CATHETER ASSOCIATED URINARY TRACT INFECTION IN A TETIARY HEALTH INSTITUTION IN KANO. A COMPARISON OF CATHETER TIP AND ASPIRATED URINE SAMPLE CULTURE

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ABSTRACT

Background: The use of indwelling catheter creates an inherent risk for infection. Catheter associated urinary tract infections (CAUTIs) comprise perhaps the largest institutional reservoir of nosocomial antibiotic resistant pathogens. This could lead to complications such as pyelonephritis and bacteraemia.

Objective: To compare catheter tip cultures with aspirated urine cultures in the diagnosis of CAUTIs.

Method/subjects: A prospective study of catheter tip and aspirated urine samples collected from the lumen of the catheter from 210 patients (pts) catheterized for up to 7days was carried out. These were sent to microbiology department Aminu Kano Teaching Hospital (AKTH) for bacteriological analysis between January 2005 and March 2006. Bacterial and fungal isolates were identified by standard procedures. Antibiotic susceptibility pattern was done by disc diffusion method.

Results: Out of 210patients studied, 180patients (85.7%) showed bacterial and fungal isolates from catheter tip cultures while 85patients (40.5%) showed bacterial growth from the aspirated urine sample. Among the positive culture of the catheter tips 111patients (61.6%) were males while 69patients (38.3%) were females. For the aspirated urine sample 56patients (65.8%) were females while 29patients (34.1%) were males. The prevalence rates of the isolates for catheter tip and aspirated urine culture were E. coli 69 (38.3%), 35 (41.2%). Pseudomonas aeruginosa 36 (20%), 16 (18.8%) Klebsiella spp. 25 (13.8%), 12(41.1%) Proteus spp. 23 (12.7%), 10 (11.8%) S. aureus 16 (8.8%), 4 (4.7%) Streptococcus spp 2 (1.1%), 6 (7.1%) Citrobacter freundii 5 (2.7%) 0 (0%), Candida spp 5 (2.7%), (0%) and S. epidermides 2(1.1%), 0 (0%) respectively.

Conclusion: Catheter tip samples always yield bacterial and or fungal growth that cannot be quantified. In the presence of pyuria, aspirated urine samples are preferred to catheter tip which can be quantified and are more reliable.

Keywords: CAUTIs, Catheter tip, Aspirated urine, AKTH.

Introduction: Patients who require invasive devises may have more severe underlying diseases conditions that increase their susceptibility to infections. These devices such as urinary catheter provide a pathway for microorganisms from the environment to enter the body, facilitate the transfer of pathogens from one part of the patient's body to another and act as inanimate foci where pathogens can proliferate protected from the patients immune defences.[1]

Catheters are commonly used for urinary retention, incontinence control, wound management and patients comfort.

Catheter associated urinary tract infections

(CAUTIs) comprise perhaps the largest institutional reservoir of nosocomial antibiotic resistance pathogen and the most important of which are multiple drug resistant enterobacteriacea such as Klebsiella spp, proteus spp and pseudomonas aeruginosa.[2]
These are also the most common nosocomial infections accounting for, more than 1 million cases each year in the United States hospitals and nursing homes.[3]
Two populations of bacteria exist in catheterized urinary tract. Those growing within the urine itself and those growing on the surface of catheter known as biofilm growth. Microorganisms are commonly attached to indwelling medical devices such as urinary catheters to form biofilm made up of extracellular polymers. This can subsequently lead to encrustation of the inner catheter and eventual blockage.[4]
Catheter associated urinary tract infections (CAUTIs) carry increased risk of complications and morbidity causing delayed recovery and can lead to pyelonephritis and bacteremia.[2,3]

Method/Subjects: A prospective study of catheter tip and aspirated urine samples collected consecutively from 210patients catheterized for up to 7days were sent to Microbiology department, Aminu Kano Teaching hospital, Kano for bacteriological analysis between January 2005 and March 2006. The catheter tip which was cut off aseptically from the catheter and sent to the laboratory in a sterile container was rolled on one edge of the surface of Blood and Cled agar to obtain a primary inoculum and then streaked out; while a standard wire loop was used to inoculate the aspirated urine samples into Cled and Blood agar plates to enable quantification of bacterial growth as significant or non significant to be established. Microscopy was done on wet preparation of the sample to determine the presence of pus cells, red blood cells and other cellular elements in urine. All bacteria isolates were identified according to the method of Cheesbrough[5]. Paper disc diffusion method[6] was used for the antibiotic sensitivity pattern.

