



Urinary Tract Infection in Pregnant Women

Thesis
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List of Abbreviation

The following abbreviations are used throughout the thesis:

Adult Respiratory Distress Syndrome	ARDS
Asymptomatic Bacteriuria	ASB
Asymptomatic Urinary Tract Infection	AUTI
Blood Pressure	BP
Cardiovascular Disease	CVS
Company	Co.
Drug History	DH
<i>Escherichia coli</i>	<i>E. coli</i>
Every	Q
Family History	FH
High Power Field	HPF
Hour	hr
Interleukin 8	IL-8
<i>Klebsiella oxytosa</i>	<i>K. oxytosa</i>
Last Menstrual Period	LMD
Mannitol Salt Agar	MSA
Midstream Urine	MSU
Minimum Bacterial Concentration	MBC
Minimum Inhibitory Concentration	MIC
National Committee for Clinical Laboratory Standards	NCCLS
Number	No.
Past Medical History	PMH
Prelabor Rupture of Membrane	PPROM
<i>Proteus mirabilis</i>	<i>P. mirabilis</i>

<i>Pseudomonas aeruginosa</i>	<i>P. aeruginosa</i>
Pulse Rate	PR
Red Blood Cells	RBCs
Standard Error of Mean	SEM
<i>Staphylococcus saprophyticus</i>	<i>S. saprophyticus</i>
<i>Staphylococcus aureus</i>	<i>S. aureus</i>
Temperature	temp.
Three Times Daily	TID
Transforming growth factor-beta	TGF- β
United States of America	USA
Urinary Tract Infection	UTI
Weight per Volume	W/V
White Blood Cells	WBC
World Health Organization	WHO

ABSTRACT

Urinary tract infection (UTI) is a serious health problem affecting millions of people each year at all age groups.

UTI during pregnancy are a common cause of serious maternal and perinatal morbidity; with appropriate screening and treatment, this morbidity can be limited.

The present work is a prospective randomized study involved 190 women, 165 pregnant and 25 non-pregnant as a control group. UTIs were found in 76 patients (40%), 72 were pregnant and 4 non-pregnant patients. Forty-seven pregnant patients (65.28%) and 3 non-pregnant patients (75%) did not show symptoms.

The peak of UTI in pregnant women occurred in the young age group 26-30 years (34.72%). Most of the pregnant women were multipara (79.16%) and at the 2nd trimester (47.22%).

Escherichia coli was the most common isolated organism causing UTI (54.12%) in both groups. In the group of pregnant patients, the next common organism was *Klebsiella oxytosa* (14.80%). Followed by *Staphylococcus saprophyticus* (11.11%), *Proteus mirabilis* (8.64%), *Staphylococcus aureus* (6.17%), *Pseudomonas aeruginosa* (3.70%), and *Enterobacter colacae* (2.46%). While In the non-pregnant patients only 2 bacterial strains were isolated, *Escherichia coli* (75%) and *Staphylococcus aureus* (25%). Mixed infections were found in 9 pregnant patients (12.5%), most of them (7) were symptomatic.

The isolated microorganisms showed a higher sensitivity to cephalexin (77.65%) followed by co-amoxiclavate (68.24%) and cephadroxil (64.71%). A lower sensitivity was found to amoxycillin (48.24%), while high resistance was found against ampicillin (24.71% sensitive). Seven isolates showed resistance to all of the used antibiotics.

Duration of treatment was 7 days for most of the patients.

From this study it was concluded that:

1. UTI is common in pregnancy especially at young age and so all pregnant women should be routinely screened for UTI to prevent its complications.
2. Most of UTI are asymptomatic except the mixed infections.
3. *Escherichia coli* is the most common organism causing UTI.
4. There is a risk of mixed UTI during pregnancy.
5. Oral first generation cephalosporins and co-amoxiclave are effective for treating UTI during pregnancy.
6. Using antibacterial agent in small doses for 7 days is suitable for treating UTI in pregnancy.

Treatment Protocol for UTI in Egyptian Pregnant Women:

1. Monthly screening of all pregnant women for presence of UTI using routine urine analysis.
2. If pyuria and bacteriuria were found, urine culture and sensitivity test should be done to confirm diagnosis of UTI.
3. In case of symptomatic infections, an empirical broad spectrum antibiotic should be given until the culture results become available. These antibiotics must cover gram-negative aerobic bacilli especially *Escherichia coli*, the drugs of choice includes cephalexin (250-500mg Q 6hr), co-amoxiclave (250+125mg Q 8 hr) and cephadroxil (500-1000mg Q 12 hr).
4. The best duration of therapy is to use antibacterial agents for 7 days.
5. Patient education about the disease, importance of therapy, personal hygiene and correct use of antibiotics is very important to ensure successful treatment.
6. After completion of therapy and discontinuing antibacterial agent by 3-4 days, a repeated urine culture should be done to ensure complete eradication of the infected microorganism.
7. Follow –up examinations by urine analysis every 6 months for 2 years to avoid recurrence.

