community- and Hospital-Acquired *Klebsiella pneumoniae* Urinary Tract Infections in Portugal: Virulence and Antibiotic Resistance. Microorganisms. 2019 May 16;7(5):138. doi: 10.3390/microorganisms7050138. PMID: 31100810; PMCID: PMC6560439.

Cheesebrough, M. (2006).District laboratory practice in tropical countries.Part 2. London, Cambridge University Press

Chelkeba, L., Fanta, K., Mulugeta, T. and Melaku, T., 2022. Bacterial profile and antimicrobial resistance patterns of common bacteria among pregnant women with bacteriuria in Ethiopia: a systematic review and meta-analysis. *Archives of Gynecology and Obstetrics*, pp.1-24.

, Chu CM, Lo CK, Lau RW. Hybrid operating room Dyna-computed tomography combined image-guided electromagnetic navigation bronchoscopy dye marking and hookwire localization video-assisted thoracic surgery metastasectomy. Interactive CardioVascular and Thoracic Surgery. 2018 Feb 1;26(2):338-40.

Chowdhury, N. and Mazumdar, M.S.H., 2021. Risk Factors of UTI in Pregnant Women and the Maternal and Perinatal Outcome Attending North East Medical

Cibulka, N., Adams. S and Holzemer, E. (2022). Using the Pelvic Floor Impact Questionnaire to Improve Urinary Incontinence Assessments for Female Veterans. *Nursing for Women's Health*..

Cohen, D., and Dasgupta, R. (2013). Clinical Dilemmas. In *Urinary Tract Infection* (pp. 25-32). Springer, London.

Colgan R, Nicolle LE, McGlone A, Hooton TM. Asymptomatic bacteriuria in adults. Am Fam Physician. 2006 Sep 15;74(6):985-90. PMID: 17002033.

Curtiss N, Meththananda I, Duckett J. Urinary tract infection in obstetrics and gynaecology. Obstetrics, Gynaecology & Reproductive Medicine. 2017 Sep 1;27(9):261-5.

Dasgupta, R., and Cohen, D., (2013). Clinical Dilemmas. In *Urinary Tract Infection* (pp. 25-32). Springer, London.

Davenport M, Mach KE, Shortliffe LM, Banaei N, Wang TH, Liao JC. New and developing diagnostic technologies for urinary tract infections. Nature Reviews Urology. 2017 May;14(5):296-310.

Delzell JE (2000). Urinary tract infections in pregnancy. Am. Acad. Fam. Phys. p. 721.

Desmarais SL, Pritchard A, Lowder EM, Janssen PA. Intimate partner abuse before and during pregnancy as risk factors for postpartum mental health problems. BMC pregnancy and childbirth. 2014 Dec;14(1):1-2.

Duarte, G., Marcolin, A.C., Quintana, S.M. and Cavalli, R.C. (2008) [Urinary tract infection in pregnancy]. Rev Bras Ginecol Obstel, 30, 93-100

Edae M ., (2020) Asymptomatic bacteriuria among pregnant women attending antenatal care at Hiwot Fana Specialized University Hospital, Harar, Eastern Ethiopia: magnitude, associated factors, and antimicrobial susceptibility pattern. Int J Microbiol 2020:1–8

Enayet H, Hossain G, Ahammed F, Mohammed R, Kabir MR, Karmaker G., Bacteriological profile and sensitivity pattern of urinary tract infection patients in north east part of Bangladesh. Int J Adv Med. 2020;7:1614-8.S

Ernst EJ, Ernst ME, Hoehns JD, Bergus GR. Women's quality of life is decreased by acute cystitis and antibiotic adverse effects associated with treatment. Health Qual Life Outcomes. 2005;3:45.

