Full Length Research paper

Subclinical significant bacteriuria among pre-school children in calabar municipality: A survey

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Urinary tract infections (UTIs) are often considered uncommon among children by clinicians. The study was therefore set up to ascertain the prevalence of significant bacteriuria among pre- school children in a Nigerian urban community. Pre-school children attending nursery schools in different distinct geographical locations of Calabar city were recruited through computer assisted random sampling methods. Information from both children and parents such as age and gender of children, educational level and occupation of parents/guardians were obtained with the aid of a structured questionnaire; other anthropometric measurements on the children were also carried out. Urine samples were collected stored and processed using standard laboratory methods while diffusion methods were used to carry out the antimicrobial susceptibility tests. Dipstick was also used to screen the urine for probable urinary tract infection and the results compared with cultural methods. Data obtained was analyzed using Epi Info 6 statistical software. The prevalence of significant bacteriuria among the 455 pre-school children was 7.3% with infection rate increasing proportionately with age (P< 0.05) but with no gender difference (P> 0.05). *Escherichia coli*, *Proteus mirabilis* and *Klebsiella spp*. were the commonest organisms encountered. Dipstick screening UTI was found to be 87.9% and 96% sensitive and specific respectively compared to the gold standard. Urinary tract infection is a probable phenomenon among pre-school children and screening for it could be carried out with the aid of urinary dipstick in the absence of appropriate cultural methods and its obvious limitations proportionately factored into medical decision making.

Key Words: Bacteriuria, significant, dipstick method, children, pre-school.

INTRODUCTION

Urinary tract infection (UTI) is really not a rare clinical occurrence among adults especially women (Hooton et al., 1997; Gupta et al., 1999; Samm and Hooton 1993). The probability of listing UTI among the differentials following an assessment of a bout of fever among adults is therefore not in doubt (Zhanel et al., 2000; Foxman et a.l, 2000) . The difficulties in the correct diagnosis and appropriate management of UTI in children, as well as the risk of late complications such as chronic renal failure are

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common clinical encounters (Foxman et al., 2000; and Elders et al, 1997). In children the situation is however different where it is often difficult to determine both the absence and presence of UTI in them (Elders et al, 1997; Scholtmeijer et al, 1994) . And the distinction between cystitis and pyelonephritis is even more problematic. Contrary to the situation in adults, in children there are more often than not, no clinical findings (such as fever or flank pain) and no conclusive laboratory findings (such as erythrocyte sedimentation rate and white blood cell count) to establish a valid difference between cystitis and pyelonephritis (Ross and Kay 1994; Ross and Kay 1999; and Majd et al., 1991).

The endemic nature of malaria, acute febrile viral illnesses and other parasitic infections and infestations in the tropics has also masked the clinical diagnostic precision of UTI in children by clinicians practicing in the region (Jombo et al., 2007a, b and c) . Also, management of the children is most often dictated by the clinical severity of the illness, rather than by the specific site of infection in the urinary tract, although with no serious management set back to the patient (Seruca 1989; Rushton and Majd 1992).

Children generally but most especially in the first few years of life afflicted by UTI stand a much higher risk of renal scaring compared to older children or adults (Delzel 2000; Johnson and Stamm 1987). Prevention of UTI and subsequently this complication by proper screening of children for UTI as early in life as practically possible becomes necessary. This no doubt would halt the serious kidney complications that might arise several decades thereafter (Nicolle et al, 1994) . The importance of the pre-sent study is premised on this fact.

MATERIALS AND METHODS

Setting

The study was carried out in Calabar between November 2008 and February 2009. Calabar is the capital city of Cross Rivers state located in the north eastern part of the Nigerian Niger delta. The predominant occupations of the people are: farming, fishing, and petty trading while others are Civil servants. Two Universities along with several other higher institutions are sited in Calabar city along with several secondary, primary and nursery schools. The city also has a Teaching hospital along with several other health centres scattered over. Calabar municipality with its dense population was selected for the study due to the large number of nursery schools in the area that serve most of the city residents.

