

Current microbial and culture sensitivity pattern of urinary tract infection in a private hospital setting in Bayelsa State, Nigeria

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Abstract

UTI is a common cause of morbidity worldwide, but the patterns of UTI in private healthcare settings are not well known. To determine the common causative agents of UTI and their antimicrobial susceptibility patterns in a small but busy private hospital in Bayelsa State of Nigeria. Clean-catch mid-stream urine samples were obtained from 116 study subjects. Samples were examined microscopically, Gram-stained and cultured aerobically on blood, MacConkey and CLED agar. Bacterial isolates were identified morphologically and by standard biochemical tests. Antibiotic susceptibility was tested using the disc diffusion technique of Kirby-Bauer. 36 samples out of 116 were culture positive (31.03%; 95% CI: 22.63 - 39.43). 69.44% of positive samples were from female patients. 61.1% of bacterial isolates were Gram-negative bacilli. *Staphylococcus aureus* (38.9%) was the most common isolate, followed by *Escherichia coli* (36.1%). There was female preponderance of UTI and increased incidence in the 21 to 30 years age group. Bacterial isolates were sensitive to gentamicin and amoxicillin-clavulanic acid, but were resistant to nalidixic acid. Differences exist in the causative agents of UTI and their antimicrobial sensitivity patterns between healthcare facilities. We recommend that each facility should determine these indices to guide their management of uncomplicated UTI.

Keywords: Bacteria, urinary tract, antibiotic resistance.

INTRODUCTION

Urinary tract infection (UTI) is an important cause of morbidity and mortality in healthcare delivery, and is common in both community and hospital patients (Al Sweih et al., 2005). Recurrence is a problem, with about 26.6% of women experiencing recurrence of UTI within 6 months following an initial infection (Foxman, 1990). Diagnostic difficulties are also common in settings where facilities are scarce or are not affordable. Management of UTI is often empirical without recourse to urine culture or susceptibility testing to guide therapy (Gupta et al., 2001).

Resistance of urinary pathogens to commonly pre-

scribed antibiotics has been reported, and multi-drug resistant uropathogenic bacteria have been isolated from urine specimens in different parts of the world (Jombo et al., 2011).

There is often regional variability of pathogens and their susceptibility patterns, and these are capable of changing over time. Thus, determining the aetiological agents and their antibiotic sensitivity patterns is needed to help in empirical treatment.

A continuous review of antibiograms is also necessary to track changes in aetiological agents and antimicrobial patterns. The private hospitals and clinics are not usually involved in studies and reviews of these indices. There is limited available information on prevalence of UTI and causative agents in the private healthcare sector. Ethical issues may contribute to constraints in carrying out such

Table 1. Reasons for demanding urine culture.

	Male	Female
? UTI	24	20
? UTI in pregnancy	0	33
Routine tests	21	8
? Sexually transmitted infection	0	10
Total	45	71

studies. Also, practices in private healthcare are often different from that in public health institutions in terms of misuse of antibiotics, demand and availability of antibiotics (Okeke et al., 1999).

With this in mind, we sought to investigate the prevalence, aetiological agents and drug sensitivity pattern of UTI in patients attending a small but busy private hospital.

This study was done on patients attending a private clinic/laboratory in Yenagoa, Bayelsa State of Nigeria.

MATERIALS AND METHODS

Study design

This was a prospective cross-sectional study carried out from January 2012 to June 2012, in which 116 patients attending a small, but busy private hospital in Yenagoa were recruited.

Study area

Bayelsa State is in the Niger Delta region of Nigeria, known for oil-related activities. Majority of the people are fishermen and farmers in the rural area, whilst civil servants accounted for majority of the people in the state capital, Yenagoa. This private hospital attends to patients from all strata of the society, but most of the patients are from the middle and high socio-economic groups.

Inclusion/exclusion criteria

Patients recruited for the study were those who were yet to be clinically diagnosed for UTI (but suspected to have UTI), and those for whom urine microscopy, culture and sensitivity had been ordered as part of routine medical tests (Table 1). Patients who had been on antibiotic therapy or had any serious medical condition were excluded from the study.

Ethical consideration

Permission was obtained from the Proprietor of the hos-

pital who insisted on the name of the hospital not being mentioned in publications. Informed consent was obtained from all patients and ethical approval was obtained from the State Ethics Board.

