CATHETER ASSOCIATED URINARY TRACT INFECTION AMONG PATIENTS ATTENDING SOME SELECTED HOSPITALS IN KANO METROPOLIS

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ABSTRACT

Background: Catheter-associated urinary tract infection has become one of the major global health concerns, especially in developing countries including Nigeria. Risk factors for CAUTIs include prolongation of the catheterization and possible contamination of the indwelling catheter by normal microbial flora.

Aim: The present study aimed to evaluate catheter-associated urinary tract infection among patients attending some selected hospitals in the Kano metropolis.

Methodology: This is cross sectional prospective study among 231 consented patients, ages ≥18 years that were catheterize. Urine samples were collected and subjected to standard bacteriological procedure for culture and sensitivity test. Patient data were collected using structured questionnaire.

Result: The overall CAUTIs incidence of 163(70.6%) was obtained in this study, *Escherichia coli* was the highest uropathogene 62(38.0%) obtained followed by 58(35.6%) with *Staphylococcus aureus*. Majority of the participants are male 89(54.6%) and participants within the age group of 68 – 77 years had the highest incidence 37(22.7%) and least incidence was obtained among ages group ≥88 years 3(1.8%). Nitrofurantoin and Amoxicillin were found to be the most active antibiotics. Prolonging stay of the catheter showed the great impart in the occurrence of CAUTIs.

Conclusion: An incidence rate of 70.6% was obtained in this study. The present study revealed the presence of bacteria associated with urinary catheters in individuals with UTIs. High incidence was observed in male participant than female counterpart.

Keywords: Catheter, CAUTIs, *E. coli*, Urinary tract infections,

INTRODUCTION

Urinary tract infections (UTIs) serve as one of the healthcare-associated infections (HAIs) in developing countries. A study done by Giwa *et al*. (2018) reported that UTIs account for about 40.0% of all HAIs, and more than 80.0% of this incidence is attributed to the use of indwelling urethral catheters. The urinary catheter is a tube mostly made up of different polymers, with silicone and latex rubber (Cortese *et al*., 2018). A catheter tube is inserted into the bladder through the urethra of patients suffering from UTIs to drain urine; this process is called catheterization (Bashir *et al*., 2020).

A catheter-associated urinary tract infection (CAUTI) occurs when a pathogen usually bacteria cause infection in the urinary tract through the contaminated urinary catheter (CDC, 2010). The incidence of CAUTIs has become one of the major global health concerns, especially in developing countries where the incidence is high (Adegun *et al*., 2019). Risk factors for CAUTIs include prolongation of the catheterization and possible contamination of the indwelling catheter by normal microbial flora. The most common uropathogen implicated in CAUTIs is *E. coli, S. aureus, Klebsiella* species, *Pseudomonas aeruginosa* and *Proteus* species (Amisu *et al*., 2019).

Moreover, researchers show evidence in increased of multidrug resistance bacteria globally; this complicated the therapeutic activities against most nosocomial infection including CAUTIs (Dougnon *et al*., 2016).

Therefore, frequent surveillance on the specific CAUTIs uropathogens and their susceptibility pattern are vital in formulating local empirical antibiotic protocol. The present study aimed to evaluate catheter-associated urinary tract infection among patients attending selected hospitals in the Kano metropolis.

MATERIALS AND METHODS

Study Area

The study was carried out in some selected hospitals of Kano metropolis, that include Abubakar Imam Urology Hospital located at Fagge Local Government Area, and Murtala Muhammad Specialist Hospital (MMSH) located at Municipal Local Government Area, all in Kano metropolis, at latitudes 10^{o} 33N to 11^{o} 15N and longitudes 34^{o}CE to 8^{o} 20CE (NBS, 2018).

Study Design

This was a cross-sectional study using a convenience sampling technique among patients on urethral catheters during their treatment at Abubakar Imam Urology Hospital and Murtala Muhammad Specialist Hospital, Kano.

Ethical Consideration

The ethical permission was obtained from the ethical committee of the Kano State Ministry of Health before the commencement of the study (Ref: MOH/Off/797/T.1/1821).

Study Population

The study population comprise of patients with age ≥18years on urethral catheters during their treatment at Abubakar Imam Urology Hospital and Murtala Muhammad Specialist Hospital, Kano.

Inclusion and Exclusion Criteria

The study shall consist of:

1. Consented patients from the selected study site.
2. Patients age ≥18years on urethral catheter during their treatment.

Data Collection

Data of every participant were collected using a standard, structured, and interviewer-administered questionnaire. The questionnaire was given to each participant after consent. The questionnaire had four sections have the following parts: Section A. (Participants Biodata), Section B. (History of Underline Illness), Section C. (Post Medical History), and Section D. (Laboratory Analysis).

