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Etiology of urinary tract infection in obstetric patients attended an urban hospital in Dhaka, Bangladesh

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ABSTRACT

UTIs during pregnancy are a common cause of serious maternal and perinatal morbidity. Pregnancy-related physiological changes increases risk of UTI, which more frequently progresses to pyelonephritis. We aimed to examine the common etiology of UTI in obstetrics and its correlation with the age of patients. A total of 300 urine samples were collected from obstetric patients at their third trimester of pregnancy attended at an urban hospital in Dhaka, Bangladesh. Mid stream urine samples were processed for culture. Isolates were identified and antimicrobial drug susceptibility was found out. Obstetric patients had higher prevalence of UTI, found in 23% of the patients in the study. Among the UTI cases, 59% developed purulent infection. Pregnancies in both lower and higher age are more vulnerable to UTI infections. Mostly isolated etiological agents were E. coli and Klebsiella spp. among the Gram negative bacteria. Staphylococcus spp. and Enterococcus spp. were isolated among the Gram positive bacteria. Candida spp. were also isolated in a significant number of cases. The prevalence of UTI cases and the etiological agents varied with the age of patients; E. coli was found prevalent in younger patients which markedly declined in patients aged above 33 years. The occurrence of Candida spp. increased in older age. The prevalence as well as associated etiological agent of UTI in obstetric patients was found to have strong correlation with the age. Both the lower and higher age groups are more vulnerable to UTI and the later had the most versatile etiology.

Key words: Etiology, Pregnancy, Prevalence, Urinary tract infection

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INTRODUCTION

Urinary tract infections (UTIs) represent the most common bacterial infection in pregnant women [1, 2]; the incidence can be as high as 8% [3, 4]. The organisms that cause UTIs during pregnancy are the same as those found in nonpregnant patients. *Escherichia coli* accounts for 80-90% of initial UTIs and 70-80% of recurrent infections [5-8]. Other gram-negative rods such as *Proteus mirabilis* and *Klebsiella pneumoniae* are also common. Among Gram-positive organisms, group B streptococcus (GBS) and *Staphylococcus saprophyticus* are commonly cause UTI. GBS is found in approximately 5% of UTI patients [9, 10]. Less common organisms reported to cause UTI include *Pseudomonas aeruginosa*, enterococci, *Gardnerella vaginalis* and *Ureaplasma ureolyticum*. [3, 11-13].

Approximately 90% of pregnant women develop ureteral dilatation until delivery. Effects of progesterone and mechanical compression by the gravid uterus lead to increased bladder residual volume; which contribute, in combination with decreased bladder and ureteral tone, and decreased urine concentration, to increased urinary stasis and ureterovesical reflux [3]. Increase in urinary progestin and estrogen may lead to a decreased ability of the lower urinary tract to resist invading bacteria. Glycosuria, which develops in up to 70% of pregnant women due to pregnancy-related changes in glomerular filtration rate, encourages bacterial growth in the urine [3, 5, 14]. In

addition, maternal immunologic defense mechanisms alter in pregnancy [15]. The combined effect increased risk of UTI for pregnant women.

UTIs during pregnancy are a common cause of serious maternal and perinatal morbidity. Significant bacteriuria may exist in asymptomatic patients, which subsequently increases risk of developing pyelonephritis [16], which is associated with hypertensive disorders of pregnancy, preeclampsia, anemia, amnionitis [17], increased risk of intra-uterine growth retardation and low-birth-weight infants [18]. Group B streptococcal vaginal colonization is known to be a cause of neonatal sepsis and is associated with preterm rupture of membranes, preterm labor and delivery [19]. Ten per cent of women identifies with asymptomatic bacteriuria during pregnancy [16, 20], which progresses to pyelonephritis in 20% to 40% of cases, higher incidence occurs in women having recurring UTIs during the same pregnancy [21]. In contrast, progression to pyelonephritis in nonpregnant women is only 1% to 2% [22]. All pregnant women should be screened for bacteriuria and subsequently treated with antibiotics. Historically, ampicillin has been the drug of choice, but in recent years *E. coli* has become increasingly resistant to ampicillin [23, 24] and should no longer be used in the treatment of asymptomatic bacteriuria [25]. Oral nitrofurantoin and cephalexin are good antibiotic choices for treatment in pregnant women with asymptomatic bacteriuria and acute cystitis, but parenteral antibiotic therapy may be required in women with pyelonephritis because it can be a life-threatening illness, with increased risk of perinatal and neonatal morbidity [25]. Pregnant women with urinary group B streptococcal infection should be treated and should receive intrapartum prophylactic therapy [25].