Sample collection and processing

Study subjects were instructed on how to collect clean-catch mid-stream urine into sterile containers after carefully cleaning the genitalia, especially around the opening of the urethra. Samples were collected within the hospital premises and immediately sent to the laboratory. Only one sample was obtained from each patient, and samples were processed within one hour of collection.

Microscopy

After noting and recording the colour, turbidity/ cloudiness of each sample, 10 ml of the urine sample was centrifuged at 1500 rpm for 5 min and the residue examined under the microscope. Urine containing more than 5 pus cells/high power field was cultured. Each sample was Gram-stained and examined microscopically.

Bacterial culture and isolation

Using a calibrated loop capable of delivering 0.01ml of urine, each sample was inoculated on blood, MacConkey and cystine lactose electrolyte-deficient (CLED) agar respectively and incubated aerobically for 18 - 24 hours. A semi-quantitative method was used to determine the colony counts and significant bacteriuria was defined as pure bacterial culture of $>10^5$ colony forming units/ml of urine. Isolated organisms were identified by standard biochemical tests.

Antimicrobial sensitivity testing

Susceptibility of the isolated bacteria to antibiotics was tested using the Kirkby-Bauer disk diffusion method, and

Table 2. The age and sex distribution of the study subjects.

Age (years)	Patients studied (n=116)			Positive bacterial growth (n=36)	
	Total	Male	Female	Male	Female
0 to 10	3 (2.6%)	1	2	0	0
11 to 20	23 (19.8%)	4	19	2	5
21 to 30	62 (53.5%)	27	35	4	16
31 to 40	21 (18.1%)	9	12	3	4
41 to 50	3 (2.6%)	1	2	1	0
51 to 60	1 (0.8%)	1	0	1	0
61 to 70	2 (1.7%)	1	1	0	0
>71	1 (0.8%)	1	0	0	0
Total	116 (100%)	45	71	11	25

Table 3. The frequency of isolated bacteria.

	No. of isolates	%	Male	Female
<i>Escherichia coli</i>	13	36.1	3	10
<i>Proteus mirabilis</i>	5	13.9	2	3
<i>Klebsiella pneumoniae</i>	3	8.3	0	3
<i>Staphylococcus aureus</i>	14	38.9	6	8
<i>Pseudomonas aeruginosa</i>	1	2.8	0	1
Total	36	100	11	25

interpreted according to the laid down standards of the National Committee for Clinical Laboratory Standards (National Committee for Clinical Laboratory Standards, 2001).

The antibiotics tested and their concentration are as follows: amoxicillin-clavulanic acid 30 µg, cefalexin 30 µg, ofloxacin 5 µg, amoxicillin 25 µg, gentamicin 10 µg, nalidixic acid 30 µg, ciprofloxacin 5 µg, penicillin 10 units and streptomycin 10 µg.

Statistical analysis

Chi square tests were used to determine statistical significance in observed differences, with significant level set at $p < 0.05$.

RESULTS

Mid-stream urine samples from 116 patients were analysed. 47 subjects were male and 71 were female, with a male: female ratio of 0.63:1. The age and sex distribution of the subjects is shown in Table 2. The age range of the subjects was 8 years to 84 years, mean 27.91 years. 53.5% of the subjects were of the 21 years to 30 years age group.

Prevalence of UTI

36 samples out of 116 yielded significant bacterial giving a UTI prevalence of 31.03% (95% CI: 22.63 - 39.43). Gram negative bacilli accounted for 61.12% of bacterial isolates. *Staphylococcus aureus* was the most predominant pathogen isolated, followed closely by *Escherichia coli*, *Klebsiella pneumoniae* and *Proteus mirabilis*. *Pseudomonas aeruginosa* was the least common isolated pathogen (Table 3).

Age and sex

Over two-thirds of the culture-positive samples were from female patients and 55.5% were from patients from the 21years to 30 years age group. The prevalence of UTI rose steeply with age and peaked in the 21 to 30years age group and then declined steeply again. There was female preponderance until the 41 to 50 years age group, where male preponderance took over (Figure 1).

