Prevalence and Antibiotic Sensitivity Pattern of Asymptomatic Bacteriuria among Female Students and Staff of College of Applied Medical Sciences, Taif University

Taisir Saber¹,², Nahed M. Hawsawi¹, Aisha hassen alharthi¹, Mashaal hamad algethami¹, Reem Abdullah alnefaie¹, Aisha abdul Rahman asiri³, Tamer Saber³, and Amal Fathi Gharib¹,⁴

¹Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Taif University, Taif, Saudi Arabia.

²Medical Microbiology and Immunology Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt.

³Internal medicine Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt.

⁴Biochemistry Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt.

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Corresponding Author: Amal Fathi Gharib

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ABSTRACT

Background: Asymptomatic bacteriuria (ASB) is a common condition where bacteria are present in a significant count in urine without symptoms. Pathogen persistence for a long period of time can cause urinary tract infection (UTI) that may lead to a serious complication. This study was carried out to assess the prevalence of ASB among female student and staff in College of Applied Medical Sciences, Taif university.

Methods: This was a cross sectional study where a clean-catch midstream urine specimens were collected from 50 participant; 29 staff (group A) and 21 students (group B). The urine specimens were cultured quantitatively onto CLED agar plates and incubated at 35-37 °C for 24-48 hours. Bacterial growth equal to or more than \(10^5\) CFU/ml was considered significant. Bacteria that grew in significant count were identified by Gram stain, catalase test, coagulase test and novobiocin sensitivity.

Results: Out of the 50 urine specimens screened for ASB, two specimens (4 %) showed significant bacterial growth; where one specimen (3.4 %) in group A and one specimen (4.8 %) in group B showed significant bacterial growth. The rest of urine specimens showed either no or non-significant bacterial growth. Staphylococcus saprophyticus and Staphylococcus epidermidis were the isolated organisms.

Conclusion: Low prevalence of asymptomatic bacteriuria was noted in this study. This may be due to the relatively small number of the students and staff investigated. Another likely explanation is that our target group has high educational status as socioeconomic marker.

Keywords: asymptomatic bacteriuria, Staphylococci, female students.

Introduction

Urinary tract infection (UTI) is infection of any part of the urinary tract (Nicolle et al., 2005). UTIs are caused by bacteria, parasites or viruses that live in the alimentary tract, within the vagina, or around the urethra. UTIs are among the most common bacterial infections in humans both in the community and
hospital settings. It happens in all age groups, genders, and frequently requires urgent treatment (Orrett and Davis, 2006). Infections of the urinary tract can be “uncomplicated” when they occur in a normal urinary tract with no structural or functional abnormalities or underlying host illness predisposing for the infection, or “complicated” when an underlying abnormality is thought to have enabled the infection to occur. Infection may involve single sites and causes urethritis, cystitis or pyelonephritis but the whole system is always at a risk of invasion by bacteria (McLellan and Hunstad, 2016).

UTIs can be symptomatic or asymptomatic (Peterside and Wokoma, 2009). Asymptomatic bacteriuria (ASB) is defined as the presence of a significant count of bacteria (equal to or greater than 10^5 CFU/ml) in an appropriately collected urine specimen from an individual without symptoms of urinary tract infection (Colgan et al., 2006). Most frequent causative agent of asymptomatic bacteriuria is Escherichia coli accounting for 80% to 90% of isolates (Nester et al., 2016). Other organisms that belong to enterobacteria and known as causes of UTI/ASB are klebsiella species and Proteus mirabilis that can be found as normal inhabitants of the large intestine and can be involved in opportunistic infections (Harvey et al., 2013). Staphylococcus saprophyticus is also an important cause of UTI. In fact, it is the second most important community-acquired UTI organism after E. coli in young female population (Anderson et al., 1981). Enterococcus species including E. faecalis and E. faecium are responsible for a minority of community-acquired UTIs, but together cause 15% to 30% of catheter-associated UTIs and are the third leading cause of hospital-acquired UTIs (Maki and Tambyah, 2001; hidron et al., 2008). Additionally, Streptococcus agalactiae, which is a normal inhabitant of colon and female reproductive tracts, are found to cause approximately 1–2% of all UTI commonly in elderly also in pregnant and diabetic individuals (foxman, 2003; Edwards and baker, 2005).