Procedure

The subjects were recruited from five nurseries from the five most important geographical regions- Akim, Marian, Eta Agbor, Atinbo, and MCC for the study. With the aid of the serial numbers of children in their class registers, subjects were recruited with the aid of statistical table of random numbers. Questionnaires, clinical, biochemical, and statistical tools were combined to obtain and analyze the data. Structured questionnaires were administered to the parents or guardians of the recruited subjects to obtain information on

: age of pupils, history of urinary frequency, abdominal pain, bed wetting, educational status and qualifications of parents. Anthropometric and blood pressure measurements were similarly carried out on the subjects. Clean catch mid stream urine specimens were subsequently obtained from the subjects through normal voiding into sterile universal specimen containers (4-8mls). Specimens were processed using standard laboratory procedures shortly on collection or were stored in refrigerator at 4-8°C in an event of delay. Significant bacteriuria was carried out using a graduated wire loop of internal diameter 4mm and uncentrifuged, uniformly mixed urine specimens were inoculated on CLED (Cysteine lactose electrolyte deficient), blood agar, chocolate and Macconkey agar media and incubated at 36.6^{o}C overnight. Biochemical tests were subsequently carried out on significant growths (Scott 1989). Significant bacteriuria was referred to when there were more than 100,000 colonies of 1 or 2 uropathogenic bacteria per millimeter of urine. Susceptibility tests of the bacterial isolates were carried out using modified Kirby-Bauer's diffusion methods (Scott 1989; and, Baron et al., 1997). All the urine samples cultured were screened with dipstick (9309\UTSH\01.1 with Nitrite, leucocyte esterase, and protein combined strip) by immersing the strip for two seconds in freshly voided urine in a test tube. The color reaction was read for probable urinary tract infection (UTI) thereafter. The sensitivity, specificity and predictive values were calculated at various definitions of a positive test or "test cutoff points".

Analysis of Results

Data obtained was analysed using Epi Info 2002 version of statistical software. Chi square and t test were used as well as Mantel-Haenszel and Yates Corrected, where applicable to compare association among variables while P values 0.05 were considered significant; Logistic regression analysis were also used to determine the predictors of significant bacteriuria among the subjects.

RESULTS

Of the 455 children studied consisting of 242 (53.2%) girls and 213 (46.8%) boys, the mean age and mode was 4 years. Children aged from 2 to 6 years were included in the survey. A total percentage of significant bacteriuria was 7.3% (33/455), with an increasing positivity rate from 2 to 6 years of age, the aetiology being dominated by *Enterobacteriaceae* (Figure 1).

Based on gender, the rate of significant bacteriuria among the females and males was 7.9% (19/242) and 6.6% (14/213) respectively with no significant gender difference (P> 0.05) (Figure 2).

In relation to age distribution pattern of the respondents, 4.0% (3/75) of those aged Two were infected, while 4.8% (5/104), 6.7% (7/106), 8.5% (8/94), and 13.1% (10/76) of those aged Three, Four, Five and Six were respectively infected with a strong correlation with increase in age (RR=2.41, 95% CI= 3.2-4.2) (Figure 3).

Microorganisms recovered from the 33 cases of significant bacteriuria included: *Escherichia coli* in 36.4% (n=12) cases; *Proteus mirabilis*, 21.2% (n=7); *Pseudomonas aeruginosa* and *Staphylococcus aureus*,
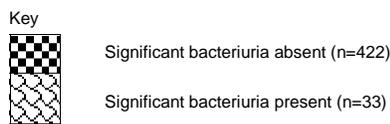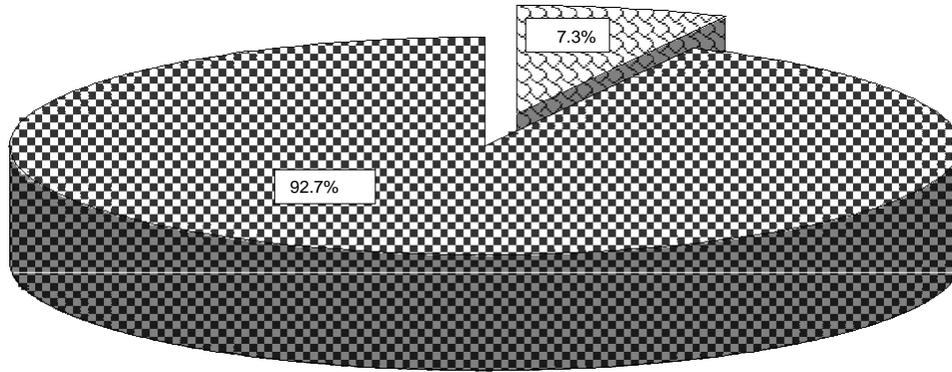
Key

Significant bacteriuria absent (n=422)

Significant bacteriuria present (n=33)

Figure 1. Rate of significant bacteriuria among pre-school children in Calabar Municipality, Southern Nigeria.