Results: From a total of 210 patients, 180patients (85.7%), (111males and 69 females) catheter tip samples processed showed bacterial and fungal growth while 85patients (40.5%) (56 females and 29 males) aspirated urine specimens processed showed bacterial growth. Although bacterial and fungal isolates were recovered, there were no mixed infections.
Table 1 shows the various sources or departments from where the specimens were received with Female medical ward (FMW) and Male medical ward (MMW) contributing 136 (64.8%) patients Tables 2 and 3 show the age, sex, and distribution of catheterized patients with bacterial and fungal growth in this study.
A total of 40 (22.2%) and 33 (38.8%) samples of catheter tip and aspirated urine culture respectively occurred in 51 - 60years age group, a prevalence that was higher than was observed in any other age group.
The prevalence of bacteria isolates in catheterized patients from both catheter tip and aspirated urine specimens is presented in Table 4.
E. coli 96(38.3%) from catheter tip culture and 35(41.2%) from aspirated urine culture was the most frequently isolated organism. Others were as follows: Pseudomonas aeruginosa 36(20%) from catheter tip culture and 16(18.8%) from aspirated urine culture. Klebsiella spp 25(13.8%) from catheter tip culture and 12(14.1%) from aspirated urine culture.
Proteus spp 23(12.7%) from catheter tip culture and 10(11.8) from aspirated urine culture.
S. aureus 16(8.8%) from catheter tip culture and 4(4.7%) from aspirated urine culture.
Strept spp 2(1.1%) from catheter tip culture and 6(7.1%) from aspirated urine culture.
Citrobacter freundii 5(2.7%) from catheter tip culture and 0(0%) from aspirated urine culture.
Candida spp 5(2.7%) from catheter tip culture and 0(0%) from aspirated urine culture.
Coagulase negative staphylococci 2(1.1%) from catheter tip culture and 0(0%) from aspirated urine culture.
Table 5 shows the in vitro antibiotic susceptibility pattern of the various bacterial isolates. The level of resistance exhibited by

the bacterial isolates emphasizes their nosocomial nature.

In the aspirated urine sample culture bacterial growth of 10^2-10^5 cfu/ml with pyuria (pus cells of 5-6 PHf × 40 objective and above) were considered significant for catheter associated urinary tract infection (CAUTI). Out of 85 cases of aspirated urine samples that had bacterial growth, 74 samples fell within the above criteria. The other 11 specimens may have been contaminated with bacteria from the biofilm growth in the inner surface of the catheter.

The actual prevalence of CAUTI in this study is in 74patients (35.2%) instead of 180patients (85.8%) as shown by catheter tip cultures. In both catheter tip cultures and aspirated urine samples, 6 cultures yielded the same organisms with Proteus spp accounting for 3 while Pseudomonas aeruginosa and E. coli were observed in 2 and 1 cases respectively.

Table 1: Distribution of catheterized patients by service units at Aminu Kano Teaching Hospital, Kano.

FMW	56(26.7)
MMW	80(38.1)
FSW	8(3.8)
ICU	13(6.1)
Dialysis	11(5.2)
SOPD	6(2.9)

FMW -Female Medical Ward
MMW -Male Medical Ward
FSW -Female Surgical Ward
ICU -Intensive care unit
SOPD -Surgical Out Patient Department

Table 2: Age and Sex distribution of catheterized patients with positive aspirated urine cultures at Aminu Kano Teaching Hospital, Kano.

Age (yrs)	Male (%)	Female (%)	Total (%)
0-10	1(1.2)	2(2.4)	3(3.5)
11-20	1(1.2)	1(1.2)	2(2.4)
21-30	2(2.4)	4(4.7)	6(7.0)
31-40	2(2.4)	3(3.5)	5(5.9)
41-50	4(4.7)	6(7.0)	10(7.0)
51-60	9(10.6)	24(28.2)	33(38.2)
61-70	6(7.0)	10(11.8)	16(18.8)
>70	4(4.7)	6(7.0)	10(11.8)
	29(34.2)	59(65.8)	85

Table 2: Age and Sex distribution of catheterized patients with positive Catheter tip cultures at Aminu Kano Teaching Hospital, Kano.

Age (yrs)	Male (%)	Female (%)	Total (%)
0-10	3(1.6)	1(0.5)	4(2.2)
11-20	5(2.7)	8(4.4)	13(7.2)
21-30	17(9.4)	6(3.3)	23(12.8)
31-40	11(6.1)	9(1.5)	20(11.1)
41-50	19(10.5)	9(1.5)	28(15.6)
51-60	26(14.4)	14(7.7)	40(22.2)
61-70	17(9.4)	18(10)	35(19.4)
>70	13(7.2)	4(2.2)	17(9.4)
	111(61.3)	69(38.1)	180

Table 4: Prevalence of bacterial isolates from catheterized patients at Aminu Kano Teaching Hospital, Kano.

Type of Organism	Catheter tip culture, (%) n=180	Aspirated urine culture (%) n=85	Urine culture from control subjects n=50
E. coli	69(38.3)	35(41.2)	2(4.0)
Strept spp	2(1.1)	6(7.1)	1(2.0)
S. aureus	16(8.8)	4(4.7)	1(2.0)
Pseudomonas aeruginosa	36(20)	16(18.8)	2(4.0)
Citrobacter Freundii	2(1.1)	2(2.3)	0(0)
Klebsiella spp	25(13.8)	12(14.1)	0(0.0)
Proteus spp	23(12.7)	10(11.8)	1(2.0)
Candida spp	5(2.7)	0(0)	0(0)
S. epidermides	2(1.1)	0(0)	2(4.0)
	180pts	85pts	9pts

Pts Patients.

