Asymptomatic bacteriuria among pregnant women attending antenatal clinic at Kilimanjaro Christian Medical Centre in Northern Tanzania

ClinicalPractice

Background: Asymptomatic Bacteriuria (**ASB**) has been demonstrated to have the adverse maternal and pregnancy outcomes precisely pyelonephritis, low birth weight, preterm premature rupture of membranes and preterm labour.

Objective: This study aimed to determine the prevalence of ASB and antibiotic sensitivity pattern among women attending antenatal clinic at Kilimanjaro Christian Medical Centre in Northern Tanzania.

Methodology: We conducted analytical cross sectional study involving women attending antenatal clinic at Kilimanjaro Christian Medical Centre between October and December 2016. All women who met the inclusion criteria and gave their informed consent were invited to participate. Interviews using a questionnaire were conducted to collect socio-demographic and obstetric information while urine samples were collected for laboratory processing.

Results: The prevalence of ASB among pregnant women in this study was 8.9%. The organism isolated from the urine sample according to the frequency of occurrence was *Escherichia coli* (50%), *Streptococcus pyogenes* (19%), *Klebsiella pneumoniae* (15%), group B *Streptococcus* (8%) and group A *Streptococcus* and *Proteus mirabilis* (4%) respectively. The rate of antibiotic sensitivity among gram negative bacteria ranged from 100% among *Escherichia coli* and *Proteus mirabilis* to ceftriaxone while ampicillin was shown to have no sensitivity to *Klebsiella pneumoniae* and *Proteus mirabilis*. Among the gram positive bacteria, erythromycin was shown to have sensitivity to group A *Streptococcus* but no sensitivity to group B *Streptococcus*.

Conclusion: The prevalence of ASB of 8.9% among pregnant women and the wide array of organisms isolated in this population warrant the development of protocols for routine ASB screening and treatment.

Keywords: asymptomatic, bacteriuria, antibiotic, sensitivity, risk factors, Tanzania

Introduction

ASB is the presence of a significant number of bacteria in the urine of an individual without symptoms [1] and it must be distinguished from symptomatic Urinary Tract Infection (UTI) by the absence of symptoms compatible with a UTI or by a clinical determination that the said symptoms are not originating from the urinary tract because neither the type of bacteria species nor the presence of pyuria can be used to determine whether the patient has ASB or not [2]. These symptoms can be either, or a combination of, lower abdominal pain and frequent urination with or without pain during urination [3]. About 10% of pregnant women with ASB will develop symptoms of a UTI [4].

Worldwide surveys show that between two and ten percent of pregnant women will be diagnosed with ASB at one point of their pregnancy [5], with frequency of ASB increasing among lower socioeconomic status, increasing age and parity groups. Some studies indicate a higher prevalence range of between 7% and as high as 86.6% [6].

Several immunological, anatomical as well as behavioural factors have been linked to increased susceptibility of the female urinary tract to pathogens and which are compounded exponentially by physiological changes of pregnancy [7].

In pregnancy, 30- 40% of untreated pregnant women with ASB will develop acute pyelonephritis in late pregnancy which is associated with significant morbidity for the mother and fetus and thus exact screening and treatment of bacteriuria regardless of symptoms is a must in order to avoid further complications [4]. Between two and ten

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percent of pregnant women will experience ASB at one point in the course of their pregnancy [5]. This is why, as a measure to reducing maternal and child morbidity, it has become standard practise to screen and treat ASB among pregnant women [8].

These women have been noted to have an antibiotic resistance pattern that is in the trend of the commonest available antibiotics in that particular population [9].

The frequency of ASB increases with lower socioeconomic status, increasing age and parity and if left untreated, thirteen percent to twenty seven percent will develop pyelonephritis which in turn is associated with premature labour, premature rupture of membranes, low birth weight and increased perinatal mortality [7].

While several research on ASB in pregnancy have been carried out in Africa, the bulk of these studies has been carried out in West Africa with varying results and very few have been done in East Africa and in particular Tanzania.

Materials and Methods

■ Study site

We conducted a cross sectional analytic study involving pregnant women attending ANC at the obstetrics and gynaecology outpatient clinic of KCMC between October 2016 and December 2016. KCMC is a teaching and zonal referral hospital located in Moshi in Northern Tanzania. The outpatient clinic runs three days a week, which is Monday, Wednesday and Friday and attends to both Obstetrical and Gynaecological cases with an average attendance of 300 patients per week.

Women who were attending routine antenatal visit at a gestation age less than 37 weeks criteria were recruited into the study after signing a written informed consent form. Pregnant women with a history of antibiotic use within the last week prior to their interview, HIV infected clients, as well as women known to have diabetes mellitus were excluded.

■ Data collection methods and tools

The study participants were subjected to a face to face interview conducted by the principle investigator to collect socio-demographic and obstetric information using a questionnaire. After the interview, a wide mouth sterile container was given to the pregnant women to collect urine sample for diagnosis of ASB. The sample was stored temporarily for an average of four hours after collection at the clinic in an ice packed cool box at temperatures of between two and eight degrees Celsius before being transferred to the laboratory. Participants who had a specific infection following processing of the results at the laboratory were treated.