Antimicrobial resistance

The bacterial isolates exhibited a high susceptibility to gentamicin (71.45 to 92.3%) and amoxicillin-clavulanic

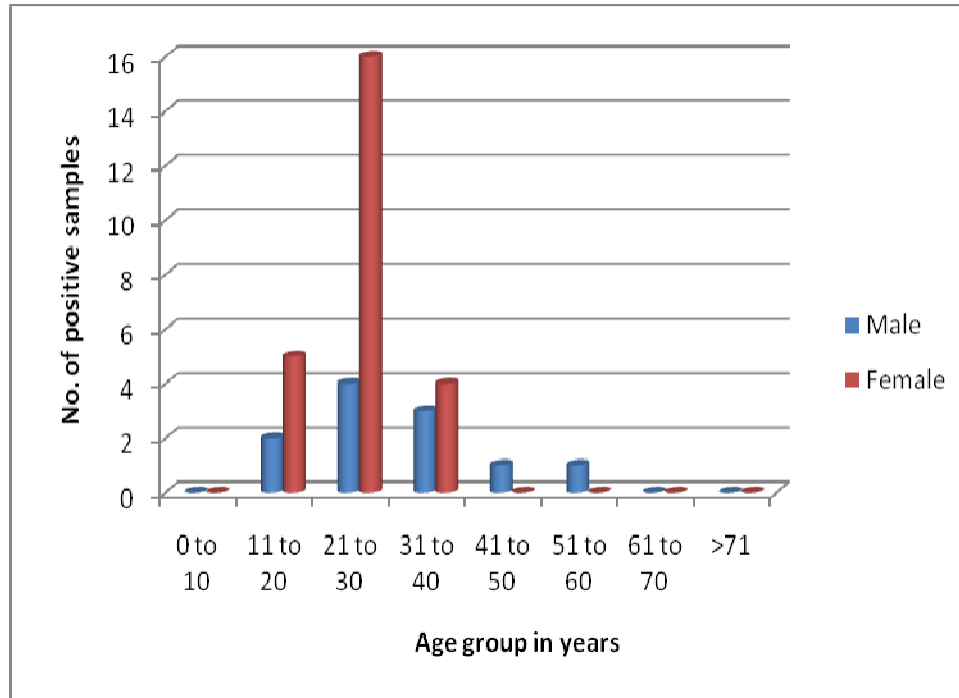


Figure 1. Distribution of patients with positive cultures according to age and sex.

Table 4. Degree of susceptibility of the isolates to antibiotics expressed in percentage sensitivity.

	<i>Staphylococcus</i>	<i>Escherichia coli</i>	<i>Proteus mirabilis</i>
AMX-CLA	64.3	84.6	60
CEP	35.7	23.1	80
OFX	21.4	61.5	60
AMX	50	23.1	80
GEN	71.4	92.3	80
NAL	35.7	23.1	20
CIP	42.9	75	80
PEN	57.1	38.5	20
STREPT	30.8	53.8	60

AMX-CLA - Amoxicillin-clavulanic acid; CEP - Cefalexin; OFX - ofloxacin; AMX - Amoxicillin; GEN - Gentamicin; NAL - Nalidixic acid; CIP - Ciprofloxacin; PEN - Penicillin; STREPT - Streptomycin.

acid (60% to 84.6%) (Table 4). Sensitivity to cefalexin and penicillin was relatively low. The isolates were least susceptible to nalidixic acid (20% to 35.7%) as shown in Figure 2. No multi-drug resistant bacteria were isolated.

Penicillins

E.coli was poorly sensitive to penicillin and amoxicillin (23.1% to 38.5%) whilst *Staph. aureus* was averagely sensitive (50% to 57.1%). *P. mirabilis* was highly

sensitive to amoxicillin but poorly sensitive to penicillin. The addition of β -lactamase inhibitor clavulanic-acid to amoxicillin increased the sensitivity of both *E.coli* and *S. aureus*.

Aminoglycosides

The response of the isolates to aminoglycosides was mixed. Whilst the sensitivity to gentamicin was high, *S.aureus* was poorly sensitive to streptomycin.