Ernst CM, Braxton JR, Rodriguez-Osorio CA, Zagieboylo AP, Li L, Pironti A, Manson AL, Nair AV, Benson M, Cummins K, Clatworthy AE, Earl AM, Cosimi LA, Hung DT. Adaptive evolution of virulence and persistence in carbapenem-resistant Klebsiella pneumoniae. Nat Med. 2020 May;26(5):705-711. doi: 10.1038/s41591-020-0825-4. Epub 2020 Apr 13. Erratum in: Nat Med. 2020 Jun 25;: PMID: 32284589; PMCID: PMC9194776.

Fakhoury, G.F., Daikoku, N.H. and Parikh, A.R., (1994). Management of sever hemorrhagic cystitis in pregnancy. A report of two cases. J Reprod Med, 39, 485-488.

Fatima SS, Mussaed EA. Urinary tract infection. InBacterial Identification and Drug Susceptibility Patterns in Pregnant and Non Pregnant UTI Patients 2018 (pp. 1-22). Springer, Singapore.

Fitzgerald MA, Lie D, Nettina SM. Urinary tract infection: providing the best care. Available at: www.medscape.com/viewprogram/1920. Accessed May 15, 2007.

Foxman B. Urinary tract infection syndromes: occurrence, recurrence, bacteriology, risk factors, and disease burden. Infectious Disease Clinics. 2014 Mar 1;28(1):1-3.

Ghafari M, Baigi V, Cheraghi Z, Doosti-Irani A. The prevalence of asymptomatic bacteriuria in Iranian pregnant women: a systematic review and meta-analysis. PloS one. 2016 Jun 23;11(6):e0158031.

Grin, P. M., Kowalewska, P. M., Alhazzan, W., and Fox-Robichaud, A. E. (2013). Lactobacillus for preventing recurrent urinary tract infections in women: meta-analysis. *Can J Urol*, *20*(1), 6607-6614.

Gilstrap L. C. Urinary tract infections during pregnancy / L. C. Gilstrap, S. M. Ramin // Obstet and Gynecol Clin. – 2001. – Vol. 57. – P. 409-413.

.Gilstrap. M., Larry C.,. D. Kenneth J. .Leveno M. D.F. Gary .,Cunningham ,M.,.D..,.Peggy J.., Whalley M. D.,.Mick L..Roark ,R..N.. ,American journal of obstetrics and gynecology, volume 141, issue 5 ,1981

Gilbert NM, O'Brien VP, Hultgren S, Macones G, Lewis WG, Lewis AL. Urinary tract infection as a preventable cause of pregnancy complications: opportunities, challenges, and a global call to action. Glob Adv Health Med. 2013 Sep;2(5):59-69. doi: 10.7453/gahmj.2013.061. PMID: 24416696; PMCID: PMC3833562.

Gonzalo J., Ochoa-Brust, Fernández, A. R., Villanueva-Ruiz, G. J., Velasco, R., Trujillo-Hernández, B., and Vásquez, C. (2007). Daily intake of 100 mg

ascorbic acid as urinary tract infection prophylactic agent during pregnancy. *Acta Obstetricia et Gynecologica Scandinavica*, *86*(7), 783-787.

Haider G, Zehra N, Munir AA, Haider A. Risk factors of urinary tract infection in pregnancy. JPMA. The Journal of the Pakistan Medical Association. 2010 Mar 1;60(3):213.

Haque R, Akhter ML, Salam MA. Prevalence and susceptibility of uropathogens: A recent report from a teaching hospital in Bangladesh. BMC Research Notes 2015;8:416.

Harris RE, Gilstrap LC 3rd. Cystitis during pregnancy: a distinct clinical entity. Obstet Gynecol. 1981 May;57(5):578-80. PMID: 7012718.sss

Hryniewicz K, Szczypa K, Sulikowska A, Jankowski K, Betlejewska K, Hryniewicz W. Antibiotic susceptibility of bacterial strains isolated from urinary tract infections in Poland. J Antimicrob Chemother 2001; 47: 773 – 80

Imade,P.E.,Izekor,P.E.,Eghafona,N.O.,Enabuele,0.I.,Ophori,E.2010.Asymptomaticbacteriuriaamongpregnantwomen.NorthAm.J.Med. Sci., 2(6): 263266.