Once the samples were received in the laboratory, each was examined macroscopically and recording done. 20 µL of urine was placed onto blood agar and MacConkey culture media and cultured for 24 hours for gram negative and gram positive bacteria, respectively. For the samples that showed a single colony growth of 100,000 units, sensitivity to the common antibiotics used during pregnancy, that is, Ampicillin, Amoxiclav, Gentamicin, Ceftriaxone and Erythromycin was done on Muller Hinton media using a standard wire loop procedure with the filling of a laboratory data extraction sheet for each sample. The two sets of data were then cleaned and compounded to come up with a tallying data sheet.

■ Statistical analysis

Data was entered using Microsoft excel and validated by double entry, cleaned and checked for missing data. All analysis was performed using Statistical Package for Social Sciences (SPSS) version 20. Data on categorical variables were presented by frequencies & percentages and by means & Standard Deviations (SD) for continuous variables. Pearson's Chi Square test for categorical variables was used to examine demographic characteristics and ASB. If the number of participants in one or more categories was less than five, Fisher's exact test was applied. P value of <0.05 was taken as cut off level of statistical significance.

■ Ethical consideration

Ethical approval was obtained from the Kilimanjaro Christian Medical University

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College Research Ethics committee (Certificate No. 969) prior to starting of data collection. Participants were informed about the purpose of the study and asked to sign written consent forms prior to their enrolment. Equal standard of care during attendance to the clinic and subsequent care during delivery at our facility was assured to the participants and non-participants of the study.

Results

A total of 304 pregnant women were involved in this study however, only 300 participants were analysed after 4 forms were withdrawn due to irretrievable information. The mean age of the women was 26.9 (SD 5.6) years and majority 235 (78%) aged between 21-35 years. More than half 189 (63%) of these women were residing in urban Moshi, 156 (52%) had college or university education and majority (92%) were married **(TABLE 1)**. Women who had ever delivered, 168 (56%) had 1-2 deliveries, of this 73(24%) had history of abortion. More than half 172 (57%) of the women were in their second trimester. Majority 151 (90%) of the participants had never had history of delivering babies with low birth weight. Less than half (28%) of the participants attended 4 or more ANC visit with 66% having had between one and three prior antenatal clinic visits and only 14 (5%) had never attended ANC visit. Almost half (49%) reported being unemployed. Three quarters (76%) of the participants reported no history of an abortion. In this study, the prevalence of ASB among pregnant women was 8.6%.

■ Bacterial isolates from the urine sample

The organism isolated from the urine sample according to the frequency of occurrence was *Escherichia coli* (50%), *Streptococcus pyogenes* (19%), *Klebsiella pneumoniae* (15%), Group B *Streptococcus* (8%), Group A *Streptococcus* and *Proteus mirabilis* (4%) **(TABLE 2)**.

■ Antibiotic sensitivity patterns

Antibiotic sensitivity was highest for ceftriaxone and least for ampicillin. *Escherichia coli* was highly sensitive to ceftriaxone that is 100%, followed by gentamicin 75% and it was less sensitive to ampicillin which was 15%. *Klebsella pneumoniae* was not sensitive to ampicillin however this organism had a sensitivity of 75% for ceftriaxone, gentamicin and nitrofurantoin. *Proteus mirabilis* was less sensitive to ampicillin as well as for nitrofurantoin however was 100% sensitive to ceftriaxone and gentamicin.

Antibiotic susceptibility testing was performed for all isolates. Antibiotic sensitivity was highest for ceftriaxone and least for ampicillin.

Escherichia coli was highly sensitive to ceftriaxone that is 100%, followed by gentamycin 75% and it was less sensitive to ampicillin which was 15%. *Klebsella pneumoniae* was not sensitive to Ampicillin however this organism had a sensitivity of 75% for ceftriaxone, gentamycin and Nitrofurantoin. *Proteus mirabilis* was

TABLE 1: Demographic characteristics of women attended ANC services at KCMC hospital, Northern Tanzania (N=300).		
Variable	**Frequency (n)**	**Percentage (%)**
Age mean (SD)	29.6(5.6)	
Age group		
15-20	9	3
21-35	235	78
35 and above	56	19
Place of residence		
Moshi Urban	189	63
Moshi Rural	70	23
Others	41	14
Education level		
Primary level	74	25
Secondary level	70	23
College/University	156	52
Occupation		
Unemployed	146	49
Informal employed	17	5
Formal employed	137	46
Marital status		
Single	25	8
Married	275	92

TABLE 2: Bacterial isolates (n=26).	
Bacterial Isolates	**N (%)**
Escherichia coli	13(50)
Streptococcus pyogenes	5(19)
Klebsiella pneumoniae	4(15)
Group B *Streptococcus*	2(8)
Group A *Streptococcus*	1(4)
Proteus mirabilis	1(4)

TABLE 3: Rate of sensitivity to antibiotics among gram negative bacteria.