Table 5: Antibiotic Susceptibility pattern of the bacterial isolates from catheterized patients at Aminu Kano Teaching Hospital, Kano.

Bacterial isolates		No tested	No (%) of isolates sensitive to:							
			CAZ	OFX	CN	AMC	CRO	F	NA	PN
E. coli	AU	35	21(60.0)	18(51.4)	11(31.4)	12(34.3)	24(68.5)	22(62.8)	20(57)	3(8.6)
	CT	69	40(57.9)	38(55.1)	30(43.4)	20(29)	45(65.2)	42(65.2)	38(55.1)	5(7.2)
Pseudomonas	AU	16	8(50)	9(56.3)	10(62.5)	3(18.8)	10(62.5)	5(31.31)	6(37.5)	0(0)
aeruginosa	CT	36	20(55.6)	18(50.0)	17(47.2)	8(22.2)	22(61.1)	6(16.6)	4(25)	0(0)
Klebsiella spp	AU	12	7(58.3)	6(50)	5(41.7)	7(58.3)	7(58.3)	6(50)	5(41.7)	1(8.3)
	CT	25	8(32.0)	10(40.0)	12(48.0)	10(40.0)	13(52)	12(48)	10(40.0)	0(0)
Proteus spp	AU	10	6(60)	6(60)	5(50)	5(50)	6(60)	6(60)	5(50)	2(8.6)
	CT	23	12(52.2)	14(60.9)	10(43.5)	12(52.2)	14(60.9)	12(52.2)	10(43.5)	0(0)
S. aureus	AU	4	2(50)	2(50)	1(25)	1(25)	2(50)	1(25)	0(0)	0(0)
	CT	16	9(56.3)	8(50)	5(31)	6(37.5)	9(56.3)	2(12.5)	2(12.5)	0(0)

Z Ceftazidim
OFX Ofloxacin
CN Gentamicin
AMC Augmentin
CRO Ceftriaxone
F Nitrofurantoin
NA Nalidixic Acid
PN Ampicillin
AU Aspirated Urine
CT- Catheter tip

Discussion: It has become a common practice to send catheter tips from catheterized patients to microbiology laboratory for the diagnosis of catheter associated urinary tract infection in secondary and tertiary health institutions including Aminu Kano Teaching Hospital as can be observed regularly.

The bacteriological analysis of catheter tip culture to diagnose catheter associated urinary tract infections (CAUTIs) will create difficulties especially when it always yields bacterial or fungal growth in the complete absence of pus cells arising from the biofilm growth on the surface of the catheter. This also has an additional problem of lacking means of quantification since urethral flora from meatal mucosa contaminates the catheter from insertion. Various authors [7],[8][9] have condemned the use of catheter tip for the laboratory diagnosis of CAUTI because this will expose patients to unnecessary treatment with antibiotics.

The use of antimicrobial agents in this situation tends to create selective pressure that promotes the emergence of resistant organisms that are notoriously difficult to treat has been facilitated by increasing the use of invasive devices and immunosuppressive drugs.[1]

Uncontaminated aspirated urine sample from the lumen of the catheter or sampling port will reveal bladder infection and host invasion by bacteria pathogens in the presence of pyuria when analyzed by standard procedures. In a study by Bergquist et al, [10] Catheter aspiration corresponded with cultures obtained by supra pubic aspiration in 90% of cases. For clinical purposes, bacteria of 10^2 cfu/ml or more especially when associated with pyuria can probably be taken as evidence of bladder infection.[11] The diversity of organisms causing CAUTI as can be seen in this study probably implies that compromised host defenses are probably more important than specific bacterial virulence factors in the genesis of those infections. The risk of developing nosocomial bacteruria in women exceeds the risk in men by approximately twofold in each decade of life, however for both sexes the risk increases with increase in age.[12]

There is a downward trend in CAUTI in the United States, in a study by Garibaldi et al[9] a prevalence of 23% was observed while in another study by Johnson et al[13] the prevalence was 10% in the same setting after more than a decade and half. This could be due to improved techniques during catheterization.

In a study by Harley et al[14] the highest isolate was E. coli with prevalence rate of 31.9%, while pseudomonas aeruginosa had a prevalence of 11.5%.

In Nigeria, there is dearth of information in this subject arising from differences in laboratory specimens used in the diagnosis of CAUTI as earlier mentioned. However, in this study the overall prevalence of CAUTI was 35.3%. E. coli was the most frequently isolated organism with prevalence of 41.2% followed by pseudomonas aeruginosa 18.8%, Klebsiella spp 14.1 and Proteus spp. 11.8% in that order.

The antibiotic susceptibility pattern of major isolates where closely similar and showed good result with Ceftazidime, ofloxacin and ceftriaxone. These antimicrobials will be of local clinical relevance in the treatment of Catheter associated urinary tract infections (CAUTIs) in this environment especially in the areas without facilities for microscopy, cultures and sensitivity.

Conclusions: Strict asceptic techniques during catheterization must be adhered to. To avoid contamination during collection of specimens, aspirated urine samples should be collected from the catheter port when a new catheter is to be put in place or from a supra pubic suction specimen.

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