Nitrofurantoin (Macrodantin) is a good choice because of its high urinary concentration. Alternatively, cephalosporins are well tolerated and adequately treat the important organisms [15]. Sulfonamides can be taken during the first and second trimesters but, during the third trimester, the use of sulfonamides carries a risk that the infant will develop kernicterus, especially preterm infants. With the low level of resistance to nitrofurantoin among uropathogens, it remains an ideal therapeutic agent and is safe for use in pregnancy [15, 26].

The present study aims to evaluate the occurrences of UTIs among obstetric patients and to estimate resistance of the causal organisms to antibiotic. The study also attempts to show the correlation between age and etiology of UTIs.

MATERIALS AND METHODS

Urine samples were taken from a total of 300 obstetric patients, at their third trimester of pregnancy, attended at an urban hospital (Apollo hospitals, Dhaka) in Bangladesh from November 2011 to August 2012. Freshly void mid stream urine samples were examined for culture by semi quantitative streaking method [27] on HiCrome UTI modified agar (Sigma-Aldrich, Switzerland). Isolates were identified by biochemical characterization and antimicrobial susceptibility was assessed by disc diffusion method [28] on Mueller-Hinton agar. The correlation of depended values was analyzed by linear and polynomial regression.

RESULTS AND DISCUSSION

Every obstetric patients attending at Apollo Hospitals Dhaka use to screen for bacteriuria as a routine procedure (an U.S. Preventative Services Task Force “A” recommendation [29] because of relatively high prevalence of asymptomatic bacteriuria reported during pregnancy). Obstetric patients, previously identified and treated UTI at early stages of pregnancy, were also screened at their third trimester because the urine of treated patients may not remain sterile for the entire pregnancy [30].

A total of 300 obstetric patients were screened for the study and 70 urine samples were found to have bacteriuria. The obstetric patients were aged between 19 and 40 years, with the same mean and median age of 29 years, which indicate a normal age distribution among the obstetric patients. Number of obstetric patients was plotted along with the UTI cases in different age (Fig. 1), which also represents a normal distribution pattern.

The prevalence (%) plot of UTI in different age group (Fig. 2 and Table 1) shows the actual portrayal between the correlations of UTI with the age of obstetric patients. The trend line for the polynomial regression analysis (Fig. 2) represents a correlation between age and prevalence of UTI cases (though a low value of the coefficient of determination, r2 = 0.2315 existed) and depicts that pregnancies in both lower and higher age groups are more vulnerable to UTI infections.

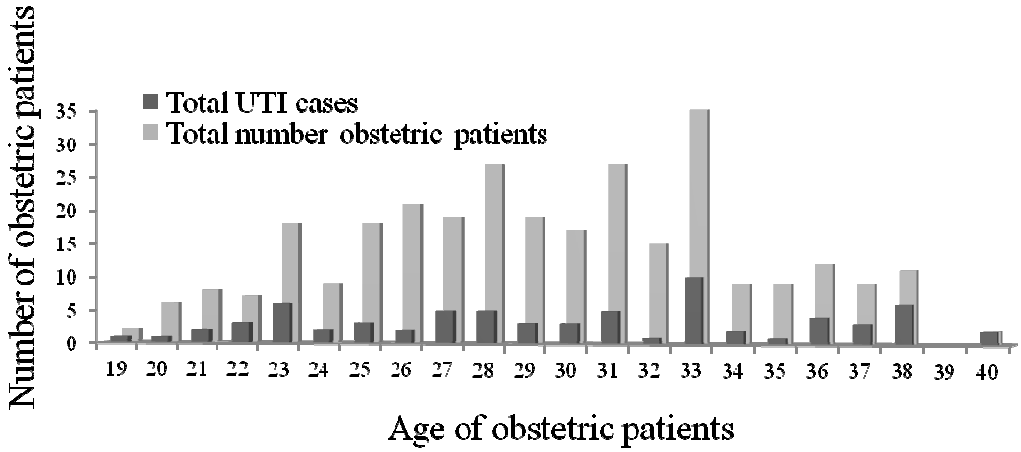

Fig. 1 Distribution of UTI among the obstetric patients
The bar diagram represents the proportion of UTI in obstetric patients of different age