Organisms	Drugs				
	Ceftriaxone	Nitrofurantoin	Amoxiclav	Gentamycin	Ampicillin
Escherichia coli (n=13)	100	62	69	77	15
Klebsiella pneumoniae (n=4)	75	75	75	100	0
Proteus mirabilis (n=1)	100	0	100	100	0

TABLE 4: Rate of sensitivity to antibiotic among gram positive bacteria.

Bacteria	Erythromycin	Penicillin
Streptococcus group A (n=1)	100	100
Streptococcus group B (n=2)	0	100
Streptococcus pyogenes (n=5)	20	40

less sensitive to ampicillin as well as for nitrofurantoin however highly sensitive to ceftriaxone and gentamycin **(TABLE 3)**.

Among the gram positive bacteria, *Streptococcus* group A was highly sensitivity to erythromycin and ampicillin. *Streptococcus* group B was highly (100%) sensitive to penicillin but less sensitive to erythromycin **(TABLE 4)**. *Streptococcus* group A showed sensitivity to erythromycin, amoxiclav and ampicillin. *Streptococcus* group B displayed sensitivity to amoxiclav and ampicillin but was resistant to erythromycin. Of 5 samples that grew *Streptococcus pyogenes*, one colony displayed sensitivity to erythromycin while four colonies of the same organism were sensitive to amoxiclav and ampicillin. Less than half (40%) of the *Streptococcus pyogenes* isolates were sensitive to penicillin. On the other hand, *Streptococcus pyogenes* showed a sensitivity of 20% to erythromycin.

Discussion

Our study shows a prevalence of 8.6% of ASB among pregnant women attending ANC at KCMC. The most common bacterial isolates were *Escherichia coli* followed by *Streptococcus pyogenes*, *Klebsiella pneumoniae* and *Proteus mirabilis*. In this study, all gram negative bacteria isolates were sensitive to ceftriaxone and gentamicin while the gram positives were sensitive to erythromycin and penicillins.

The prevalence of ASB in our study is comparable to that reported in Mwanza, Tanzania, [10]. Similar to other studies, this study recruited its participants from an antenatal clinic with patients with known risk factors such as recent antibiotic use and chronic UTIs being excluded from the study to minimize bias [11] and therefore can explain the low prevalence. However, the prevalence is higher compared to that reported in Ghana of 5.5% [12]. The observed difference might be attributed to the characteristics of the participants in that most of the participants in this study and the Ghana study were in their third trimester of pregnancy. The clinical implication of this finding is that if screening is to be initialized in our setting, then it would be highly recommended to consider screening in the third trimester where the bulk of the ASB positive participants were obtained. On the other hand, other studies have showed higher prevalence of ASB than that observed in our study [6].

This study was conducted at a hospital setting where trained health care providers were involved, this could have explained the lower prevalence of ASB as compared to other study done in Nigeria which was conducted at a traditional birth clinic where untrained attendants were at hand [13].

This study also looked into the association between the prevalence of ASB and the socio demographic and obstetric characteristics of the participants. There was however no statistically significant association between the outcome and the exposure variables. This lack of association could be linked to the low prevalence obtained in this study (8.6%) and thus the inability to draw a statistically significant inference on the population based on that prevalence. This finding was similar to a study done in elsewhere in Tanzania [10]. The non-association could be attributed to the low prevalence in both studies and thus lack of a statistical association between the socio demographic and obstetric characteristics and ASB.

In a Nigerian study, a relative higher prevalence drew up an association between

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ASB and relatively high socio economic class consisting of skilled professionals and those with tertiary education. This was linked to the possibility that this set of people could afford the antibiotics available from chemist shops even without a doctor's prescription and that may have predisposed them to sub clinical infections [13]. Further, another study in Nigeria reported a similar high prevalence and went on to find a significant association between ASB and the exposures which were parity and gestational age [3]. The implication of this study, consistently reaffirmed by previous studies, is that a decision to screen for ASB in asymptomatic pregnant women should be influenced more by the prevalence rather than the population characteristics where the prevalence is low.

In this study, *Escherichia coli*, *Klebsiella pneumoniae* and Group B *Streptococcus* were the most common organisms isolated. The finding is similar to the study done elsewhere in Tanzania [10].

The low rate of sensitivity of *Escherichia coli* to the common first line antibiotics was low. Similar pattern of sensitivity was also reported elsewhere in Tanzania [10]. This is also similar to West African studies where both the gram negative and the gram positive bacteria displayed low susceptibility to ampicillin and erythromycin [1].

Escherichia coli is a normal flora of the bowel and therefore contamination of the specimen as well as contamination of the urethral area by fecal matter may contribute to its high prevalence among the asymptomatic women. The low sensitivity to the common antibiotics has been noted with concern. The implication of these findings would be emphasising on the need to enforce regulations on non-prescription use of antibiotics. This would check the growing exposure of antibiotics to these micro-organisms and thus control the rising antibiotic resistance.

There are some limitations to the findings of this study. The study was conducted in a referral centre and thus the sample may not be representative of the entire population.

Conclusion

The prevalence of 8.9%, coupled with the low sensitivity of microorganisms isolated in this study to first line antibiotics warrant placement of national guidelines to screen and treat ASB in this population.

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