Jain, V., Das, V., Agarwal, A., and Pandey, A. (2013). Asymptomatic bacteriuria & obstetric outcome following treatment in early versus late pregnancy in north Indian women. *The Indian journal of medical research*, S*137*(4), 753.

Johnson, B., Stephen, B.M., Joseph, N., Prevalence and bacteriology of culture-positive urinary tract infection among pregnant women with suspected urinary tract infection at Mbarara regional referral hospital, South-Western Uganda. *BMC Pregnancy Childbirth* **21**, 159 (2021). https://doi.org/10.1186/s12884-021-03641-8

Johnston CL, Johnston MJ, Corke A, Davies MC. A likely urinary tract infection in a pregnant woman. BMJ. 2017 Apr 27;357.

Kaduma J, Seni J, Chuma C, Kirita R, Mujuni F, Mushi MF, van der Meer F, Mshana SE. Urinary tract infections and preeclampsia among pregnant women attending two hospitals in Mwanza City, Tanzania: a 1: 2 matched case-control study. BioMed research international. 2019 Mar 27;2019.

Kahlmeter G. An international survey of the antimicrobial susceptibility of pathogens from uncomplicated urinary tract infections: the ECO· SENS Project. Journal of antimicrobial Chemotherapy. 2003 Jan 1;51(1):69-76.

KASS, E. H. (1970). Pregnancy, pyelonephritis and prematurity. *Clinical obstetrics and gynecology*, *13*(2), 239-254.

Kathryn C. Fitzgerald, Lydia A. Cassard, Samantha Roman Fox, John C. Probasco, Sandra D. Cassard, Ellen M. Mowry, (2019) The prevalence and utility of screening for urinary tract infection at the time of presumed multiple sclerosis relapse,Multiple Sclerosis and Related Disorders,Volume 35, ISSN 2211-0348.

Katona, P., and Katona-Apte, J. (2008). The interaction between nutrition and infection. *Clinical Infectious Diseases*, *46*(10), 1582-1588.

Katie P., Fehnel, McClain, C. D., & Smith, E. R. (2019). Indirect bypass for maternal symptomatic moyamoya in the first trimester of pregnancy: case report. *Journal of Neurosurgery: Pediatrics*, *25*(2), 138-143.

Kevin C Maki, Kerrie L Kaspar, Christina Khoo, Linda H Derrig, Arianne L Schild, Kalpana Gupta, Consumption of a cranberry juice beverage lowered the number of clinical urinary tract infection episodes in women with a recent history of urinary tract infection, *The American Journal of Clinical Nutrition*, Volume 103, Issue 6, June 2016, Pages 1434–1442.

Khanum S, Ahmed JU, Khanam K. Bacterial Etiology, Antibiotic Sensitivity Pattern and Risk Factors for Asymptomatic Bacteriuria during Pregnancy: Experience in a Tertiary Care Hospital. BIRDEM Medical Journal. 2016;6(2):79-83.

Khatun AK, Rashid H, Chowdhury TA. Prevalence of urinary tract infection in pregnancy. J Bangladesh Coll Phys Surg. 1985; 2: 6-10

KOFFI, Koffi Abdoul. Epidemiological, bacteriological profile and bacterial resistance of urinary tract infections at pregnant woman in prenatal consultation in African setting. International Journal of Reproduction, Contraception, Obstetrics and Gynecology**,** [S.l.], v. 9, n. 2, p. 461-467, jan. 2020. ISSN 2320-1789. Date accessed: 29 aug. 2022.

Kumar M, Yadav AK, Varikuti SR, Nagpal R, Yamashiro Y, Marotta F. potentiais of probiotics as a versatile remedy for womens urogenital health an optimistic perspective.. International Journal of Probiotics & Prebiotics. 2014 Feb 1;9.