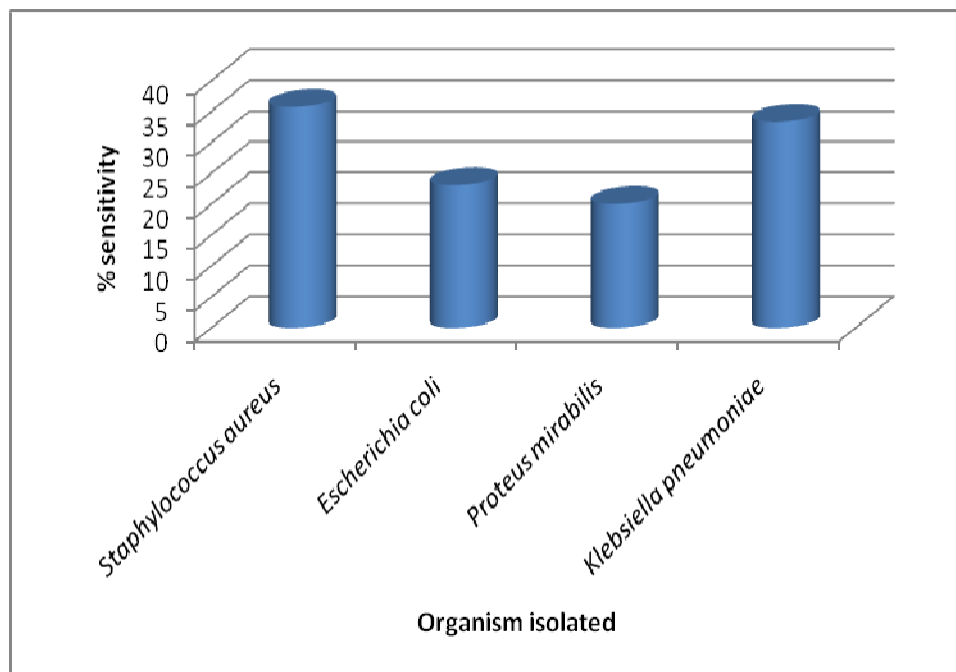


Figure 2. Degree of sensitivity of isolates to nalidixic acid.

Cephalosporins

P. mirabilis was highly susceptible to cefalexin whilst *E.coli* and *S. aureus* were poorly sensitive.

Fluoroquinolones

E. coli and *P. mirabilis* were highly sensitive to ciprofloxacin, with *S. aureus* being poorly susceptible to ciprofloxacin.

Urinary tract disinfectants

E. coli, *S. aureus* and *P. mirabilis* were poorly sensitive to nalidixic acid.

DISCUSSION

The prevalence of 31.03% we obtained in this study is close to the 37.38% we obtained in an earlier study in a public tertiary health facility in Bayelsa State (Pondei et al., 2012) and 39.69% observed in Edo State also in the Niger Delta of Nigeria (Oladeinde et al., 2011). It is much lower than the 77.9% in South-Eastern Nigeria (Mbata, 2007), 60% in North Central Nigeria (Kolawole et al., 2009); but higher than the 7.7% in North-Central Nigeria (Jombo et al., 2011), 17.7% in Turkey (Arslan et al.,

2005) and 24.52% in India (Banerjee, 2011). This supports the suggestions of local and regional differences in UTI prevalence.

Our observation of *Staphylococcus aureus* as the most common pathogen causing UTI is contrary to our earlier finding within Bayelsa State (Pondei et al., 2012) and most studies on UTI in Nigeria which found *E. Coli* as the predominant pathogen (Kolawole et al., 2009; Obiogbolu et al., 2009; Okonko et al., 2010; Kehinde et al., 2011; Oladeinde et al., 2011). The reason for this difference is not known.

In this present study, the isolates were generally susceptible to gentamicin and amoxicillin-clavulanic acid. They were poorly sensitive to nalidixic acid, cefalexin, penicillin and streptomycin. These are frequently prescribed drugs in Nigeria and thus prone to abuse (Yah et al., 2008).

The female preponderance of UTI observed was not unexpected, as a shorter urethra and lack of prostatic secretions are believed to be responsible for increased incidence of UTI in females (Tice, 1999).

Our results are compatible with the existence of different aetiological agents and different antimicrobial patterns in different localities.

Infection control is practically non-existent in private hospitals/clinics in our environment. We suggest that the Health authorities introduce and help institute guidelines that will cut across public and private healthcare facilities. The private health facilities should be encouraged to determine baseline indices for all infections.

CONCLUSION

The aetiological agent of UTI and their sensitivity pattern vary between health institutions even within the same area. We therefore suggest that each health institution should determine the causative agents of UTI and their susceptibility to guide the management of UTI. Gentamicin and amoxicillin-clavulanic acid are recommended for treatment of uncomplicated UTI in this private hospital.