INTRODUCTION

Urinary tract infection (UTI) refers to both microbial colonization of the urine and tissue invasion of any structure of urinary tract. Bacteria are most commonly responsible, although yeast, fungi, and viruses may produce UTI. UTIs are often categorized by the site of infection into two general anatomic categories: lower tract infection (urethritis, cystitis, and prostatitis) and upper tract infection (acute pyelonephritis and intrarenal and perinephric abscesses). Significant bacteriuria refers to sufficient numbers of bacteria in the urine ($> 10^5/\text{ml}$) to denote active infection rather than contamination (Andriole, 1987).

UTI is a problem in all age groups, although the prevalence varies markedly in infants. Up to the age of 6 months, the incidence is about 2 cases per 1000 live births, and is much more common in boys than in girls. In preschool children the sex ratio reverses, and the prevalence of bacteriuria are 4.5% for girls and 0.50% for boys. Infections during these early years are often symptomatic, and it is thought that serious renal damage can occur; hence it is very important to treat these infections aggressively and follow up the children for a period of several years if any urinary tract abnormalities are found (Moffatt *et al.*, 1988).

In schoolgirls and schoolboys prevalence of bacteriuria are 1.2 and 0.03%, respectively. In girls only about one-third of infections are symptomatic. The occurrence of bacteriuria during childhood appears to lead to higher incidence of bacteriuria in adulthood (Moffatt *et al.*, 1988).

When women reach adulthood, the prevalence of bacteriuria rises to 3-5%. Each year about a quarter of the bacteriuric women clear their bacteriuria spontaneously and are replaced by an equal number of newly infected women (often those with a history of previous infections). At least 10 to 20% of all women will have asymptomatic UTI during their lifetime. In the elderly of both

sexes, the prevalence of bacteriuria rises dramatically: 20% for women and 10% for men (McMurdo and Davey, 1993). In hospitals, a major predisposing cause of UTI is urinary catheterization. If a catheter is left in for longer than 10 days infection rates rise to 70 to 80%.

Acute symptomatic pyelonephritis may develop in pregnant women with untreated bacteriuria. In an evaluation of 256 bacteriuric pregnant patients, there was a 25% prevalence of acute pyelonephritis in the untreated group versus 3% in the treated group (Little, 1966). Another study reported comparative rates of 19% and zero%, respectively. Thus, proper treatment of bacteriuria greatly reduces this complication. In addition, there is evidence that maternal UTIs during pregnancy are associated with an increase in perinatal mortality rates and more frequent pre-term deliveries (Naeye, 1979). Although a cause and effect relationship has not been established, this is an important consideration and strengthens the argument for treating maternal UTIs.

There are three possible routes by which organisms can reach the urinary tract and cause infection: ascending, blood-borne and lymphatic. There is little evidence for the last route in humans. Blood-borne spread to the kidney can occur in bacteraemia, most notably *Staphylococcus aureus* septicemia. However, the most common route by far is the ascending route. In women, urinary tract infections are preceded by colonization of the perineum and periurethral area by the pathogen, most often a strain of *Escherichia coli*. These organisms then ascend into the bladder via the urethra. Sexual intercourse appears to be important in forcing bacteria into the female urethra. The association of cystitis in women, with intercourse ('honeymoon cystitis') is real (Kunin, 1978).

Most UTI are caused by *Escherichia coli*. There are many different serogroups of *Escherichia coli*, but only a few cause most infections. It is therefore thought likely that some strains of *Escherichia coli* possess certain

virulence factors that enhance their ability to cause infection (Mulholland, 1979; Reese *et al.*, 2000).

Any structural abnormalities leading to the obstruction of urine flow increases the likelihood of infection. Such abnormalities include congenital anomalies of the ureter or urethra, renal stones and, in men, an enlarged prostate. All of these lead to stasis of urine. Vesico-ureteric reflux (VUR) is a condition caused by failure of a physiological valve at the junction of the ureters and the bladder, thus allowing urine to reflux back to the kidneys when the bladder contracts. It is probable that VUR plays an important role in childhood urinary tract infections in leading to chronic renal damage and persistence of infection. The presence of abnormal residual urine in the bladder, caused by obstructive lesions like an enlarged prostate or urethral stricture, predisposes patients to infection (Bailey, 1973).

