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Full Length Research Paper

Bacteriuria in patients with indwelling urethral catheter in Owerri municipality, Nigeria

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Bacteriuria in patients with indwelling urethral catheter in Owerri Municipality of Imo State, Nigeria was studied. A total of 500 early mornings mid stream urine samples from patients admitted in different hospitals within the Municipality. The samples were microbiologically analyzed using cultural methods on different isolation media. A total of 220 isolates were identified. Identification tests showed the presence of *Escherichia coli* (10%), *Staphylococcus aureus* (9.0%), *Klebsiella* sp. (7.0%), *Proteus* sp. (5.8%), *Streptococcus faecalis* (4.0%), *Pseudomonas aeruginosa* (3.8%), *Citrobacter* sp. (2.8%) and *Enterobacter* sp. (1.6%). Samples obtained from patients aged 71 to 80 years had the highest incidence of bacteria. A total of 120 (48.0%) of the isolates were obtained from female patients. Out of these, 12.0% were identified as *E. coli*. Result further show that, long duration catherized patients of up to 29 days and above have more bacteriuria infection than short term indwelling catheter. These findings have greatly implicated indwelling catheter as a major cause of bacteriuria in catheterized patients.

Key words: Bacteuria, urethral, cathether, isolates.

INTRODUCTION

Bacteriuria is the presence of bacteria in voided urine. Normally, urine is sterile but as it passes down the urethra, it becomes contaminated by the normal flora of the urethra and other superficial urogenital membranes. To confirm infection, either the number of organisms present or the species isolated must be shown to be significant (Birch et al., 1983).

Occurrence of bacteriuria in indwelling catheterized patient is age and sex dependent (Mino et al., 1997). Approximately 10% of children with functional or anatomical abnormalities of the urinary tract develop infection during neo-natal period (Warren, 1997). Infection in males is found primarily in pre-school boys with activity (Garibaldi et al., 2005). Bacteriuria rates in females increases dramatically with 20% experiencing one or more infections annually (Wille et al., 2003). In the elderly, both sex, gynecologic or prostatic surgery, incontinence, instrumentation and chronic urethra catheterization push urethral tract rates to 30 to 40% (Mino et al., 1997). This infection could be symptomatic or asymptomatic, acute or chronic and singular or recurrent (James, 1994). At times, they may produce permanent damages to the kidney (James, 1994). Indwelling catheter may be either a urethral or a suprapubic catheter; they are widely used in diagnosis and treatment of urological problems, resuscitation and emergency new setting (Berger et al., 2006). Indwelling catheters are used in about 15 to 20% of patients hospitalized for urologic problem (Kunin and Calvin, 2001). Most patients, even if they acquire infection, appear to do well and may loose their bacteriuria spontaneously or respond to appropriate anatomical therapy. However, many remain infected (Damron et al., 1986).

Furthermore, catheters relieve temporarily anatomical or physiological urinary obstructions, facilitate surgical repairs of the urethra and its surrounding structure to provide a dry environment for incontinent patients and permit accurate measurement of urinary out-put in severely ill patients (Mino et al., 1997). It drains the bladder but obstructs the urethra from strictures and

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epididymites (Berger et al., 2006). Unfortunately, when poorly managed, indwelling catheters may present hazard to the very patients they are designated to protect (Kunin and Calvin, 2001). This study was aimed at assessing disposition usage of indwelling urethral catheter to bacteuria in Owerri municipality of Nigeria.

MATERIALS AND METHODS

Sample collection

Urine samples were collected from catherized patients in health institutions in Owerri Municipality, Nigeria, which include Federal Medical Center, General Hospital Umuguma, Saint David specialist Hospital and Umuezurike Hospital all in Owerri municipality, Nigeria. Five hundred catheter urine samples were collected from two hundred and fifty males and two hundred and fifty females within the age bracket of twenty-one to eighty years on admission at the hospital. Mid-stream early catheter urine samples were collected in a sterile universal container. Catheter was clamped and allowed to remain in such position for at least 30 min during which enough urine were accumulated in the catheter. The junction of the catheter was separated, unclamped and the urine was allowed to flow into the sterile universal container. After collection, the urine samples were labeled and age, sex of patient and duration of the catheter were recorded.

