زانکۆی سەلاحەدین - هەولێر
Salahaddin University-Erbil

Prevalence of Urinary Tract Infections in Pregnant Women in Erbil City/Iraq

Research Project

Submitted to the Department of Biology in partial fulfillment of the requirements for the degree of BSc. In Biology

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April - 2023

﴿قُلْ هَلْ يَسْتَوِي الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لاَ يَعْلَمُونَ إِنَّمَا يَتَذَكَّرُ أُولُو الأَلْبَابِ﴾

سورة الزمر / الآية 9

SUPERVISOR CERTIFICATE

This research project has been written under my supervision and has been submitted for the award of the degree of BSc. in Biology with my approval as a supervisor.

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I confirm that all requirements have been fulfilled

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Head of the department of biology

Date**: April- 2023**

DEDICATION

This work is dedicated to

My merciful mother

My father

My siblings

All whom I appreciate

ACKNOWLEDGEMENTS

First of all, I would like to thank the merciful of "ALLAH" help me to successfully complete my study.

My deepest gratitude to my supervisor Asst. Prof. Dr. Khadija Kh. M.Barzani for her supervision and choosing of this project, scientific guidance, and support during the period of the study.

My deepest thanks to the deanery of the Education College, head and all staff of biology department for their kindness and support.

I would like to express my thanks to the Ministry of Higher Education and Scientific Research and presidency of Salahaddin University /Erbil.

Thanks for all my friends who help me to complete my study and thanks for my family which help me for complete my research.

SUMMARY

Urinary tract infection (UTI) is the most common bacterial infection in pregnant women. In current study , the data and information for year 2022 were collected from the medical records of Maternity Hospital Teaching hospital in Erbil city / Iraqi after the final diagnosis of UTI in pregnant women which identified by a physician in addition to 123 cases of UTI caused by bacteria in pregnant and the age of pregnant women ranged from 15 to 48 years. Moreover, in January to December 98679 patients admitted to Maternity hospital and their urine was tested and 36538 of pregnant women were infected with UTI with percentage ranged from 30.63 to 58% and the causative microorganisms were fungi and virus in addition to bacteria. Moreover, in these above mentioned 123 cases, 152 isolates including five genera and 8 species of Gram positive and negative bacteria were recorded and the Staphylococcus species were the leading cause of UTI in hospitals in Erbil city include 82 isolates including 71 isolates of *Staphylococcus spp.*, 7 isolates of *Staph. haemolyticus*, 4 isolates of *staph. aureus* and followed by 53 isolates of *E.coli* , 12 isolates of Streptococcus species including 9 isolates of *Streptococcus* spp. and 3 isolates of *Str. agalactiae* , 3 isolates of *Proteus* spp. I, 2 isolates of *klebsiella* spp. On the other hand, mixed infection between *E. coli* and *Staph. aureus* , *E. coli* and *klebsiella* spp. , *E. coli* and *Streptococcus* spp was found.

Keywords: Age, Bacteria, Pregnant women, UTI.

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1. INTRODUCTION

A urinary tract infection (UTI) is a collective term for infections that involve any part of the urinary tract. Urinary tract infection is caused by colonization and growth of microorganisms such as bacteria, fungi and viruses within the urinary tract (Vasudevan, 2014; Flores-Mireles et al., 2015). The primary etiological agents of UTIs are Gram-negative bacteria and Gram-positive bacteria may also be involved in UT infections (Fauci, 2008). The urinary tract is the body's filtering system for removing waste liquid, or urine; it comprises the kidneys, ureters, bladder and urethra (Ramadan, 2003).

Urinary tract infections are frequently encountered in pregnant women. Pyelonephritis is the most common serious medical condition seen in pregnancy. Thus, it is crucial for providers of obstetric care to be knowledgeable about normal findings of the urinary tract, evaluation of abnormalities, and treatment of disease. Fortunately, UTIs in pregnancy are most often easily treated with excellent outcomes. Rarely, pregnancies complicated by pyelonephritis will lead to significant maternal and fetal morbidity. Changes of the urinary tract and immunologic changes of pregnancy predispose women to urinary tract infection. Physiologic changes of the urinary tract include dilation of the ureter and renal calyces; this occurs due to progesterone-related smooth muscle relaxation and ureteral compression from the gravid uterus. Ureteral dilation may be marked. Decreased bladder capacity commonly results in urinary frequency. Vesicoureteral

reflux may be seen. These changes increase the risk of urinary tract infections (Habak, & Griggs, 2022).