Kudinha T, Johnson JR, Andrew SD, Kong F, Anderson P, Gilbert GL. Genotypic and phenotypic characterization of Escherichia coli isolates from children with urinary tract infection and from healthy carriers. The Pediatric infectious disease journal. 2013 May 1;32(5):543-8.

Laurent , S., Briet, M., Collin, C., Karras, A., Bozec, E., Jacquot, C., ..and Nephrotest Study Group. (2011). Arterial remodeling associates with CKD progression. *Journal of the American Society of Nephrology*, *22*(5), 967-974.

Lawani EU, Alade T, Oyelaran D. Urinary tract infection amongst pregnant women in Amassoma, Southern Nigeria. African journal of microbiology research. 2015 Feb 11;9(6):355-9.

Loh KY, Sivalingam N. Urinary tract infections in pregnancy. Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia. 2007;2(2):54.

Lowder, J. L. and Chu, C. M., (2018). Diagnosis and treatment of urinary tract infections across age groups. *American journal of obstetrics and gynecology*, *219*(1), 40-51.

Macejko AM, Schaeffer AJ. Asymptomatic bacteriuria and symptomatic urinary tract infections during pregnancy. Urologic Clinics. 2007 Feb 1;34(1):35-42.

M I Majumder, T Ahmed, D Hossain, S Begum. Bacteriology and antibiotic sensitivity patterns of urinary tract infections in a tertiary hospital in Bangladesh. Mymensingh Med J. 2014; 23 (1): 99-104.

Manjula NG, Math GC, Patil A, Gaddad SM, Shivannavar CT. Incidence of urinary tract infections and its aetiological agents among pregnant women in Karnataka region. Advances in Microbiology. 2013 Oct 18;2013.

Marina, L., Ritchie, and Romanuk, T. N. (2012). A meta-analysis of probiotic efficacy for gastrointestinal diseases. *PloS one*, *7*(4), e34938.

McCormick T, Ashe RG, Kearney PM. Urinary tract infection in pregnancy. The Obstetrician & Gynaecologist. 2008 Jul;10(3):156-62.

Mead PJ, Harris RE: Incidence of group B beta hemolytic Streptococcus in antepartum urinary tract infections. Obstet Gynecol 51: 412, 1978

Meghadas A., Iragian A., Beheshti A. Prevalence of extended spectrum beta lactamase positive a multi drug resistance pattern of Escherichia coli and klebsiella pneumonia isolates ,Semnan, Iran. Issue.vo: 1 No : 1 (2009) Q R code.

Mohammed AM ,Ashshi AM, Faidah HS, Saati AA, El-Ella GA, Al-Ghamdi AK, . Urinary tract infections in pregnant women, assessment of associated risk factors in Makkah, KSA. Biosciences Biotechnology Research Asia. 2013 Jun 28;10(1).

Mohammed I, Abass E. Phenotypic detection of Extended Spectrum β-Lactamases (ESBL) among gram negative uropathogens reveals highly susceptibility to imipenem. Pakistan Journal of Medical Sciences. 2019 Jul;35(4):1104.

Møller M, Borch K, Thomsen AC, Dinesen K, Zdravkovic M. Rupture of fetal membranes and premature delivery associated with group B streptococci in urine of pregnant women. The Lancet. 1984 Jul 14;324(8394):69-70.

Mana Oloomi, M. Oloomi, Maryam Javadi, M. Javadi, Mohammad Reza Asadi Karam, M. Reza Asadi Karam, Jamil Kheirvari Khezerloo, J. Kheirvari Khezerloo, Zohreh Haghri, Z. Haghri, & Saeid Bouzari, S. Bouzari. (0000). Protective multi-epitope candidate vaccine for urinary tract infection. *Biotechnology reports, 28*, e00564. doi: 10.1016/j.btre.2020.e00564

Moore A, Doull M, Grad R, Groulx S, Pottie K, Tonelli M, Courage S, Garcia AJ, Thombs BD. Recommendations on screening for asymptomatic bacteriuria in pregnancy. Cmaj. 2018 Jul 9;190(27):E823-30.