Analysis of urine samples

Macroscopic examination

The urine samples were examined macroscopically to ascertain the colour of the sample which could be amber, pale yellow and deep amber, presence and absence of blood and cloudiness were noted.

Cultural analysis

The sterile urine universal containers were greatly tapped to homogenize the urine samples. After which a loopful of the urine was collected with a sterile wire loop and inoculated on already prepared sterile CLED media using streak method of Fawole and Oso (2004). After inoculation, the plates were incubated at 37°C for 24 h. After the incubation period, colonies that appeared were identified morphologically and then subculture on fresh sterile nutrient agar followed by incubation at 37°C for 24 h. They were then transferred to slants as stocks and then stored in the fridge for further use.

Identification of isolates

Different bacteria colonies that appeared after incubation were identified using their colonial morphology, for properties such as size, shape, colour, elevation, consistency and so on, were considered. They were further identified using their cellular morphology followed by biochemical tests with methods described by Cheesbrough (2000) and Fawole and Oso (2004).

Microscopic examination

The urine sample were centrifuged at 3000 revolution per minutes, after which the supernatants were discarded, deposits were re-suspended by tapping the bottom of the test tubes. A drop of the deposits for each sample was placed on a clean grease free slide and then covered with cover slip, followed by examination under the microscope using the X10 and X40 objectives with condenser iris sufficiently closed to give good contrast.

Urine analysis

Combi-9 urine test strip was inserted into the urine samples, after two seconds, colour change on the strips for heamoglobin, urobiligen, biliribin, protein, nitrate, peptone, ascorbic acid, glucose and PH were compared with the standard colours in the combi-9 strip container.

RESULTS

Overall percentage occurrence of different genera of bacteria isolated

Overall percentage occurrence of different bacteria genera isolated from urine of patients with indwelling urethral catheter is shown in Figure 1. Out of the five hundred patients sampled, different bacteria genera were isolated from two hundred and twenty patients as follows, *Escherichia* sp. (10.0%), *Staphylococcus* sp. (9.0%), *Klebsiella* sp. (7.0%), *Proteus* sp. (5.8%), *Streptococcus* sp. (4.0%), *Pseudomonas* sp. (3.8%), *Citrobacter* sp. (2.8%) and *Enterobacter* sp. (1.6%).

Sex-related pattern of bacterial genera infection among patients with indwelling catheter

The sex-related pattern of individual genera infection among patients with indwelling catheter is shown in Figure 2. Among 220 male patients, *Staphylococcus* sp. had the highest infection of 8.8%, followed by *Escherichia* sp. that had 8.8%. Others had percentage occurrence that ranged from 7.6% for *Proteus* sp. to 1.2% for *Enterobacter* sp. Among female patients, *Escherichia coli* had the highest level of infection of 12.0%; followed by *Staphylococcus* sp. that had 8.0%. Others had percentage levels of infection that ranged from 7.2% for *klebsiella* sp. to 2.8% for *Citrobacter* sp.

Age-related pattern of bacteriuria infection among patients with indwelling catheter

The result on the age related pattern of bacteriuria infection among patients with indwelling catheter is shown in Figure 3. Patients from 71 to 80 years had the highest percentage occurrence of 60.0%. Others had percentage occurrence levels that ranged from 7.6% for *Proteus* sp. to 1.2% for *Enterobacter* sp. For female patients, *E. coli* had the highest level of infection of 12.0% followed by those in age brackets of 60 to 70, 51 to 60; that had percentage occurrence of infection of 41.67 and 30.00%, respectively, while those in age