Asymptomatic bacteriuria is a common condition, with a highly variable prevalence among the population (Nicolle, 2003). The exact cause of asymptomatic bacteriuria has not been determined although there is a proved evidence that certain population groups are at higher risk of developing asymptomatic bacteriuria (Givler and Givler, 2018). In terms of gender, females develop bacteriuria more frequently than males due to the anatomical nature of the female urinary system. Females have short urethra that gives bacteria short distance to the bladder. In addition, accidental introduction of fecal flora into the urinary tract may occur aided by proximity of the urethra to the rectum (Crader and Leslie, 2018). Most women have temporary bacteriuria after sexual activity, but few develop symptomatic infections (Givler and Givler, 2018). During pregnancy, complications of asymptomatic bacteriuria in the form of acute pyelonephritis is a cause for major concern. The reason of such condition is obstructive hydronephrosis that occurs in 43% to 100% of pregnant women. Hydronephrosis and hydroureter occur when the kidney and ureter respectively are distended with urine and swollen. The Dilatation of the ureters and renal pelvis come because of high-level progesterone during pregnancy and mechanical compression of the ureters between the growing uterus and linea terminalis. The dilated collecting system can hold up to 300 mL of urine, leading to urinary stasis, which increases the risk for pyelonephritis to 40% in pregnant women with asymptomatic bacteriuria. Up to 30% of pregnant females develop acute pyelonephritis if ASB is left untreated (Samaill and Vazquez, 2015). In the same instance ASB prevalence in women at post-menopausal age range from ~5–19%, with a highly increased occurrence in women who have prior history of UTI. The main known cause is that female at this age lose their acidic vaginal pH, with other contributing factors like diminishing oestrogenic effect on the genitourinary mucosa and genetic predisposition (Carder and Leslie, 2018; Nicolle, 2003). On the contrary, it is uncommon for males to have ASB at least before the age of 50 years (Nicolle, 2015). In general, the incidence of ASB increase with age despite the gender. Other candidate risk factor is low socioeconomic class, where some previous studies reported high prevalence of ASB in rural areas, among uneducated individuals and among people who have difficult financial status. All these factors are considered socioeconomic markers (peterside and wokoma, 2009).

Untreated asymptomatic bacteriuria leads to kidney infection that may lead to loss of kidney function in severe cases, as such requiring kidney transplant, thus early detection of bacteriuria aids in preventing renal related complications of UTI, and can prevent renal scarring, obstructive atrophy, hypertension and renal dysfunction that may develop as a direct result of asymptomatic UTI (Ayoade et al, 2013).
Moreover, asymptomatic bacteriuria is one of the major causes of spread of multi-drug resistant pathogen (Ensor et al., 2006). As pathogens remain undetected in the body, they develop resistance to all kind of drugs used for treatment of other infections. So the aim of the study was to determine the prevalence and investigating the antibiotic sensitivity pattern of asymptomatic bacteriuria among female students and staff of college of applied medical sciences, Taif University.

**Subjects and methods:**
A cross-sectional study was carried out for the present research in the female section of Collage of Applied Medical Sciences, Taif University. A total number of 50 apparently healthy female students and staff were included in the study. Subjects with symptoms of urinary tract infection were excluded from the study. In addition, those with antibiotic treatment within two weeks of the study were avoided.

**Ethical concerns:**
Permission to conduct the study was taken from the research committee in Collage of Applied Medical Sciences - Taif University after explanation of the aim of the study. Informed consent to participate in the study was obtained from the participants after clarification of the aim of the study.

**Collection of samples:**
Clean catch mid-stream urine samples were collected from the participants in sterile wide-neck, leak-proof disposable plastic containers. The subjects were given written instructions for the collection of the clean catch mid-stream urine sample including the following: Main instruction that gives to them.
- wash hands with soap and water and dry them well.
- put the container and two wipes on a place they can reach to it.
- take the lid out of a container, don’t touch inside the container or lid.
- sit as for back on toilet and spread legs apart.
- Use two fingers of one hand to spread the labia because it folds of skin on each side of the vagina.
- clean the area very well by using water and dry it by clean wipe.
- Then discarded first few streams then collect remain.

Each urine sample was cultured quantitatively on cystine lactose electrolyte deficient (CLED) agar plate using disposable calibrated loop (0.01 ml) and incubated aerobically at 35-37 °C for 24-48 hours. The significant bacterial growth was identified by:
- Microscopic examination of Gram-stained film.
- Biochemical reactions (catalase and coagulase tests were performed according to the result of the Gram stain).
- Novobiocin test is used to differentiate coagulase-negative Staphylococci; where *Staphylococcus saprophyticus* is novobiocin-resistant and *Staphylococcus epidermidis* is novobiocin-sensitive.

**Data analysis method:**
Data entry and statistical analysis were done using SPSS 19.0 statistical package of social sciences.