Urinary tract infections are caused by both Gram-negative and Gram-positive bacteria, as well as by certain fungi such as Candida spp. The most common causative agent for UTI are *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus saprophyticus*, *Enterococcus faecal is*, *Enterococcus* spp., group B *Streptococcus*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* (Kline et al., 2011; Levison et al. 2013). UTIs are common in pregnancy. Not all UTIs cause symptoms, but in pregnancy even those without symptoms need to be treated to prevent problems later in pregnancy. This means all pregnant women should have a test for UTI early in pregnancy to avoid abortion.

2. LITERATURE REVIEW

2.1. Urinary tract infections

Urinary tract infections are remains the second most common bacterial infection in the human population, UTI in women more frequent than in men (Tambekar et al., 2006). UTIs are generally classified as: uncomplicated or complicated. Nevertheless, there are two types of UTI presentations: lower UTI which is an infection of the bladder and the urethra known as cystitis and urethritis**,** respectively**.** The other type is upper UTI; an infection of the kidneys and the ureters known as pyelonephritis and urethritis, respectively. Upper UTIs are potentially more serious than lower UTIs because there is a possibility of kidney damage (Franz and Horl, 1999).

Urinary tract infections are frequently encountered in pregnant women. Pyelonephritis is the most common serious medical condition seen in pregnancy. Thus, it is crucial for providers of obstetric care to be knowledgeable about normal findings of the urinary tract, evaluation of abnormalities, and treatment of disease. Fortunately, UTIs in pregnancy are most often easily treated with excellent outcomes. Rarely, pregnancies complicated by pyelonephritis will lead to significant maternal and fetal morbidity. Changes of the urinary tract and immunologic changes of pregnancy predispose women to urinary tract infection. Physiologic changes of the urinary tract include dilation of the ureter and renal calyces; this occurs due to progesterone-related smooth muscle relaxation and ureteral compression from the gravid uterus. Ureteral dilation may be marked. Decreased bladder capacity commonly results in urinary frequency. Vesicoureteral reflux may be seen. These changes increase the risk of urinary tract infections (Patricia et al., 2022).

2.2 Routes of urinary tract infection

- **Ascending route:** entry is normally by ascent from the urethra especially if vesicoureteral reflux is present. It is the most common route.
- **Hematogenous route:** infection of the kidney parenchyma by blood-borne organisms resulting in abscess formation, important for a few organisms such as *S. aureus* and *C. albicans*.
- **Lymphatic route:** occur when pressure is increased in the bladder, lymphatic flow to be directed toward the kidney (Wahid and Bela, 2001).

2.3. Most common causative agents of UTI

The commonest is *E. coli* which is responsible for 80% of UTI. *S. saprophyticus* accounts 10% of UTIs, mostly in younger women, with a higher incidence in the summer. Other Gram negatives; *Proteus* and *Enterobacter* constituted about 5%. Moreover, mixed of *Klebsiella, Candida albicans*, viruses and sexually transmitted bacteria e.g. *Chlamydia* formed approximately 3%. While, other Gram positive bacteria like *Staphylococcus aureus*, group B streptococci and *Enterococcus* represent 2% (Wing et al., 2014). However, others such as *P. mirabilis*, *P. aeruginosa* and *Enterococcus* spp. predominantly cause complicated UTIs Subsequently (Niveditha et al., 2012).

2.4 Physiological Changes of Pregnancy and its Association with UTIs

Pregnancy increases the risk of UTIs. At around 6th week of pregnancy, due to the physiological changes of pregnancy the ureters begin to dilate. This is also known as"hydronephrosis of pregnancy", which peaks at 22-26 weeks and continues to persist until delivery. Both progesterone and estrogens levels increase during pregnancy and these will lead to decreased ureteral and bladder

tone. Increased plasma volume during pregnancy leads to decrease urine concentration and increased bladder volume. The combination of all these factors leadto urinary stasis and uretero-vesical reflux. Glycosuria inpregnancy is also another well-known factor which predisposes mothers to UT (Delzell,. & Lefevre , 2000).