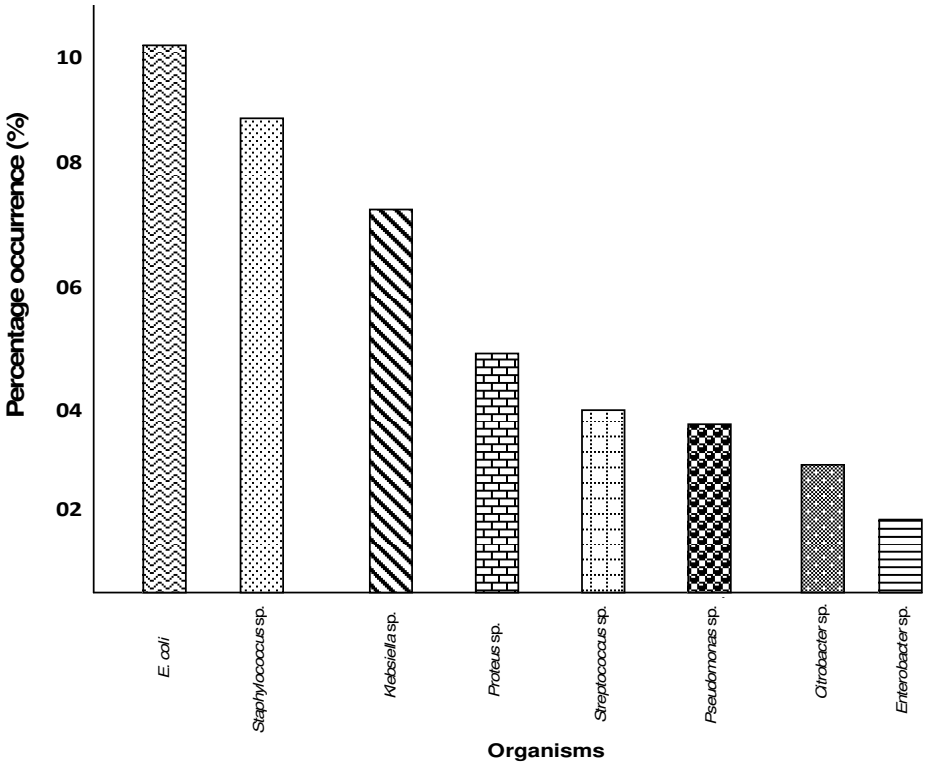

Figure 1. A bar chart showing the overall percentage occurrence of different genera of bacteria isolated.