X^2 (Yates Corrected)= 0.00, OR= 0.88, RR= 0.99, P> 0.05

Key

Significant bacteriuria present

Significant bacteriuria absent

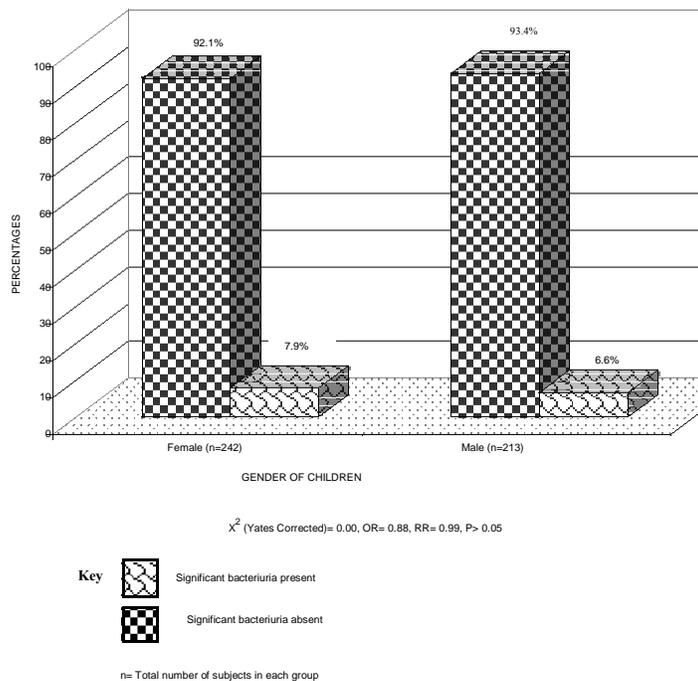n= Total number of subjects in each group

Figure 2. Rate of significant bacteriuria in relation to gender among pre-school children in Calabar municipality, southern Nigeria.

9.1% (n=3) each; *Enterobacter spp.*, 6.0% (n=2); and *Klebsiella spp.*, 18.2% (n=6). No parasite eggs or worms were recovered from the urine specimens. The most potent antibiotics against most of the bacterial isolates were ceftriaxone (100%), cefuroxime (50%-100%) and gentamicin (50%-100%), while ampicillin, co-trimoxazole, and cephalexin were the most inactive (33%-50%) (Figure 4).