Table 1 Prevalence (%) of UTI in different age groups of obstetric patients

Age group of obstetric patients	Total number of obstetric patients	Number of UTI infectious case (prevalence per cent), p-value	Purulent infectious case among UTIs (prevalence per cent), p-value
19-23 years	41	13 (32%)	10 (77%)
24-28 years	94	17 (18%)	08 (47%)
29-33 years	113	21 (19%)	11 (52%)
Above 33 years	52	19 (37%)	12 (63%)
Total	300	70 (23%)	41 (59%)

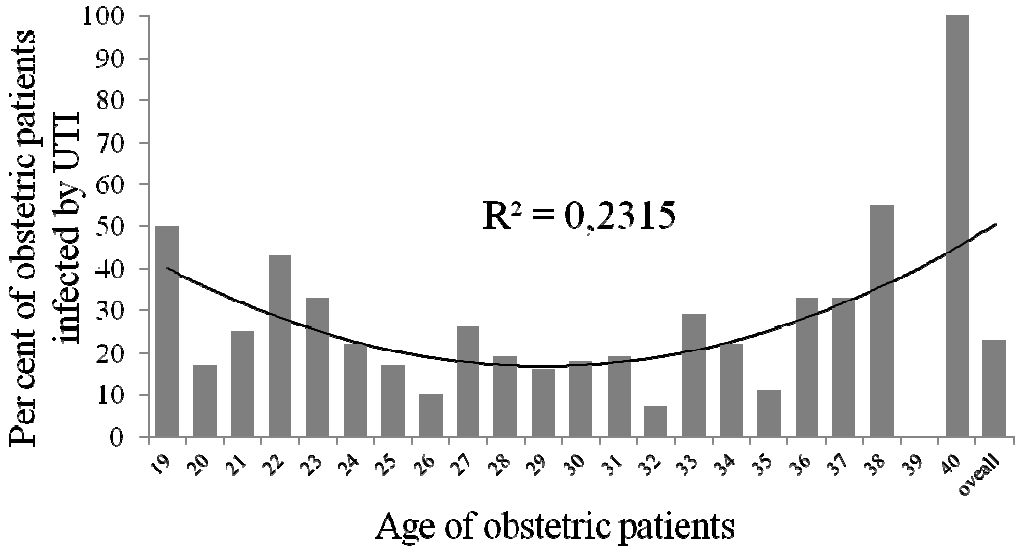

Fig. 2 Prevalence of UTI in obstetric patients
Each bar represents the prevalence (% of UTI case among the total patients of certain age) and the trend line of polynomial regression analysis represents the correlation of age with the prevalence. Though, the value for the coefficient of determination (r^2) represents a weak correlation

The etiological agents of UTI, isolated from obstetric patients, belonged to a wide variety of organisms, covering both the Gram positive and Gram negative organism (Fig. 3). *Escherichia coli* was the most prevalent bacteria found in 39% patients having bacteriuria. *Klebsiella* spp., the second most prevalent bacteria associated with UTI, was found in 13% of UTI cases. Among the Gram positive bacteria, *Enterococcus* spp. was found in 12% and *Staphylococcus* spp. was found in 10% of UTI cases. *Staphylococcus aureus* was the major species of the group; a considerable number of methicillin resistant *S. aureus* was also isolated. Others were *S. epidermidis S. saprophyticus* among the staphylococci. *Proteus* spp., *Pseudomonas* spp. and *Enterobacter* spp. were also isolated in

a number of bacteriuria cases among the obstetric patients. Other than bacteria, almost more than 13% of UTI cases, *Candida* spp. was found to be associated.