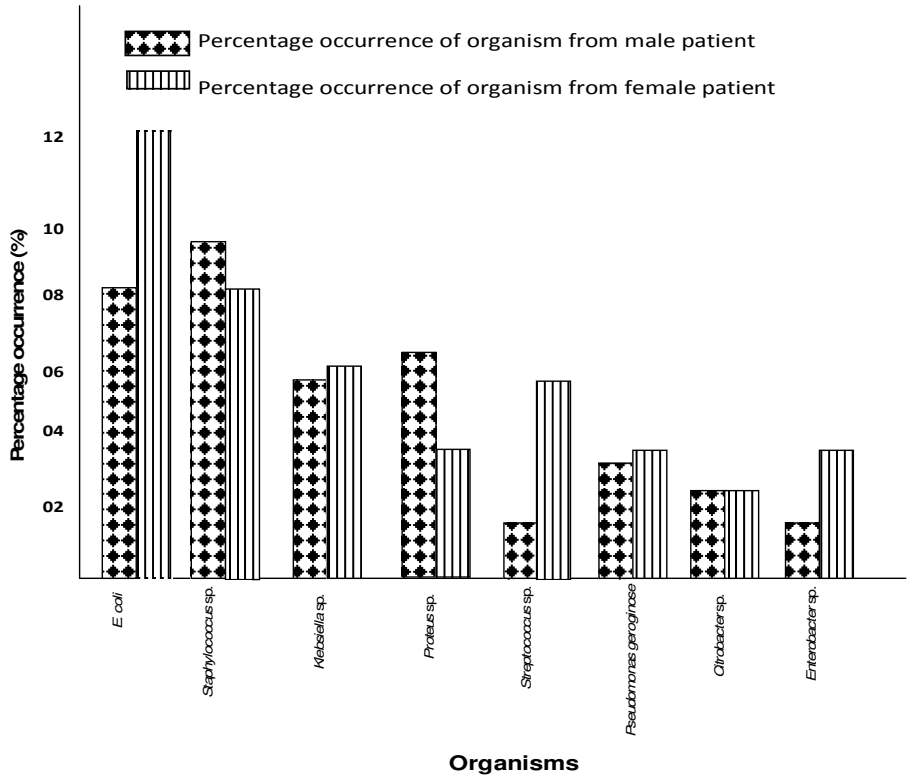

Figure 2. A bar chart showing the sex related pattern of individual bacteria genera infection among patients with indwelling catheter.

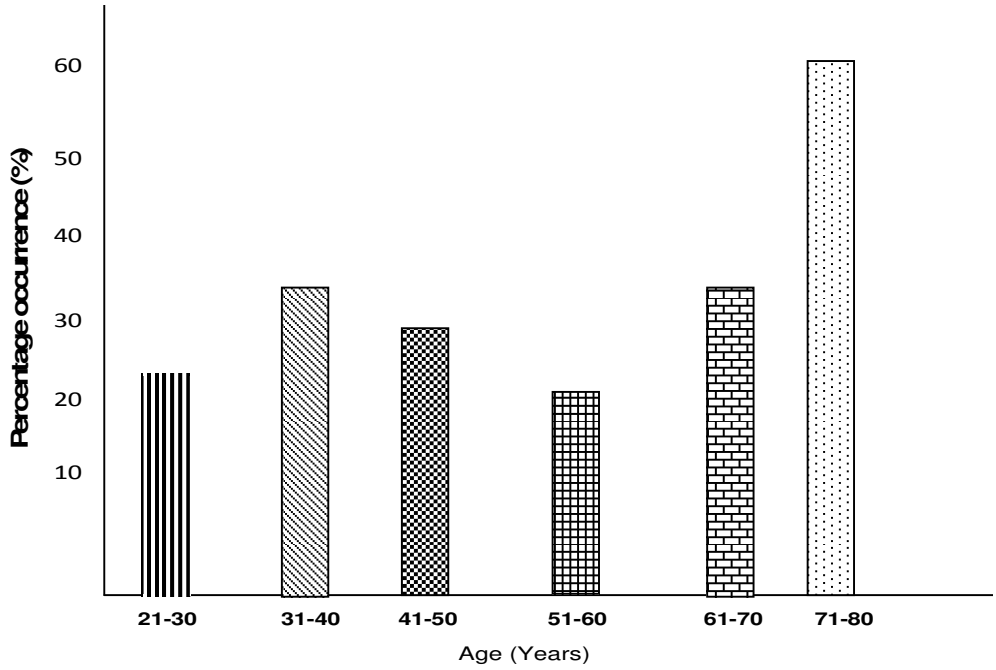

Figure 3. A bar chart showing the overall age-related occurrence of bacteriuria infection.

bracket of 21 to 40 had the least (25.00%).

Pattern of infection among patients based on duration of indwelling catheter

The pattern of infection among patients based on the duration of indwelling catheter is shown in Figure 4. The percentage occurrence increased with increase in the duration of indwelling catheter. Those with catheter for up to 29 days and above had a percentage level of infection of 50.0%, followed by those with the duration of 22 to 28, 15 to 21, 8 to 14 and 1 to 7 days, that had percentage occurrence of 37.5, 33.3, 30.5 and 28.5%, respectively.