2.5 Types of UTI in Pregnancy and Clinical Presentations

They are asymptomatic bacteriuria, acute cystitis and acutepyelonephritis. The clinical presentations of theseconditions vary. Asymptomatic bacteriuria is defined as a finding of mor ethan 105 colony-forming units per mL of urine in a clinically asymptomatic person (Orenstein & Wong, 1999). This condition may be present even before the mother gets pregnant. There are reports that 1.2 to 5 % of young girls will demonstrate asymptomatic bacteriuria at some time before puberty (Gabbe, 2002). The prevalence of asymptomatic bacteriuria in pregnancyis about 10%. Lower serum interleukin-6 levels and serumantibody responses to *E. coli* antigens which occurs in pregnancy has been associated with increased incidenceof asymptomatic bacteriuria in pregnancy. Neonatalcomplications which are associated with asymptomaticbacteriuria include intrauterine growth restriction, low birthweight and pre-term premature rupture of membrane (Vazquez & Villar , 2003). Maternal complications which are associated withasymptomatic bacteriuria are hypertension, pre-eclampsiaand maternal anemia. Without treatment, this conditionleads to symptomatic cystitis in about 30% of pregnant (O'Donnell et al. 2002).

2.6 Epidemiology

The most significant factor predisposing women to UTI in pregnancy is asymptomatic bacteriuria (ASB). ASB is defined as more than 100,000 organisms/mL on a clean catch urinalysis obtained from an asymptomatic patient. If asymptomatic bacteriuria is untreated in pregnancy, the rate of subsequent UTI is approximately 25%. Due to both to 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%. 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. Women who are carriers for sickle cell trait also have a higher incidence of ASB (Gilstrap & Ramin, 2001).

UTIs are a common cause of serious infection in pregnant women. In one study, 3.5% of antepartum admissions were due to UTI. Pyelonephritis is the most common cause of septic shock in pregnant women. Risk factors for UTIs in pregnancy include low socioeconomic status, young age, and nulliparity. As with ASB some patients may be predisposed to infection and may report a history of having had ASB, cystitis or pyelonephritis in the past. Pyelonephritis is more often right-sided however may be bilateral in up to 25% of cases (Gazmararian et al., 2002).

3. METHODOLOGY

In current study the data and information for 2022 were collected from the medical records of Maternity hospital Teaching hospital in Erbil city / Iraqi after the final diagnosis of UTI in pregnant women which identified by a physician including 98679 patients admitted to Maternity hospital and their urine was tested in addition to 123 cases of UTI caused by bacteria in pregnant women and the form was made for all cases containing scientific name of bacteria, age and clinical source and the age ranged between 15 to 48 years .

4. RESULTS AND DISCUSSION

In present study the data and information for year 2022 were collected from the medical records of Maternity Hospital Teaching hospital in Erbil city / Iraqi after the final diagnosis of UTI in pregnant women which identified by a physician, in addition to 123 cases of UTI caused and the age of pregnant women ranged from 15 to 48 years. Moreover, in January to December 98679 patients admitted to Maternity hospital and their urine was tested and 36538 of pregnant women were infected with UTI (Figure 1) with percentage ranged from 30.63 to 58% (Table 1) and the causative microorganisms were fungi and virus in addition to bacteria.

Indeed, in present study from the above mentioned 123 cases, 152 isolates including five genera and 8 species of Gram positive and negative bacteria were recorded and the Staphylococcus species were the leading cause of UTI in hospitals in Erbil city include 82 isolates (Table 2) including 71 isolates of *Staphylococcus* spp. in pregnant women their age ranged between (20- 34) years, 7 isolates of *Staph. haemolyticus* in pregnant women with age ranged between (20-31) years , 4 isolates of *staph. aureus* in women their age ranged between (15-19) years and followed by 53 isolates of *E.coli* patients with ages ranged between (28-48)years , 12 isolates of Streptococcus species including 9 isolates of *Streptococcus* spp. in women with age ranged between (24- 30) years and 3 isolates of *Str. agalactiae* in pregnant women with age ranged between (34-40) years , 3 isolates of *Proteus* spp. in women with age ranged between (20- 23) years, 2 isolates of *klebsiella* spp. in women with age ranged between (29- 31) years (Figure 2).

On the other hand, mixed infection between *E. coli* and *Staph. aureus* , *E. coli* and *klebsiella* spp. , *E. coli* and *Streptococcus spp* was found.