A comparison of the dipstick method for detection of significant bacteriuria with that of culture methods showed no significant difference (P> 0.05) with a sensitivity and specificity of 87.9% and 96.0%
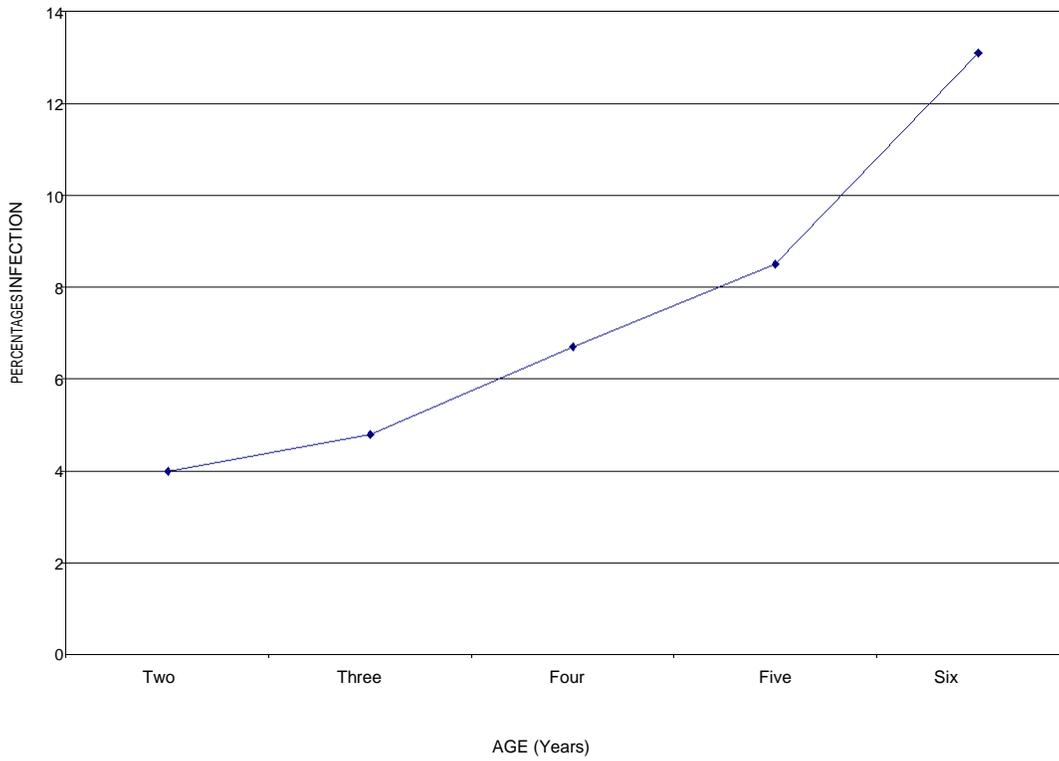
Figure 3. Rate of significant bacteriuria in relation to age among pre-school children in Calabar municipality, southern Nigeria.
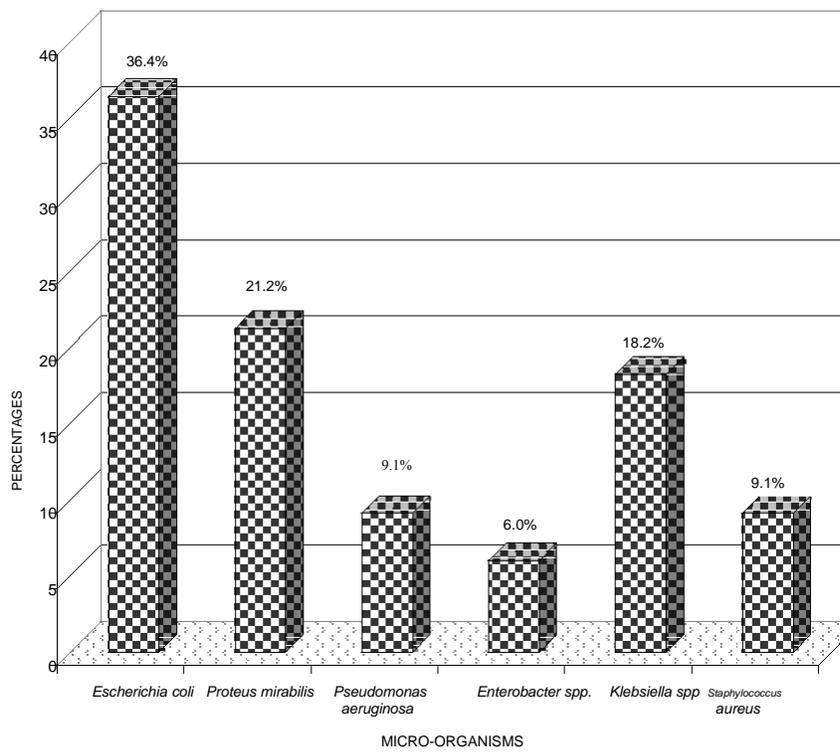

Figure 4. Microorganisms recovered from urine of pre-school children with significant bacteriuria in Calabar municipality, southern Nigeria.
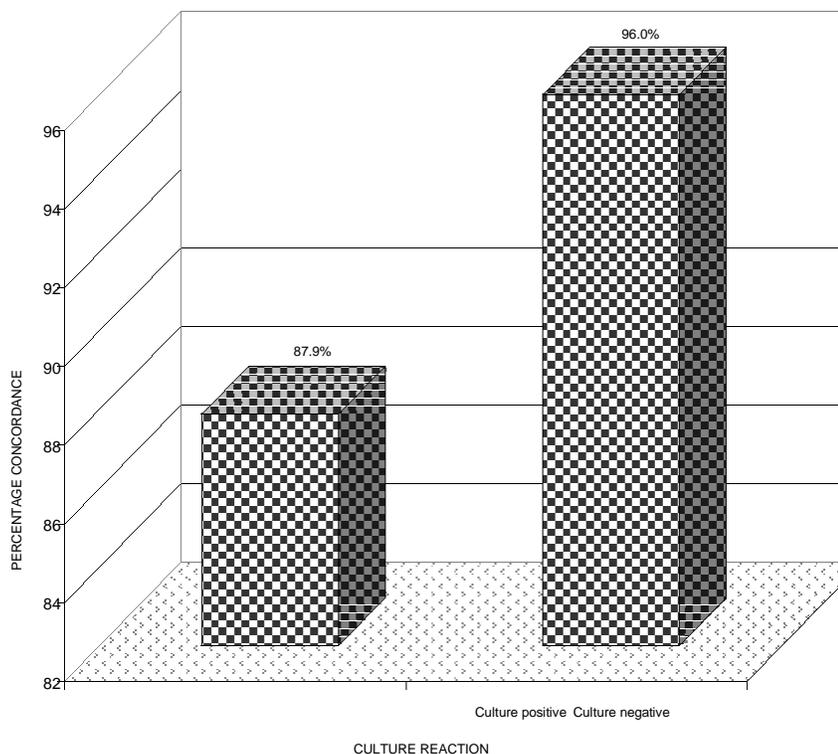
Figure 5. Rate of concordance of dipstick screening method with cultural methods in the detection of significant bacteriuria among pre-school children in Calabar municipality, southern Nigeria.

respectively. Relying only on dipstick method for diagnosis of UTI, 4 (12.1%) and 17 (4.0%) would receive undertreatment and overtreatment for UTIs among the respondents respectively (Figure 5).