DISCUSSION

The individual bacterial genera and species isolated from patients with indwelling urethral catheter included *E. coli*, *Staphylococcus aureus*, *Klebsiella* sp., *Proteus* sp., *Streptococus faecalis*, *Pseudomonas aeruginosa*, *Citrobacter* sp. and *Enterobacter* sp. The presence of these microorganisms in the samples analyzed is indicative of bacteriuria infection in patients with indwelling catheters. Normally, *E. coli* is harmless as a commensal in the alimentary canal, however, some serotypes frequently cause urinary tract infections in patients whose resistance to disease is severely compromised especially in catherized cases (Jepsen et al., 2003). *E. coli* is by far the most frequent infecting organism in indwelling urethral catheters and as a result, its isolation in this work was expected. Other bacteria genera isolated include *S. aureus*, *Klebsiella* sp., *Proteus* sp., *S. faecalis*, *P. aeruginosa, Citrobacter* sp. and *Enterobacter* sp.. These bacteria genera have similarly been isolated in previous work (Richardson et al., 2006). The presence of these organisms in the samples analyzed may be attributed to the insertion of a urinary catheter, which by-passes normal host defenses against urinary tract infection and as a result, provides a conduct for opportunistic pathogens to reach the bladder. Therefore, manipulation of the closed catheter system can introduce bacteria resulting in bacteriuria in indwelling catheter (Decapite and Richards, 2001). The high prevalence of *E. coli* encountered in this work when compared with other organisms may be due to the absence of adhesive structures in the organisms. Ibe and co-workers demonstrated that, *E. coli* cystitis isolates and urinary isolates tend to adhere more strongly to uroepithelial cells than random faecal *E. coli* isolates (Ibe et al., 1995). Recognized virulence factors include increased adherence to unepithelial cells, resistance to serum bactericidal activity high quality of k-antigen and hemolysin production (Turch and Mark, 2001). Binding of *E. coli* to mannose containing receptors occurs with most uropathogenic strains. In fact, strains from cystitis patients are more likely to bind than those from pyelonephritis patients. Studies with other species of bacteria have similarly demonstrated the significance of adherence to confirm the role of fimbriae in *Proteus mirabilis* attachment to the renal pelvic mucosa