REFERENCES

- Al Sweih N, Jamal W, Rotimi VO (2005). Spectrum and Antibiotic Resistance of Uropathogens Isolated from Hospital and Community Patients with Urinary Tract Infections in Two Large Hospitals in Kuwait. *Medical Principles Pract.* 14: 401–407.
- Arslan H, Azap OK, Ergonul O, Timurkaynak F (2005). Risk factors for ciprofloxacin resistance among *Escherichia coli* strains isolated from community-acquired urinary tract infections in Turkey. *J. Antimicrob. Chemother.* 56: 914–918.
- Banerjee S (2011). The Study Of Urinary Tract Infections And Antibigram Of Uropathogens In And Around Ahmadnagar, Maharashtra. *The Internet J. Infect. Dis.* 9(1).
- Foxman B (1990). Recurring Urinary Tract Infection: Incidence and Risk Factors. *Am. J. Public Health.* 80(3): 331-333.
- Gupta K, Hooton TM, Stamm WE (2001). Increasing Antimicrobial Resistance and the Management of Uncomplicated Community-Acquired Urinary Tract Infections. *Ann. Intern. Med.* 135(1): 41-50.
- Jombo GTA, Emanghe UE, Amefule EN, Damen JG (2011). Urinary tract infections at a Nigerian university hospital: Causes, patterns and antimicrobial susceptibility profile. *J. Microbiol. Antimicrob.* 3(6): 153-159.
- Kehinde AO, Adedapo KS, Aimaikhu CO, Odukogbe AA, Olayemi O, Salako B (2011). Significant Bacteriuria Among Asymptomatic Antenatal Clinic Attendees In Ibadan, Nigeria. *Trop. Med. Health.* 39(3): 73-76.
- Kolawole AS, Kolawole OM, Kandaki-Olukemi YT, Babatunde SK, Durowade KA, Kolawole CF (2009). Prevalence of urinary tract infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria. *Int. J. Med. Medical Sci.* 1(1): 163-167.
- Mbata T (2007). Prevalence And Antibigram Of Urinary Tract Infections Among Prison Inmates In Nigeria. *The Internet J. Microbiol.* 3(2).
- National Committee for Clinical Laboratory Standards (2001). Performance standards for antimicrobial susceptibility testing. Performance standards for antimicrobial susceptibility testing. Wayne, Pa.
- Obiogbolu CH, Okonko IO, Anyamere CO, Adedeji AO, Akanbi AO, Ogun AA, Ejembi J, Faleyeye TOC (2009). Incidence of Urinary Tract Infections (UTIs) among pregnant women in Akwa metropolis, Southeastern Nigeria. *Sci. Res. Essay.* 4(8): 820-824.
- Okeke IN, Lamikanra A, Edelman R (1999). Socioeconomic and Behavioral Factors Leading to Acquired Bacterial Resistance to Antibiotics in Developing Countries. *Emerg. Infect. Dis.* 5(1): 18-27.
- Okonko IO, Ijandipe LA, Ilusanya AO, Donbraye-Emmanuel OB, Ejembi J, Udeze AO, Egun OC, Fowotade A, Nkang AO (2010). Detection of Urinary Tract Infection (UTI) among pregnant women in Oluyoro Catholic Hospital, Ibadan, South-Western Nigeria. *Malay. J. Microbiol.* 6(1): 16-24.
- Oladeinde BH, Omoregie R, Olley M, Anunibe JA (2011). Urinary tract infection in a rural community of Nigeria. *North Am. J. Medical Sci.* 3(2): 75-77.
- Pondei K, Oladapo O, Kunle-Olowu (2012). Anti-microbial susceptibility pattern of micro-organisms associated with urinary tract infections in a tertiary health institution in the Niger Delta Region of Nigeria. *Afr. J. Microbiol. Res.* 6(23): 4976-4982.
- Tice AD (1999). Short-course therapy of acute cystitis: a brief review of therapeutic strategies. *J. Antimicrob. Chemother.* 43(Suppl. A): 85–93.
- Yah SC, Yusuf OE, Eghafona NO (2008). Pattern of antibiotic usage by adult populations in the city of Benin, Nigeria. *Sci. Res. Essay.* 3(3): 081-085.