Nicolle LE, Gupta K, Bradley SF, Colgan R, DeMuri GP, Drekonja D, Eckert LO, Geerlings SE, Köves B, Hooton TM, Juthani-Mehta M. Clinical practice guideline for the management of asymptomatic bacteriuria: 2019 update by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2019 May 2;68(10):e83-110.

Nicolle LE, Colgan R ,McGlone A, Hooton TM. Asymptomatic bacteriuria in adults. American family physician. 2006 Sep 15;74(6):985-90.

Obstet and Gynecol, Publisher**:** Lippincott Williams and Wilkins on behalf of the American College of Obstetricians and Gynecologists (United States) ,ISSN**:** 0029-7844 (print); 1873-233X (web), Impact factor: 4.982 (2017).

Okonko IO, Ijandipe LA, Ilusanya OA, Donbraye-Emmanuel OB, Ejembi J, Udeze AO, Egun OC, Fowotade A, Nkang AO. Incidence of urinary tract infection (UTI) among pregnant women in Ibadan, South-Western Nigeria. African Journal of Biotechnology. 2009;8(23).

Onyango HA, Ngugi C, Maina J, Kiiru J. Urinary tract infection among pregnant women at Pumwani Maternity Hospital, Nairobi, Kenya: bacterial etiologic agents, antimicrobial susceptibility profiles and associated risk factors. Advances in Microbiology. 2018 Mar 21;8(03):175.

Perveen, K., Ansari, S. H., Shamsi, T. S., Bohray, M., Khan, M. T., Farzana, T., and Erum, S. (2011). Molecular epidemiology of β-thalassemia in Pakistan: far reaching implications.

Patricia. A. Y., Nelson, C. A., Meaney-Delman, D., Fleck-Derderian, S., Cooley, K. M., and Mead, P. S. (2021). Antimicrobial treatment and prophylaxis of plague: recommendations for naturally acquired infections and bioterrorism response. *MMWR Recommendations and Reports*, *70*(3), 1.

Patterson, T. F.,and Andriole, V. T. (1987). Bacteriuria in pregnancy. *Infectious disease clinics of North America*, *1*(4), 807-822.

Peter, J.,Mortaz, E., Adcock, I. M., Folkerts, G., Barnes, P. J., Paul Vos, A., and Garssen, J. (2013). Probiotics in the management of lung diseases. *Mediators of inflammation*, *2013*.

Qureshi, A. Z., Ullah, S., AlSaleh, A. J., and Ullah, R. (2017). Spinal cord injury during the second trimester of pregnancy. *Spinal Cord Series and Cases*, *3*(1), 1-4.

Rahimkhani M, Khavari-Daneshvar H, Sharifian R. Asymptomatic bacteriuria and pyuria in pregnancy. Acta Medica Iranica. 2008:409-12.

Ranjani G. Asymptomatic bacteriuria in type 2 diabetic women patients who attending Medicine OPD of Government Dharmapuri Medical College, Dharmapuri. IAM Journal. 2017;4(9):36-42.

Raiten, D. J., Steiber, A. L., and Hand, R. K. (2016). Executive summary: evaluation of the evidence to support practice guidelines for nutritional care of preterm infants—the Pre-B Project–4. *The American journal of clinical nutrition*, *103*(2), 599S-605S.

Rane A., Fiadjoe P, Kannan K, Maternal urological problems in pregnancy. Eur J Obstet Gynecol Reprod Biol. 2010;152:13–7. Herráiz MA, Hernández A, Asenjo E, Herráiz I. Urinary tract infections in pregnancy. Enferm Infecc Microbiol Clin. 2005;23:40–6

Razzaq, M., Azam, M. I., and Naeem, M. F. (2017). Study of Vaginitis in Reproductive Age Group at THQ Hospital Jampur. *PAKISTAN JOURNAL OF MEDICAL & HEALTH SCIENCES*, *11*(1), 281-284.