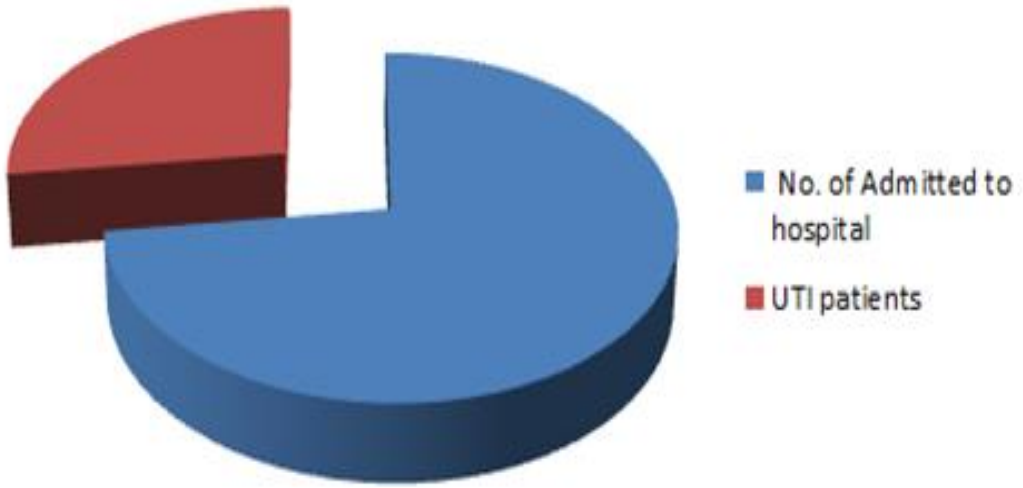

Figure 1. Total number of admitted pregnant women to Maternity hospital and total number of UTI.

Table 1. Number of admitted pregnant women to Maternity hospital and total number of UTI and percentage of infection.

Months	No. of Admitted to hospital	UTI patients	% of Infection
January	8513	3306	38.83
February	7670	2893	37.71
March	8234	2926	30.63
April	8201	2512	30.63

May	8500	2940	34.58
June	8350	3049	36.51
July	10312	3270	31.71
Augest	10125	3247	31.06
September	8961	3109	34.69
October	7859	3147	40.04
November	6133	2752	44.87
December	5839	3387	58

Table 2. Number of bacterial species and age of infected pregnant women with urinary tract infection.

Bacterial species	**No. of Isolates**	**Age (Year)**
***Staphylococcus* spp.**	71	20-34
Escherichia coli	53	28-48
***Streptococcus* spp.**	9	24-30
Staphylococcus haemolyticus	7	20-31
Staphylococcus aureus	4	15-19
Streptococcus agalactiae	3	34-40
***Proteus* spp.**	3	20-23
***Klebsiella* spp.**	2	29-31
Total	152	

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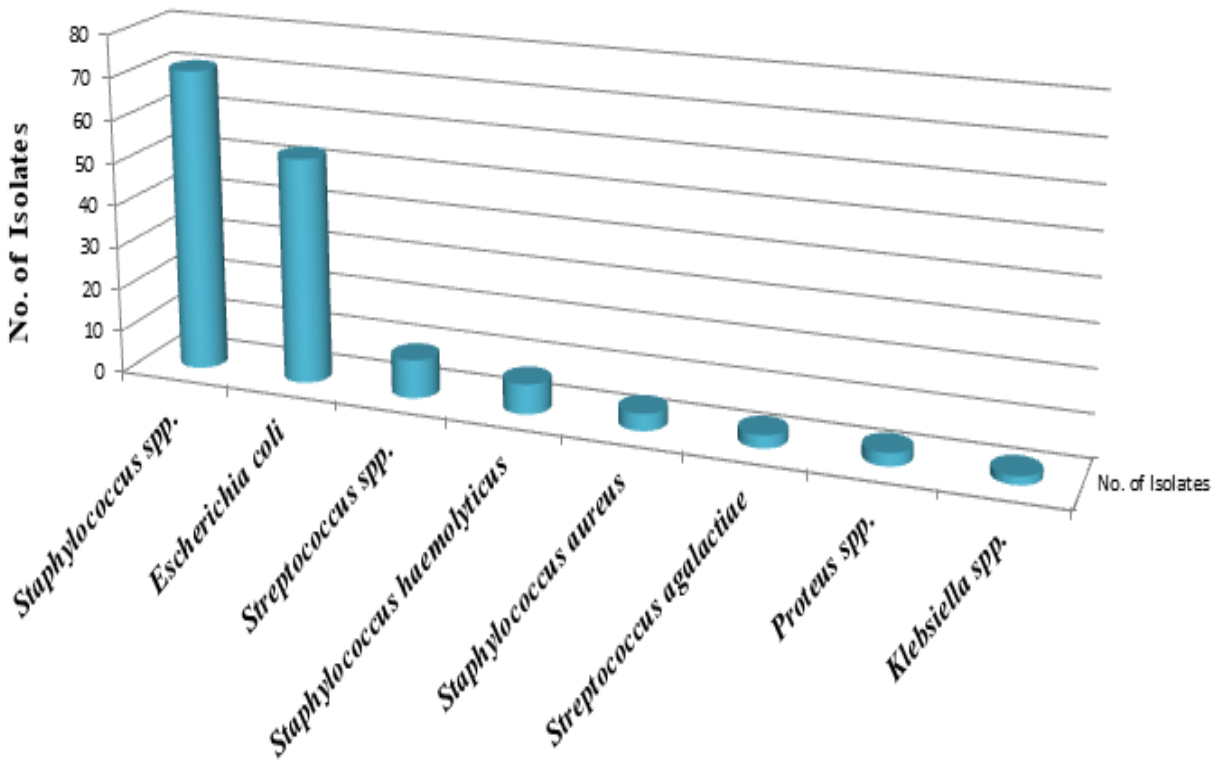

