Journal of Public Health and Epidemiology Vol. 5(2), pp. 66-69, February 2013
Available online at http://www.academicjournals.org/JPHE
DOI: 10.5897/JPHE12.104
ISSN 2141-2316 ©2013 Academic Journals

Full Length Research paper

Asymptomatic bacteriuria among secondary school students in Benin City, Nigeria

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Accepted 5 February, 2013

Asymptomatic bacteriuria (AB) is common, with varying prevalence by age and gender, amongst other factors. AB is more likely to develop to symptomatic urinary tract infection, thus, necessitating periodic review. This study aims to determine the prevalence of AB among secondary school students in Benin City. Etiologic agents and bacterial susceptibility will also be determined. Clean-catch mid-stream urine was obtained from 315 apparently healthy secondary school students in Benin City. The subjects consists of 158 (81 males and 77 females) Junior Secondary School (JSS) and 157 (84 males and 73 females) Senior Secondary School (SSS) students. The urine specimens were processed to diagnose AB. Significant emergent colonies were identified and disc susceptibility tests performed on bacterial isolates using standard techniques. The prevalence of AB was significantly (P = 0.039) higher in SSS students compared to JSS students (SSS versus JSS: 11.57 versus 5.06%). Generally as well as among JSS and SSS students, the prevalence of AB did not differ significantly by gender (P > 0.05). *Staphylococcus aureus* were the predominant isolates causing AB. Among JSS students, *S. aureus* predominated while among SSS students *E. coli* was the most prevalent. In terms of gender, *S. aureus* was the most prevalent in males in both JSS and SSS as well as in female JSS students, while *E. coli* was the predominant etiologic agent among female SSS students. Nitrofurantion and pefloxacin was the most active antibacterial agent. In conclusion, an overall prevalence of 8.25% of AB was observed and measures to reduce AB among secondary school students were advocated.

Key words: Asymptomatic bacteriuria, secondary school students, Nigeria.

INTRODUCTION

Urinary tract infections (UTIs) are one of the most common infection for which antibiotics are prescribed (Colgan et al., 2006). UTIs are among the most common bacterial infections in humans, both in the community and hospital settings occur in all age groups, in both genders, and usually require urgent treatment (Orrett and Davis, 2006). UTIs can be symptomatic or asymptomatic (Frank-Peterside and Wokoma, 2009).

Asymptomatic UTI, also known as asymptomatic bacteriuria (AB), is defined as the presence of significant bacteria (≥ 10^5 cfu/ml) in an individual's urine without signs and symptoms of UTI (Colgan et al., 2006; Frank-Peterside and Wokoma, 2009). AB is common with varying prevalence by age, sex, sexual activity and the presence of genito-urinary abnormalities (Colgan et al., 2006). Women with AB are more likely to experience symptomatic UTI than those without AB (Hooton et al., 2000).

UTIs are the most frequent bacterial infections in children, with a prevalence of 8% in girls and 2% in boys (Moses et al., 2012). The prevalence of AB in children varies with location. Prevalence of 2 to 5.4% have been reported in developed countries (Nicolle, 2003) while in developing countries, prevalence of 10 to 48% have been reported (Franks-Peterside and Wokoma, 2009; Moses et al., 2012).

UTI in children are a significant source of morbidity, particularly when associated with renal abnormalities. AB

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Table 1. Prevalence of AB among secondary school students

Characteristic	No. tested	No. infected (%)	OR	95% CI	P value
School					
JSS	158	8 (5.06)	2.428	0.960, 6.309	0.042
SSS	157	18 (11.57)			
School/gender					
JSS					
Male	81	4 (4.94)	1.055	0.212, 5.254	1.000
Female	77	4 (11.57)			
SSS	84	8 (9.52)	1.508	0.510, 4.504	0.459
Female	73	10 (13.70)			

OR = odd ratio; CI = confidence interval

can predispose to serious morbidity and mortality in children when not detected and treated (Chukwu et al., 2011) and recurrent UTI if untreated (Moses et al., 2012), thus necessitating periodic reviews. Against this background, this study aims to determine the prevalence of AB among secondary school students in Benin City, Nigeria. Etiologic agents of AB and bacterial susceptibility will also be determined.