**Results:**
A total of 50 non-symptomatic female subjects from collage of Applied Medical Sciences were participated in this study. Clean-catch midstream urine specimens were collected from 29 staff (group A) and 21 students (group B). Each specimen was cultured quantitatively on CLED agar plate using a calibrated loop (0.01 ml) to screen for asymptomatic bacteriuria. Bacteria that grew on the CLED agar in a significant count (equal to or more than $10^5$/ml) was identified by Gram stain catalase test, coagulase test and novobiocin sensitivity.

Out of the 50 urine specimens screened for ASB, two specimens (4 %) showed significant bacterial growth; where one specimen (3.4 %) in group A and one specimen (4.8 %) in group B showed significant bacterial growth, with no significant difference between the two groups ($P >0.05$) The rest of urine specimens showed either no or non-significant bacterial growth (table 1) (figures 1, 2 and 3). One of the two bacterial strains isolated in significant count from the urine specimens was *Staphylococcus saprophyticus* and the other was *Staphylococcus epidermidis*.

**Table 1:** Distribution of the significant bacterial growth among the collected urine specimens.

<table>
<thead>
<tr>
<th>Urine specimens</th>
<th>Total specimens N=50</th>
<th>Group A No= 29</th>
<th>Group B No =21</th>
<th>P- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant bacterial growth</td>
<td>2 (4 %)</td>
<td>1 (3.4 %)</td>
<td>1 (4.8 %)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>No or non-significant bacterial growth</td>
<td>48 (96 %)</td>
<td>28 (98.6 %)</td>
<td>20 (95.2 %)</td>
<td>(not significant)</td>
</tr>
</tbody>
</table>
Discussion:

Our study included 50 participants, 29 staff (group A) and 21 students (group B). Each group showed one positive result that is 3.4%, 4.7% respectively. Findings indicate that the prevalence of ASB among female student and staff in health collage at Taif university is 4%. Peterside and wokoma (2009) reported nearly similar prevalence of ASB among female students in secondary school where it was 6%. In our study, the recovered organisms were Staphylococcus saprophyticus and staphylococcus epidermidis, unlike most previous studies that reported Escherichia coli as the commonly isolated organism (Schnarr and Smaill, 2008).

Prevalence in our study is considered to be low as expected leaning to the obvious high educational status as a socioeconomic marker. This concept remains controversial where some studies state an association between ASB and the socioeconomic class while other studies reject it. This variance has been indicated in different target groups. For example, a study conducted by labi et al. (2015) concluded that there is no association between ASB among pregnant females and low socioeconomic class, while other study by Schnarr and Smaill (2008) came with contradicting findings considering low socioeconomic status a risk factor for bacteriuria in pregnancy, keeping the controversy on this issue not resolved.

Staphylococcus saprophyticus is one of the normally present organisms in the female genital tract specifically in the urethra where it shows better adherence to uroepithelial cells than to buccal or skin cells. It is found to be the second most common ASB community acquired causative agent after E. coli among female population (Anderson et al, 1981).

In our study Staphylococcus saprophyticus had prevalence of 2%, more significant results were noted in previous studies like in study conducted by Marrie et al. (1982), where Staphylococcus saprophyticus incidence was 7.5% among 145 college women with actual symptoms of UTI. Moreover, results of studies carried out by University of British Columbia and York District Hospital had a prevalence of S. saprophyticus of 6.9% and 6.6%, respectively.

Although, Staphylococcus epidermidis is more common and best known for opportunistic and nosocomial infections worldwide (kanai et al., 2014), it can cause Community-acquired urinary tract infections. This organism is frequently recovered from positive cultures for ASB among pregnant females in different previous studies. In a study conducted by Andabati and Byamugisha (2010) involved 218 pregnant females to determine the microbial aetiology of asymptomatic bacteriuria among ante-natal mothers, Staphylococcus epidermidis had the second lead prevalence of 20.2% after E.coli.

Student population showed higher percentage (4.7%) of ASB in comparison with the studied staff (3.4%). This can be roughly attributed to the marital status where staff members are more likely married requiring more feminine hygiene care compared to students who are usually not married. We attribute this variance to the social norm how it views female’s health and essential caring measures.
relating to that to their marital status. However, our sample size is relatively small which preclude a firm view. Further studies are needed to explore and confirm such assumption, as female gender as a risk factor of developing ASB/UTI is well established and well known. The future studies should focus on the variance among female population itself.

**Conclusion:**

The current study showed low prevalence of asymptomatic bacteriuria among the female students and staff in College of Applied Medical Sciences, Taif University. This may be due to the relatively small number of the students and staff investigated. Another likely explanation is that our target group has high educational status as socioeconomic marker.

**References:**

21. Orrett FA, Davis GK. A comparison of the antimicrobial susceptibility profile of urinary