Sample Collection

A total of 231 urine samples were aseptically collected into sterile containers from catheterized patients 24 hours after catheter insertion in the selected study site. Urine samples obtained from eligible patients were transported to the Medical Microbiology Laboratory of Murtala Muhammad Specialist Hospital, Kano in leak-proof/zip lock bags where the samples underwent microscopy and culture.

Specimen processing

Immediately samples were collected, the macroscopic examination was carried out for observable features as, colour, turbidity, and blood tinge as the case may be. The urine samples were mixed by rotating the container before inoculating on to Cystein Lactose Electrolyte Deficient Agar (CLED) and Blood Agar by streaking method and incubated at 37^{o}C for 24hours aerobically (Cheesbrough, 2010).

Identification of the isolates

Positive plates after 24 hours incubation were sub-cultured on to MacConkey agar plate to obtain discrete colonies for further characterization and identification. The discrete colonies obtained on purity plates were used for the identification of the isolates using standard bacteriological methods for bacterial Identification (Cheesbrough, 2010).

Characterization of the isolates

In addition to morphological features of the colonies obtained on the purity plates; Gram staining reaction, and biochemical tests (catalase test, coagulase test, bile solubility test, oxidase test, citrate utilization, urease test, triple sugar iron (TSI), test, indole test, and motility test) were carried out to characterizing the isolates according to Cheesbrough (2010).

Antibiotics Susceptibility Test

The susceptibility testing of isolates to 8 antibiotics was carried out by the disk diffusion method according to the Clinical and Laboratory Standards Institute (CLSI, 2019). The antibiotics (Oxoid, UK) used include, Gentamicin, Amoxicillin, Augmentin, Nitrofurantoin, Ciprofloxacin, Cloxacillin, Levofloxacin, and Cefotaxime. Briefly, a bacterial suspension was adjusted to 0.5 McFarland and inoculated onto Mueller Hinton Agar (MHA) (Oxoid, UK). All the plates were incubated at 35^{o}C for 24hour aerobically, after which the plates were held a few inches above a black, non-reflective surface illuminated with reflected light; a ruler was used to measure each zone with the unaided eye while viewing the back of the Petri dish. The result was recorded and was compared with the zone diameter interpretive standard of the Clinical and Laboratory Standards Institute (CLSI, 2019).

Data Analysis

The data generated in this study were analyzed using the Statistical Package for Social Sciences (SPSS) for windows version 25.0 used for statistical analysis and data interpretation. The values were expressed as means and percentages. Comparison of variables was determined by Chi-square test. The level of significance of $p \leq 0.05$ was employed.

RESULTS

Out of 231 samples collected 163 yielded positive growth giving an overall incidence rate of 70.6% (Table 1). *Escherichia coli* was found to be the most predominant organism 62 (38.0%), followed by *S. aureus* and *Klebsiella* species 58(35.6%) and 18(11.0%), respectively. Alpha heamolytic *Streptococcus* 2(1.2%) and *Streptococcus pneumonia* 7(4.3%) are the least isolated organisms (Table 2.).

Among all the 163 bacterial isolates obtained, the majority of isolates 37(22.7%) were found from participants age groups 68 – 77 years followed by 27(16.6%) in age groups 48 – 57 and 58 – 67 years each. Participants aged ≥88 and 18 – 27 years have the least prevalent rate of the isolated organism 3(1.8%) and 5(3.1%) respectively. More than half of the positive isolated bacteria 89(54.6%) are from the male participant and the remaining 74(45.4%) are from female participants. Statistically, the result of the study shows a significant relationship between the demographic parameters of the participants and the presence of the isolates (Table 3).

Among all the observed underline clinical detail obtained, the only duration of catheterization shown a significant relationship with the incidence of infection (P=0.060), while other parameters show the significant statistical difference as p-value >0.05 (Table 4).

The antimicrobial susceptibility pattern of the bacterial isolates, to 8 conventional antibiotics tested, showed Nitrofurantoin and Amoxicillin were the most active drugs, and all the isolated bacteria showed great resistance to Levofloxacin and Cloxacillin (Table 5).

Table 1: Occurrence of Bacteria in Urine Samples of Catheterized Patients

Culture	Frequency	Percent (%)
Growth	163	70.6
No. Growth	68	29.4
Total	231	100.0

Table 2: Distribution of Bacterial species among the Isolated Organisms

Isolated Organisms	Frequency	Percent (%)
Alpha heamolytic Streptococcus	2	1.2
Staphylococcus aureus	58	35.6
Klebsiella species	18	11.0
Proteus spp	16	9.8
E. coli	62	38.0
Streptococcus pneumoniae	7	4.3
Total	163	100.0