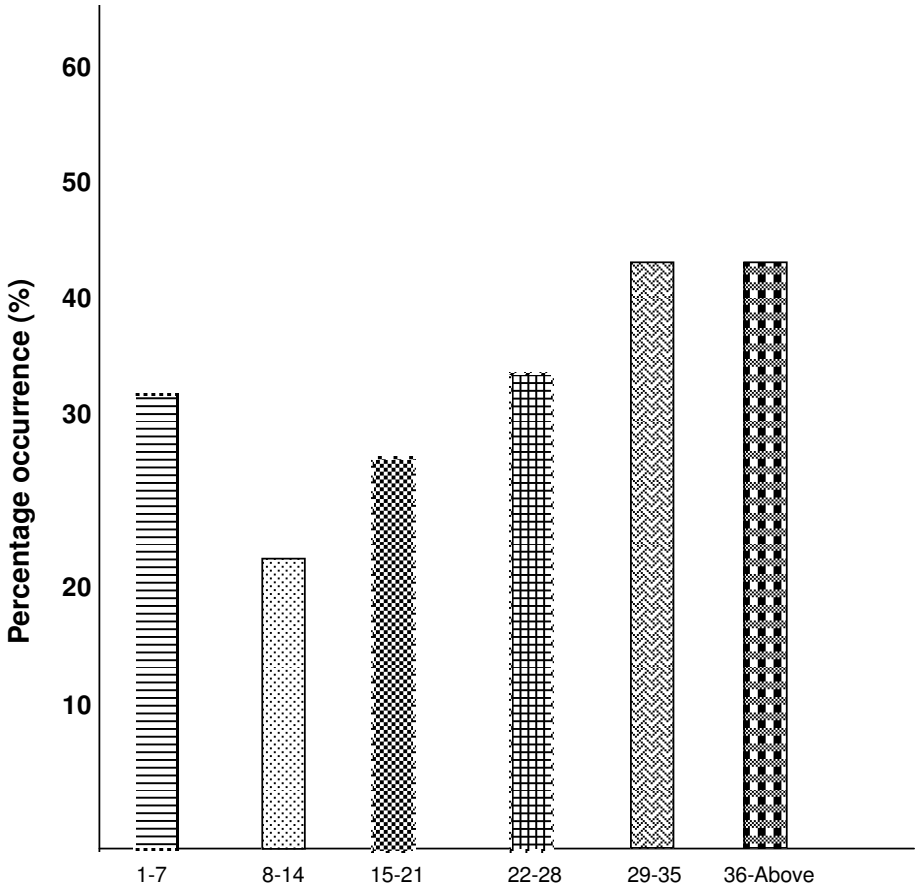

Figure 4. A bar chart showing the occurrence of bacterial infection among patients with indwelling catheter based on the duration of the catheter.

(Tambyah and Maki, 2000). Similar observation has been made with *Klebsiella* sp., *Pseudomonas* sp., *Streptococcus* sp., *Citrobacter* sp. and *Enterobacter* sp. *Staphylococcus* sp. which uncommonly cause cystitis and ascending pyelonephritis, is a frequent cause of lower urinary tract infection. *Staphylococcus saprophyticus* adheres significantly to better uroepithelial cells than *Staphylococcus epidermidis* (Turch and Mark, 2001).

Bacteriuria in indwelling catheters occurs in both male and female but is more in females than in males as observed in this study. This is consistent with other findings which revealed that, incidence rates of cystitis and urinary tract infection was high in young females due to the shortness of the female urethra (Prescott et al., 2005).

Other factors such as improper cleaning of the perineum and the use of sanitary towels, catheter use contribute to the higher incidence of bacteriuria among indwelling catheters in the various categories of women (Ibe et al., 1995; Tambyah and Maki, 2000; Prescott et al., 2005). In addition, females urine has been reported to have a more suitable pH and osmolality for the growth of *E. coli* than urine from males (Ibe et al., 1995).

Damron et al. (1986) reported that, polymicrobial bacterial infections are mainly limited to patients with prolonged indwelling catheter. Jawets et al. (1998) also reported that, the incidence of catheter associated infection increases as the use of indwelling catheter is increased. Also those patients with prolonged indwelling catheter had a greater than or equal to 77% infection with multiple organisms (Jawetz et al., 1998).

It is a common knowledge that *E. coli* strains are opportunistic pathogens. This organism has the highest frequency of occurrence amongst other Gram negative (*Klebsiella* sp., *Proteus* sp., *P. aeruginosa*, *Citrobacter aureus* and *S. faecalis*) bacteria that cause urinary tract infection in indwelling catheters. This does not mean that other organisms apart from bacteria do not cause urinary tract infection in indwelling catheters. The important infecting organism was found to be the commensals of perianal and vaginal regions. This calls for increased personnel hygiene. Women should be taught that, while defecating, they should clean from the front backwards and not from the back (anus) to the front (urethra) as this may frequently lead to infecting the urethral with faucal commensally and pathogens. The insertion of catheter has been shown to increase the incidence of bacteriuria

in hospital environments (Decapite and Richards, 2001). This is due to the introduction of the nosocomial infections into the bladder; therefore, care must be taken while inserting these instruments so as not to increase the patient's health burden, while trying to solve one.

This study has shown that, indwelling cartether can be a source of urinary infections given various factors as described. Therefore, catheterization should be avoided when not required and when not needed, it should be terminated or removed as soon as possible. Aseptic catheter insertion and properly maintained closed drainage system are crucial to reducing the risk of bacteriuria. The use of gloves, hand washing, a high level of nursing knowledge and skill is required to achieve effective and safe management. Patients with indwelling urethral catheter should also be given urine drainage assistance whenever possible, which options include intermittent supra pubic and intra-urethral methods.

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