Rizvi M, Khan F, Shukla I, Malik A, Shaheen. Rising prevalence of antimicrobial resistance in urinary tract infections during pregnancy: necessity for exploring newer treatment options. J Lab Physicians. 2011 Jul;3(2):98-103. doi: 10.4103/0974-2727.86842. PMID: 22219563; PMCID: PMC3249726.

Romero, R. O. B. E. R. T. O., Oyarzun, E. N. R. I. Q. U. E., Mazor, M. O. S. H. E., Sirtori, M. A. R. I. N. A., Hobbins, J. C., and Bracken, M. I. C. H. A. E. L. (1989). Meta-analysis of the relationship between asymptomatic bacteriuria and preterm delivery/low birth weight. *Obstetrics and gynecology*, *73*(4), 576-582.

Sarah, K., Glanville, J., Sanders, M. E., Fitzgerald, A.,and Varley, D. (2014). Effectiveness of probiotics on the duration of illness in healthy children and adults who develop common acute respiratory infectious conditions: a systematic review and meta-analysis. *British Journal of Nutrition*, *112*(1), 41-54.

Schnarr, J. and Smaill, F., 2008. Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy. *European journal of clinical investigation*, *38*, pp.50-57.

Shaheen, M., Hodi, F. S., Chesney, J., Pavlick, A. C., Robert, C., Grossmann, K. F., McDermott, D. F., .. and Postow, (2016). Combined nivolumab and ipilimumab versus ipilimumab alone in patients with advanced melanoma: 2-year overall survival outcomes in a multicentre, randomised, controlled, phase 2 trial. *The Lancet Oncology*, *17*(11), 1558-1568.

Shanker, V., Mallikarjun, R., V., B.M., and Rajeshwer R., S. 2018. Asymptomatic Bacteriuria in Pregnant Women – Study at a Tertiary Meternity care Hospital in Hyderabad *Int.J.Curr.Microbiol.App.Sci.*.7(5): 1133-1142.

Silva Jss, G. S. D., Moreira, S. R., Nishida, S. K., Sass, N., and Kirsztajn , G. M. (2016). Urinary abnormalities and renal function in pregnant women with chronic hypertension. *Brazilian Journal of Nephrology*, *38*, 191-202.

Smaill FM, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy. Cochrane Database Syst Rev 2015;(08):CD000490. Doi: 10.1002/14651858.CD000490.pub3

Taye, S., Getachew, M., Desalegn, Z., Biratu, A., and Mubashir, K. (2018). Bacterial profile, antibiotic susceptibility pattern and associated factors among

pregnant women with Urinary Tract Infection in Goba and Sinana Woredas, Bale Zone, Southeast Ethiopia. *BMC research notes*, *11*(1), 1-7.

Tadesse, S., Kahsay, T., Adhanom, G. *et al*. Prevalence, antimicrobial susceptibility profile and predictors of asymptomatic bacteriuria among pregnant women in Adigrat General Hospital, Northern Ethiopia. *BMC Res Notes* **11**, 740 (2018). https://doi.org/10.1186/s13104-018-3844-1

Tomas, M. E., Getman, D., Donskey, C. J., and Hecker, M. T. (2015). Overdiagnosis of urinary tract infection and underdiagnosis of sexually transmitted infection in adult women presenting to an emergency department. *Journal of clinical microbiology*, *53*(8), 2686-2692.

Ullah, M. A., Barman, A., Siddique, M. A., and Haque, A. K. M. E. (2007). Prevalence of asymptomatic bacteriuria and its consequences in pregnancy in a rural community of Bangladesh. *Bangladesh Medical Research Council Bulletin*, *33*(2), 60-64.

Ullah, A., Barman, A., Ahmed, I., and Salam, A. (2012). Asymptomatic bacteriuria in pregnant mothers: a valid and cost-effective screening test in Bangladesh. *Journal of Obstetrics and Gynaecology*, *32*(1), 37-41.