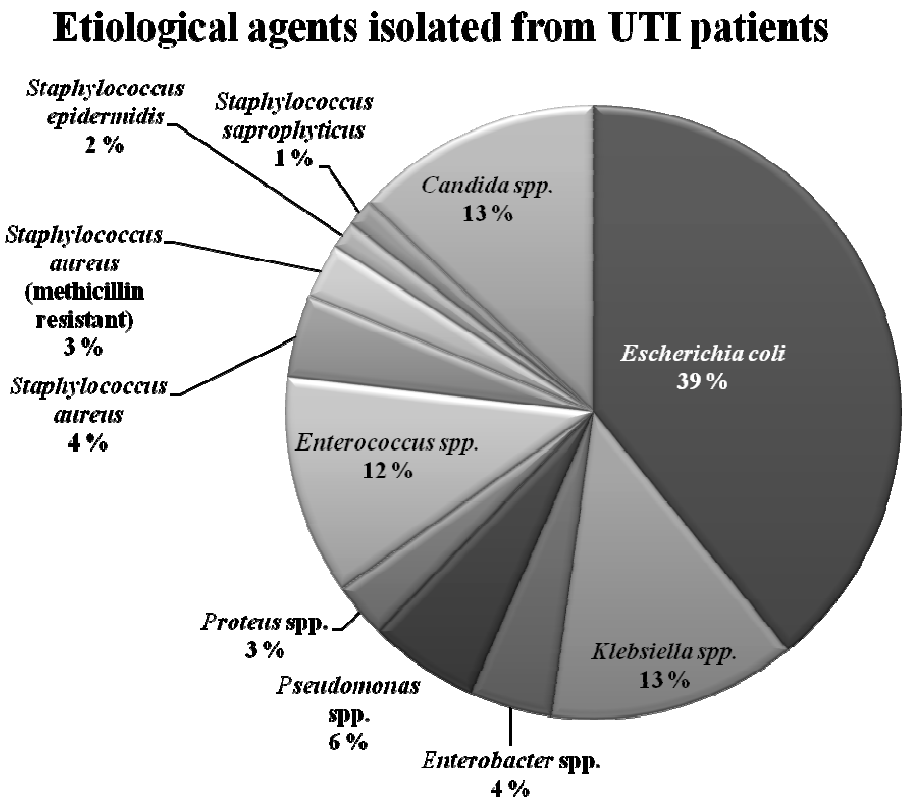

Fig. 3 Etiology of UTI in obstetric patients

The pi-chart represents an overview of etiological agents isolated in the study from the urine sample of obstetric patients at their third trimester of pregnancy

Both asymptomatic (not characterized by symptoms but the microscopy of urine sample) and purulent infections were found (characterized by high pus cells and RBC in urine) in the study. The ratio of purulent to asymptomatic infection cases has been shown in Fig. 4 and Table 1. On an average 59% of UTI infections were found purulent. Asymptomatic UTI cases were more common in age group around mean/median (Table 1) and associated with *Staphylococcus* spp. and *Enterococcus* spp. Gram negative bacterial agents were associated with most of the purulent infections though asymptomatic cases also found for these bacteria. Patients infected by *Candida* spp. have found to have high pus cells and RBC in urine as well.

Etiology was found to differ with age of patients (Fig. 5). *E. coli* was found to be associated with UTI in younger age group, which markedly declined in UTI patients aged above 33 years. *Klebsiella* spp. was found consistently in all age group and *Proteus* spp. was found only in the older patients. There is a regular increase in occurrence of *Candida* spp. was found with the increase in age of patients (Fig. 6); the value of correlation coefficient, r = +0.9441, indicating a strong correlation between occurrence of *Candida* spp. and age of obstetric patients.