MATERIALS AND METHODS

Study population

A total of 315 apparently healthy secondary school students in Benin City were recruited for this study. They consisted of 158 (81 males and 77 females) Junior Secondary School (JSS) with age ranging from 11 to 15 years and 157 (84 males and 73 females) Senior Secondary School (SSS) students with age range of 15 to 18 years. Subjects with signs and symptoms of UTI used antibiotics within one week and had large fluid intake (less than one hour) before specimen collection were excluded from the study. Informed consent was obtained from each subject's parents or guardian prior to specimen collection. Approval for this study was given by the Ethical Committee of Edo State Ministry of Education, Benin City, Nigeria.

Specimen collection and processing

Clean-catch midstream urine was collected from each subject into sterile universal containers with boric acid as preservative. A loopful (0.001 ml) of well-mixed urine was streaked on the surface of blood agar and a cystine lactose electrolyte deficient (CLED) medium (M6, Plasmatec Laboratories, UK). The plates were incubated aerobically at 37°C for 24 h, and counts were expressed in cfu/ml. A count of 10^5 cfu/ml was considered significant to indicate UTI. Each urine sample (10 ml) was centrifuged at 2,000 × *g* for 5 min. The supernatant was discarded and a drop of the deposit was examined microscopically at high magnification for pus cells, red blood cells, epithelial cells, casts, crystals, yeast-like cells and *Trichomonas vaginalis.* The presence of pus cells (5 per high-power field) was considered significant to indicate infection. Urinary tract infection was diagnosed if the bacterial or pus cell count, or both, were significant in an individual. The isolates were identified by standard microbiological methods (Barrow and Feltham, 2003), and disc susceptibility tests for bacterial isolates were performed by the British Society for Antimicrobial Chemotherapy (BSAC) method (Andrews, 2009).

Statistical analysis

Statistical analysis was performed using the Fisher's exact test and odds ratio (OR) analysis, using the statistical software INSTAT (GraphPad Software Inc., La Jolla, CA, USA).

RESULTS

The prevalence of AB was significantly (P = 0.039) higher in SSS than in JSS pupils (11.57% versus 5.06%, respectively). In both JSS and SSS students, the prevalence of AB did not differ significantly (P = 0.05) between males and females (Table 1). *Staphylococcus aureus* was the most prevalent etiologic agent of AB, with a prevalence of 34.62% and *Klebsiella* species (3.85%) were the least cause of AB. *S. aureus* were the predominant isolate from JSS student while *E. coli* predominated among SSS students (Table 2). Among JSS students, *S. aureus* were the most prevalent among males while among females only *S. aureus* and *Candida albicans* were recovered. Among SSS students, *S. aureus* were most prevalent in males while *Escherichia coli* were most prevalent in females (Table 3). Nitrofurantoin and pefloxacin were the most active anti-bacterial agents against all bacterial isolates (Table 4).

DISCUSSION

Asymptomatic bacteriuria in children is a significant source of morbidity and can predispose to recurrent UTI

Table 2. Prevalence of uropathogens among secondary school students.

Organism	School		Total (%)
	JSS (%)	SSS (%)	
Escherichia coli	2 (25)	6 (33.33)	8 (30.77)
Klebsiella species	0	1 (5.56)	1 (3.85)
Staphylococcus aureus	4 (50)	5 (27.78)	9 (34.62)
Coagulase negative staphylococci	0	2 (11.11)	2 (7.69)
Candida albicans	2 (25)	4 (22.22)	6 (23.08)
Total	8 (30.77)	18 (69.23)	26 (100)

Table 3. Distribution of uropathogens among gender of secondary school students.

Organism	School			
	JSS		SSS	
	Male (%)	Female (%)	Male (%)	Female (%)
Escherichia coli	2 (33.33)	0	2 (25)	4 (40)
Klebsiella species	0	0	1 (12.50)	0
Staphylococcus aureus	3 (50)	1 (50)	3 (37.50)	2 (20)
Coagulase negative staphylococci	0	0	1 (12.50)	1 (10)
Candida albicans	1(16.67)	1 (50)	1 (12.50)	3 (30)

Table 4. Susceptibility profiles of bacterial isolates.