Figure 2. Isolated Gram positive and negative bacteria in pregnent women with urinary tract infections.

Some studies found that more than 95% of urinary tract infections are caused by a single bacterial species. *E. coli* is the most frequent infecting organism in acute infection (Ronald, 2002). Other studies found that the Klebsiella, Staphylococci, Enterobacter, Proteus, Pseudomonas, and Enterococci species are more often isolated from inpatients, whereas there is a greater preponderance of *E. coli* in an outpatient population . Coagulase Negative Staphylococci are a common cause of urinary tract infection in some reports . Coagulase negative Staphylococci tends to cause infection in young women (Schneider and Riley, 1996).

Urinary tract infection (UTI) is the most common bacterial infection in pregnancy. Known risk factors for UTI in pregnancy include diabetes and certain urologic conditions. Other maternal characteristics might also be associated with risk and could provide clues to the etiology of UTI in pregnancy Hormones are one reason. In pregnancy, they cause changes in the urinary tract, and that makes women more likely to get infections. Changes in hormones can also lead to vesicoureteral reflux, a condition in which your pee flows back up from your bladder to your kidneys. This can cause UTIs (Johnson et al., 2022).

urinary tract infections frequently affect pregnant mothers. This problem causes significant morbidity and healthcare expenditure. Three common clinical manifestations of UTIs in pregnancy are: asymptomatic bacteriuria, acute cystitis and acute pyelonephritis. *E. coli* remains the most frequent organism isolated in UTIs. All pregnant mothers should be screened for UTIs in pregnancy and antibiotics should be commenced without delay. Urine culture and sensitivity is the gold standard in diagnosing UTIs. Without treatment, asymptomatic bacteriuria in pregnancy is associated with preterm delivery, intrauterine growth retardation, low birth weight, maternal hypertension, pre-eclampsia and anaemia. Acute pyelonephritis can lead to maternal sepsis. Recurrent UTIs in pregnancy require prophylactic antibiotic treatment (Jolly et al., 2012; Angelescu et al., 2016).

Urinary tract infection represents one of the most common diseases encountered in medical practice today and occurring from the neonate to the geriatric age group.

Some studies have found that teenagers have high prevalence of UTI in pregnancy (Jolley, et al ., 2012; wing et al., 2014). For example, Finnish teenagers were more likely than women aged 25–29 years to have UTI in pregnancy (Leppälahti et a., 2013) . However, Astudy found no association between age and UTI in pregnancy (Conde-Agudelo.et al., 2005).

5. CONCLUSION

It was concluded that many species of Gram positive and Gram negative are causes of the UTI in the pregnant women and the bacteria Staphylococcus species and *E. Coli* were the leading cause of UTI in pregnant women in in Erbil city.

6. RECOMMEDATION

Urine examination and culture are regarded as the gold standard for pregnant woman and necessary during pregnancy.

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