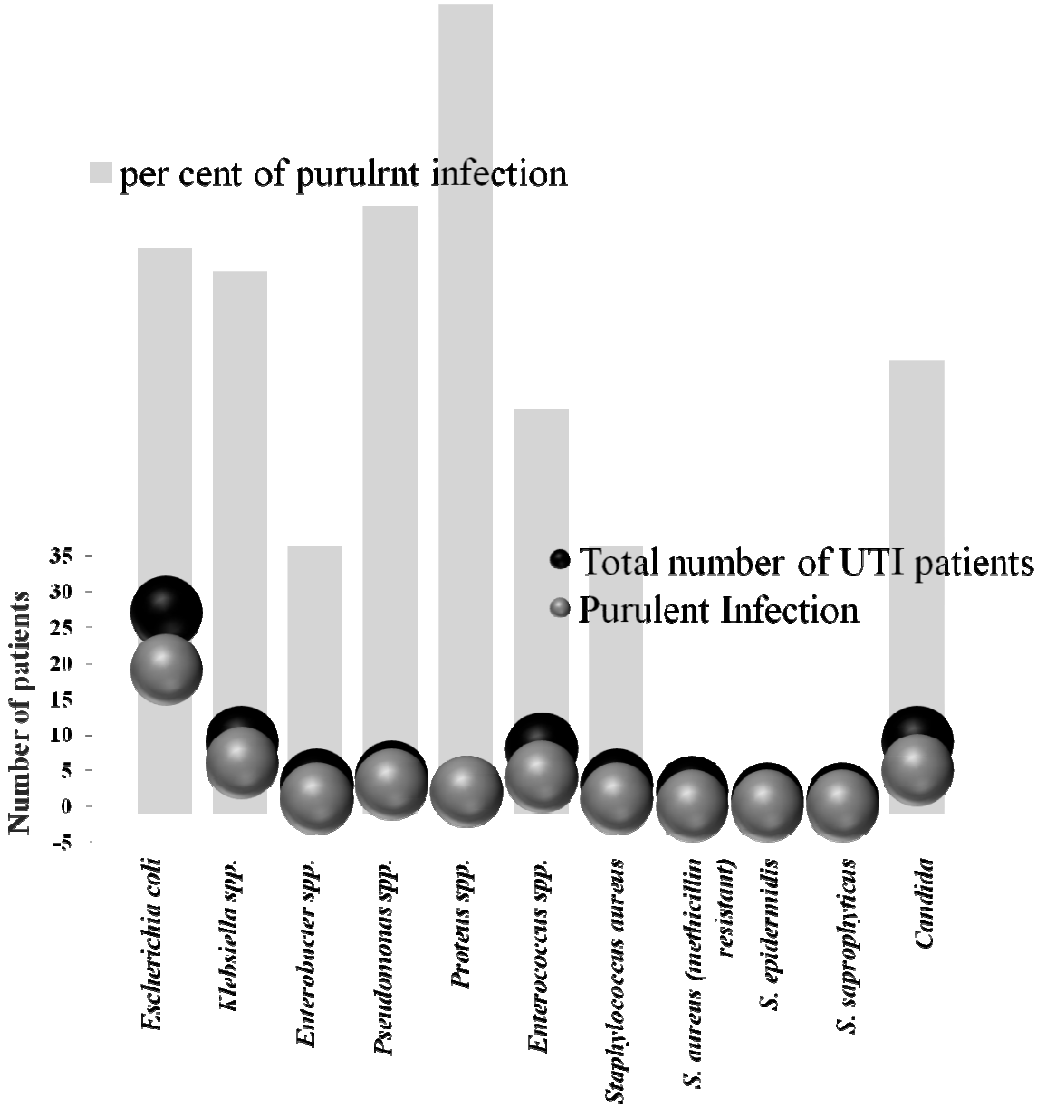

Fig. 4 Comparative analysis of purulent and asymptomatic UTI cases in obstetric patients

Each bar represents the per cent of purulent infectious cases among a certain etiological agent. The grey circle is representing the number of purulent infections, which overlapped the black circle representing the actual number of UTI case for each etiological agent