Epidemiology:

Infections of urinary tract (UTIs) occur frequently in both community & hospital environments and are the most common bacterial infections in humans (Sobel and Kaye, 1989). In fact, UTIs are the most common bacterial infection occurring in a person's life span, with 43% of females and 12% of males experiencing at least one UTI (Kunin, 1987).

Epidemiologically, urinary tract infections should be subdivided into hospital acquired (nosocomial) infections e.g. catheter-associated infections, and non-catheter-associated (community-acquired) infections. Infections in either category may be symptomatic or asymptomatic. Acute infections are very common in non-catheterized patients (more so among women than among men) (Kunin, 1994).

After one year of age and until about the age of 50, UTI is predominantly a disease of females. From ages 5 through 14, the incidence of bacteriuria is 1.2% among girls and 0.03% among boys. One to three percent of women between the age of 15 and 24 have bacteriuria, the incidence increasing one to two percent for each ensuing decade of life, up to a rate of approximately 10% by the sixth decade (Sobel and Kaye, 1989). Approximately 10% to 20% of women in the general population will experience a UTI during their lifetime (Komaroff, 1984). Women have more UTIs, than men probably because of anatomical and physiological differences. The female urethra is relatively short, which allows bacteria easy access to the bladder. In contrast, males are partly protected because the urethra is longer and antimicrobial substances are secreted by the prostate (Sobel and Kaye, 1989; Lipsky, 1989).

The incidence of UTIs in neonates is about 1%, and most neonatal cases occur in males (Abbot, 1972). The mortality rate among newborns with UTIs is about 10% to 11%. UTIs again become a problem for males after the age of 50, when prostatic obstruction, urethral instrumentation, and surgery influence the infection rate. Infection at an earlier age in a male is rare and requires careful evaluation for the presence of urinary tract pathology (Lipsky, 1989).

In general, 10% to 20% of the elderly living at home have bacteriuria. This increases to 20% to 25% in extended care facilities, 30% in hospitals, and 35% to 40% in long-stay hospitals (Boscia *et al.*, 1986; Boscia and Kaye, 1987). The frequency of infection also tends to rise with increasing age for those 65 years of age and older. Most of urinary tract infections in these patients are asymptomatic, but they are still important because they often result in symptomatic infection (Kaye, 1980). In addition, bacteriuria in old age may be associated with a decreased survival (Dontas *et al.*, 1981). The reasons for higher UTI rates in elderly people include the high prevalence of prostatitis in males, poor bladder emptying, and fecal incontinence in very old patients (Kaye, 1980; Resnick *et al.*, 1989).

Urinary Tract Infections during Pregnancy:

Urinary tract infections are detected in 2-8% of pregnant women. The exact figure depends on socioeconomic status (Kunin, 1994). Mati, (1974) reported that the exact *prevalence* of bacteriuria during pregnancy is difficult to state because published reports showed great variations. Campbell - Brown *et al.*, (1987) reported that the estimated frequency of bacteriuria in females varies from 2% to about 11% and increased by a further 1% during pregnancy. Although dysuria and frequency occur in 1-3% (Andriole and Patterson, 1991). It is estimated that about 10% to 20% of all women suffer from a UTI at some point in life. During pregnancy, the prevalence of bacteriuria does not change but there are some changes in the pathogenesis that increase the rate of pyelonephritis (Weissenbacher and Reisenberger, 1993).

Pathogenesis:

The risk for urinary tract infection is related to both microbial and host defense factors (Ward and Jones, 1996). The microbial factors include virulence, strain, organ specificity, and dose. Whereas many organisms infect the lower urinary tract, the number of microorganisms able to infect the renal parenchyma is limited. Host defenses along the entire urinary tract are important and probably eliminate one third of the potential infections (Reid and Sobel, 1987). Urinary flow is a major defense in that ascending organisms are flushed through the tract and removed from the body. Bladder emptying is another consideration, since residual bacteria-containing urine allows for attachment of bacteria to the bladder mucosa and establishment of bacterial growth. Any condition that impairs bladder emptying or causes retention increases the risk for infection (Maureen, 2001). The presence of residual bladder urine allows inoculums of bacteria to multiply. The frequency of recurrence of UTI is increased in woman with small increase (1-10 ml) in residual urine volume (Bailey, 1987).