There was no significant association of social class of children's parents, mean height and weight as well as average blood pressures with the incidence of significant bacteriuria among the subjects (P> 0.05).

DISCUSSION

The rate of UTI among pre-school children in Calabar municipality was found to be 7.3% with no significant gender difference (P> 0.05), but with strong correlation between rate of infection and increase in age (95% RR= 2.41). This finding further buttresses the fact that UTIs in the under fives are not as rare as could ordinarily be the common thinking among health personnel; and should be considered a probability among them. The fact that over

95% of the children with significant bacteriuria did not present with any form of febrile illness stresses the need for a much closer vigilance for this disease among infants and children (Nurullaev 2004; Leung et al., 2005).

Compared to the findings from the present study, UTIs among infants and children were also found not to be an uncommon occurrence in the Scandinavian region (especially, Sweden and Denmark) (Van de Lisdank 2000; Jodal and Lindberg 1999). Higher rates of 13.2% to 15.2% cystitis were documented from separate longitudinal studies while in the Netherlands, the rate of UTI among children was found to be 1.2% from a cross sectional study (Harmsen et al., 2007). The type of sampling methodology, the use of equipments with supposedly high accuracy and precision in the Scandinavian studies coupled with the high standard of healthcare delivery system could account for the high and low figures respectively recorded in the two communities compared to that of the present study (Jodal and Lindberg 1999; Harmsen et al, 2007; Jakobsson et al, 1999). The findi-

ngs in Nairobi, Kenya of 13.3% rate of UTI among hospitalized children and a corresponding 11.4% bacteraemia and over 12.6% malaria infection among them brings up other medical conditions that need to be looked out for among children with UTIs (Okwara et al, 2004).

The commonest bacterium recovered from the urine of the children was *Escherichia coli* 36.4%, followed by *Proteus mirabilis* 21.2% and then *Klebsiella spp.* 18.2%. Similar organisms were recovered in Ibadan, though in varying proportions among children with sickle cell disease (Brown et al., 2003) and among children without sickle cell disease in Gwagwalada (Musa- Asien et al., 2003) and Maiduguri (Rasaba and Shattima 2002). The high resistance recorded by these organisms against most of the commonly prescribed antibiotics as also documented in other centres (Olowu and Oyetunji 2003) calls for the need to, among other things, streamline and seriously regulate both the sale and intake of antibiotics on a general note. This control measure would reduce the abuse of the drugs by the general public and hence assist in the reduction of emergence resistance among bacteria.

Dipstick method for screening of UTI was found to be 87.9% sensitive and 96.0% specific compared to the gold standard (microscopy, culture and sensitivity) . Although a complete anaerobic microenvironment could not be provided in the present study in addition to the other microhabitats provided, a well noted limitation; these findings by implication showed that the subjects stood the risk of 12.1% and 4.0% under -treatment and over-treatment res-pectively. In the midst of absent or near absence of fa-cilities and requisite personnel to carry out exhaustive laboratory diagnosis of UTIs, dipstick could be used and its obvious limitations factored in, in the management of suspected patients (Rasaba and Shattima, 2002). These findings agree with that of St John and co-workers in Australia (St John et al., 2006), Lammers and co- workers in USA (Lammers et al, 2001) and Eigbefoh et al in Irrua, Nigeria (Eigbefoh et al., 2008) who in their separate studies found dipstick a useful tool for screening of patients with UTIs. Though, Whiting et al. in Bristol, United Kingdom (Whiting et a.l, 2006) could not establish the usefulness of dipstick in the diagnosis of UTIs.

Conclusion

In conclusion, this study has also proved that urinary tract infections are not as rare among pre-school children as might be the general thinking and hence need to be looked up for at paediatric emergency units as well as paediatric outpatients departments. Also dipstick method has shown to be a reliable alternative for screening of patients for UTIs and could be deployed to enhance the diagnosis of UTI in challenging situations.

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