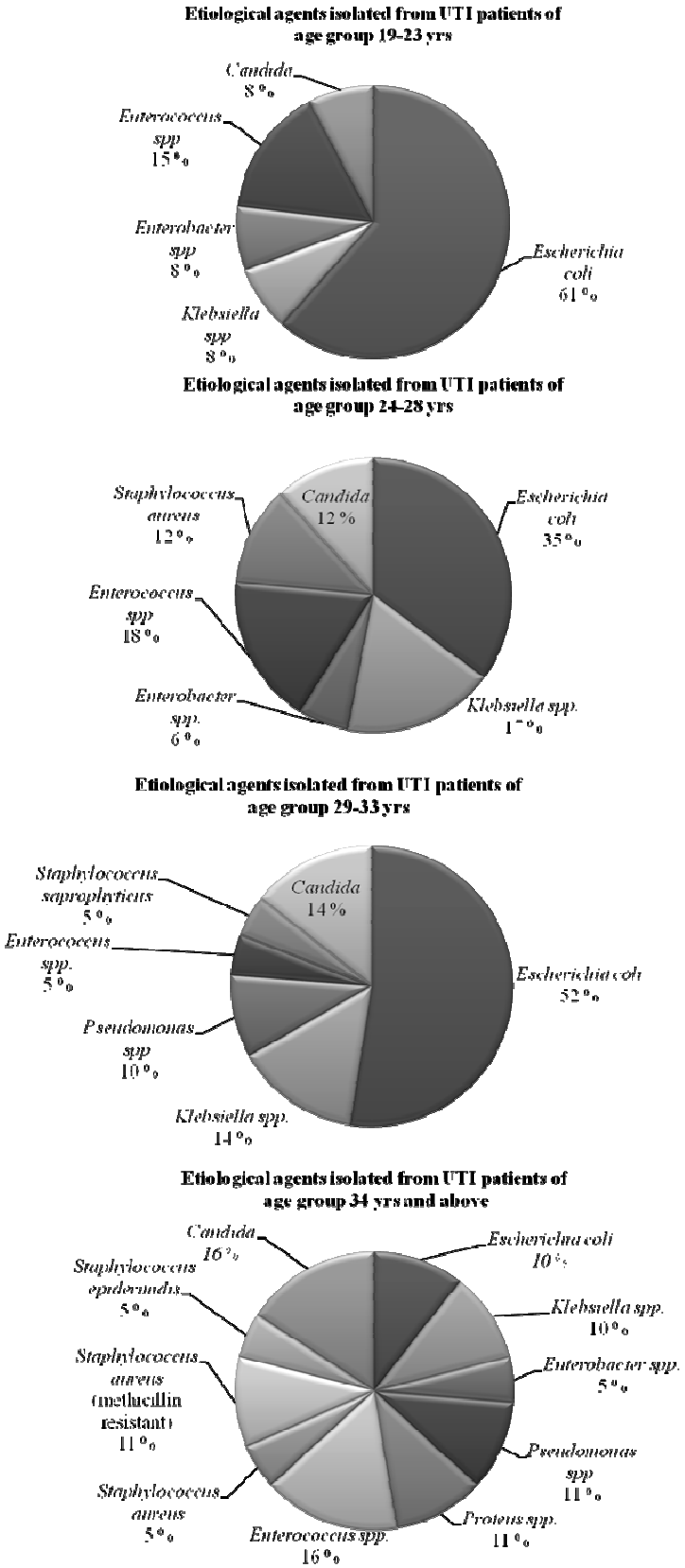

Fig. 5 Etiology of UTI in different age group of obstetric patients

The pi-chart represents an overview of etiological agents isolated from the urine sample of obstetric patients of different age group at their third trimester of pregnancy

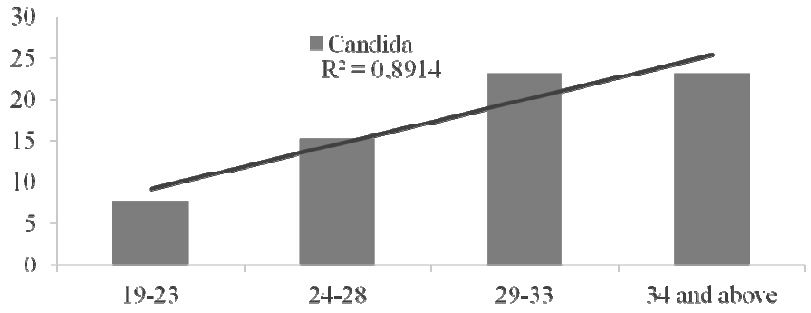

Fig. 6 Prevalence of *Candida* spp.-associated UTI cases in different age group of obstetric patients
Each bar represents the prevalence (% of UTI case among the total patients of a certain age) and the trend line of linear regression analysis represents the correlation of age with the prevalence, the value for correlation coefficient, r = +0.9441 (for the coefficient of determination, r^2 = 0.8914), indicating a strong correlation between occurrence of Candida spp. and age of obstetric patients

CONCLUSION

Traditional diagnostic criteria of significant bacteriuria include culture of 10^5 cfu/mL of a single uropathogen on two consecutive clean catch urine specimens [5, 15] . Recent evidence suggests that lower colony counts (10^2–10^3 cfu/mL) may demonstrate active infection and eventually lead to pyelonephritis in pregnant women [26, 31, 32]. Thus a minimum of 10^3 cfu/mL of a single etiological agent positive in urine sample was considered as active UTI. Presence of more than one genus of etiological agent in urine sample was carefully recorded but excluded in the present study. Out of 300 obstetric patients, a total of 70 urine samples were found to possess significant Gram positive and Gram negative bacteria along with *Candida* spp. A variety of etiological agents were isolated with UTI of obstetric patients. Among the Gram positive organism *Enterococcus* spp. and *Staphylococcus aureus* were the major types isolated. Among Gram negative isolates *Escherichia coli* was the most prevalent bacteria followed by *Klebsiella* spp.

The etiological agents differed in different age groups. *E. coli* was found to be the most prevalent causal agent for UTI in all age groups, except for obstetrics patients aged 33 or above. A number of asymptomatic infections were observed and the ratio of asymptomatic to purulent infectious cases observed to be depended on both the etiological agents isolated and age of patients. Most of the isolates were found multidrug resistant when assessed.

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