Antibacterial agent (µg/disc)	Bacterial isolate			
	E. coli (n = 8)	*Klebsiella* species (n = 1)	*S. aureus* (n = 9)	Coagulase negative staphylococci (n = 2)
Ampicillin (25)	1 (12.50)	0	6 (66.67)	1 (50)
Ceftazidime (30)	4 (50)	0	4 (44.44)	1 (50)
Ceftriaxone (30)	8 (100)	0	9 (100)	2 (100)
Gentamicin (10)	6 (75)	1 (100)	7 (77.78)	2 (100)
Tetracycline (25)	2 (25)	1 (100)	5 (55.56)	2 (100)
Sulfamethoxazole-trimethoprim (25)	2 (25)	0	2 (22.22)	1 (50)
Nitrofurantoin (300)	8 (100)	1 (100)	9 (100)	2 (100)
Nalidixic acid (30)	6 (75)	1(100)	ND	ND
Pefloxacin (5)	8 (100)	1 (100)	9 (100)	2 (100)

ND = not done

(Moses et al., 2012). The prevalence of AB is influenced by age, gender, sexual activity, amongst other factors (Colgan et al., 2006). This study focused on the prevalence of AB among secondary school students in Benin City, Nigeria. A total of 26 (8.25%) of the 315 student had AB. This is lower than the 10% previously reported (Frank-Peterside and Wokoma, 2009). Among children with diarrhoea, prevalence of infection varied with geographical location as well as between regions in the same country (Petri et al., 2008). This may explain the finding in this study as Frank-Peterside and Wokoma (2009) study was carried out in Port Harcourt, Nigeria, while our study was in Benin City, Nigeria.

The finding that the prevalence of AB was significantly higher in SSS students compared with JSS students (P = 0.039) agrees with the notion that UTI increases with age (Colgan et al., 2006). Sexual intercourse, a known risk factor for UTI, may be more common in SSS students. Females are known to have higher prevalence of UTI including AB, due to the close proximity of female urethral meatus to the anus, shorter urethra and sexual intercourse (Omoregie et al., 2008). A number of authors have reported higher prevalence of AB in females (Omoregie et al., 2008; Frank-Peterside and Wokoma, 2009). This was observed in this study in both JSS and SSS students. However, it was not statistically significant.

In this study, *S. aureus* (34.62%) was the most prevalent aetiologic agent of AB generally and among JSS

students. This is in agreement with a previous report (Frank-Peterside and Wokoma, 2009). Several reports from Benin City, Nigeria, among different populations, had revealed *S. aureus* as the predominant agent of AB (Omoregie et al., 2008; Omoregie and Eghafona, 2009). This may explain the finding in this study. *E. coli* predominated among SSS students. It is important to note that the study of Frank-Peterside and Wokoma (2009) did not differentiate their students into JSS and SSS, and that the change in aetiologic agents of AB between JSS and SSS students may indicate change in AB pathogen with age. This may not be plausible, as previous reports by Omoregie et al. (2008) and Omoregie and Eghafona (2009) did not indicate *E. coli* as the most prevalent in their older subjects. Further studies are needed to clarify this.

In relation to gender and with the exception of female SSS students were *E. coli* was the most prevalent, *S. aureus* was the predominant organism in both genders. *S. aureus* is a normal flora of the female perineum and vulva, and can easily be carried into the urethra during sexual intercourse by a massaging process (Davies, 1996). The age of JSS students ranged from 11 to 15 years. It is important to note that the first reported case of Human immunodeficiency virus (HIV) in Nigeria was a 13 years old girl. However, we did not ascertain whether our subjects were sexually active or not. We could not adduce any reason for the higher prevalence of *S. aureus* in males.

Nitrofurantoin and pefloxacin were the most active against all bacterial isolates. Ampicillin, ceftazidime and sulfamethoxazole-trimetoprim were poorly active. This may be due to prescription of antibiotics without laboratory guidance and/or over the counter sales of antibiotics without prescription, both of which are rife in Nigeria (Okeke et al., 1999). Pefloxacin, a fluoroquinolone, is contraindicated in children (Egbe et al., 2011). Nitrofurantoin therefore appears to be the drug of choice.

Conclusion

An overall prevalence of 8.25% of AB among secondary school students was observed. Senior secondary school students have 1 to 6-fold increase of acquiring AB compared to JSS students. *S. aureus* is the most prevalent uropathogen causing AB. Measures to reduce AB among secondary school students are advocated.

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