Wabe YA, Reda DY, Abreham ET, Gobene DB, Ali MM. Prevalence of Asymptomatic Bacteriuria, Associated Factors and Antimicrobial Susceptibility Profile of Bacteria Among Pregnant Women Attending Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. Ther Clin Risk Manag. 2020 Sep 29;16:923-932. doi: 10.2147/TCRM.S267101. PMID: 33061397; PMCID: PMC7532909.

Warren, J. W., Abrutyn, E., Hebel, J. R., Johnson, J. R., Schaeffer, A. J., and Stamm, W. E. (1999). Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. *Clinical Infectious Diseases*, *29*(4), 745-759.

Wazait, H.D., Patel, H.R., Veer V., Kelsy, M., Van Der Meulen, J.H., Miller, R.A. and Emberton, M.(2003); Catheter - associated urinary tract infections: prevalence of uropathogens and pattern.of antimicroloial resistance in a UK hospital (1996-2001). BJU International 91(9):806-809.

Willy, F., J. Wanyoike, N. Mugo (2015). Prevalence of urinary tract infection, microbial aetology and antibiotic sensitivity pattern among antenatal women presenting with lower abdminal pains at Kenyatta National

Hospital, Nairobi, Kenya. Oppen Access J. Sci. Technol. 3: Article ID 101115.

Wilson, M. L., and Gaido, L. (2004). Laboratory diagnosis of urinary tract infections in adult patients. *Clinical infectious diseases*, *38*(8), 1150-1158.

Wing DA, Fassett MJ, Getahun D. Acute pyelonephritis in pregnancy: an 18-year retrospective analysis. Am J Obstet Gynecol. 2014 Mar;210(3):219.e1-6. doi: 10.1016/j.ajog.2013.10.006. Epub 2013 Oct 5. PMID: 24100227.

Yasmin, T., Sarwar, M. Y., and Sen, A. (2018). Prevalence of urinary tract infection in pregnant women in Katihar district, Bihar. *prevalence*, *2*(98), 2-06

.Zanatta, D. A. D. L., Rossini, M. D. M., and Trapani, A. (2017). Pyelonephritis in pregnancy: clinical and laboratorial aspects and perinatal results. *Revista Brasileira de Ginecologia e Obstetrícia*, *39*, 653-658.

Appendix

❖ **Section: 1 Patient's Demographic Data:**

- Patients Name :
- Age :
- ABO- blood group : A+ ve/ A- ve/ / B+ ve/ / B- ve/ / O+ ve/ / O- ve/ / AB+ ve/ AB- ve/

❖ **Section-2: Patient's Socio-Economic Information:**

. Address :

- Patients occupation :
- Patients educational Level:
  1) Illiterate (0 yrs)
  2) Primary (0- 5 yrs)
  3) Higher secondary or more (> 5yrs

• Name of the husband:

• Husband's educational qualifications:

1) Illiterate (0 yrs)
2) Primary (0- 5 yrs)
3) Secondary or more (>5yrs)

• Household income:

1. Tk. 15,000 - Tk 25,000,
2. Tk. >25,000 – Tk 35,000
3. Tk. > 35,000

.Sanitation Status

1. Dirty
2. Moderately clean
3. Hyagenic

• Family type:

Single family ( )

Joint family ( )

❖ **Section 3: Clinical Data**

Aneamia :

present

absent

Weight :

Gestational Period :

1st trimester (0 - 3) months

2nd trimester (4 – 6) months

3rd trimester (7 - 9) months

Gravida :

Primigravida :

Multigravida :

Clinical symptoms

• Feeling of pain or burning (embarrassment) during urine : Yes ( ) No ( )

• It is often necessary to urinate more than usual : Yes ( ) No ( )

• Blood is released with urine : Yes ( ) No ( )

• lower abdominal pain : Yes ( ) No ( )

• Is there any fever, sweating, urine leak ? : Yes ( ) No ( )

• Waking up from sleep to peer tendency : Yes ( ) No ( )

. History of previous UTI : Yes ( ) No ( )

History of catheterization or other instrumentation : Yes ( ) No ( )