Table 3: Distribution of Bacterial Isolates in Relation to Demographic Factors

Demographic Factors	No. Examined	Isolated Organisms						*P-value*
		α-H	*SA*	*Kleb* spp	*Proteus* spp	*E. coli*	*SP*	
Age (Years)								
18 – 27	5 (3.1)	0	1	3	0	1	0	0.046
28 – 37	19 (11.7)	0	5	4	0	8	2	
38 – 47	21 (12.9)	0	11	1	2	6	1	
48 – 57	27 (16.6)	0	14	1	2	10	0	
58 – 67	27 (16.6)	0	6	5	4	11	1	
68 – 77	37 (22.7)	1	7	2	6	19	2	
78 – 87	24 (14.7)	1	13	2	2	6	0	
≥88	3 (1.8)	0	1	0	0	1	1	
Gender								
Male	89 (54.6)	2	24	10	14	36	3	0.009
Female	74 (45.4)	0	34	8	2	26	4	
Total	163 (100)	2	58	18	16	62	7	

Key: α-H = α-Heamolytic *Streptococcus,* SA = *S. aureus,* Kleb. = *Klebsiella,* SP = *S. pneumoniae*

Table 4: Distribution of bacterial isolates in relation to Underlying Illnesses

Underline Illness	**Isolated Organisms**						**Total**	***P-value***
	α-H	*SA*	*Kleb* spp	*Proteus* spp	*E. coli*	*SP*		
History of Diabetes								
Yes	0	12	6	2	10	1	31	0.553
No	2	46	12	14	52	6	132	
History of Trauma								
Yes	0	3	1	0	0	0	4	0.384
No	2	55	17	16	62	7	159	
Duration of Catheter (Days)								
0 – 9	0	23	12	11	27	0	73	0.060
10 – 19	1	14	1	1	13	5	35	
20 – 29	1	13	4	2	15	1	36	
≥30	0	8	1	2	7	1	19	

Key: α-H = α-Heamolytic *Streptococcus,* SA = *S. aureus,* Kleb. = *Klebsiella,* SP = *S. pneumoniae*

Table 5: Resistance Pattern of the Isolated Organisms

Antibiotics	Isolated Organisms					
	α-H	*SA*	*Kleb* spp	*Proteus* spp	*E. coli*	*SP*
Gentamicin	1 (50.0)	16(27.6)	7(38.9)	4(25.0)	25(40.3)	5(71.4)
Levofloxacin	1 (50.0)	23(39.7)	7(38.9)	0(0.0)	30(48.4)	2(28.6)
Cloxacillin	1 (50.0)	23(39.7)	5(27.8)	2(12.5)	26(41.9)	1(14.3)
Ciprofloxacin	0 (0.0)	20(34.5)	6(33.3)	0(0.0)	26(41.9)	1(14.3)
Amoxicillin	1 (50.0)	12(20.7)	5(27.8)	5(31.3)	6(9.7)	0 (0.0)
Augmentin	0 (0.0)	17(29.3)	7(38.9)	2(12.5)	14(22.6)	2(28.6)
Cefotaxime	0 (0.0)	26(44.8)	7(38.9)	5(31.3)	27(43.6)	1(14.3)
Nitrofurantoin	0 (0.0)	8(13.8)	0 (0.0)	3(18.8)	16(25.8)	2(28.6)

Key: α-H = α-Heamolytic *Streptococcus,* SA = *S. aureus,* Kleb. = *Klebsiella,* SP = *S. pneumoniae*

DISCUSSION

The overall incidence obtained in this study (70.6%) revealed a high prevalence of catheter-associated UTIs among patients attending the selected study site. The incidence in this study was relatively higher compared to findings in other studies in Nigeria, 17.3% and 41.1% by Muzzammil *et al.* (2016) in Kano and Olaniran *et al.* (2016) in Abeokuta respectively. More recently, Ushie *et al.* (2020) in Lagos reported the 58.4% incidence of catheter-associated UTIs and 52.2% by Amisu *et al.* (2019). Bashir *et al.* (2020), reported 94.0% catheter-associated UTIs from Yola, Adamawa Northeastern Nigeria.

The predominant isolate in this study was *E. coli* followed by *S. aureus, K. pneumoniae*, *Proteus, S. pneumoniae*, and α-heamolytic *Streptococcus* with isolation rates of 38.0%, 35.6%, 11.0%, 9.8%, 4.3%, and 1.2%, respectively. This report is in line with the report of the works done in other parts of the country including Kano by Muzzammil *et al.* (2016), Dougnon *et al.* (2016) in Benin, Olaniran *et al.*(2016) in Abeokuta, Amisu *et al.*(2019) in Lagos, Ushie *et al.*(2020) in Lagos, and Bashir *et al.*(2020) at Yola Adamawa state, Nigeria, which showed that *E. coli* were predominantly isolated organism.

The antimicrobial susceptibility pattern confirms that most of the isolates in our study are resistant to one or more of the commonly used antibiotics including cephalosporin and fluoroquinolones. This high resistant pattern could have resulted from poorly guided antibiotic prophylaxis after catheterization and empiric therapy of catheter-associated UTI. In particular, the high resistance of the Gram-negative isolates to the fluoroquinolones is worrisome as these are reserve drugs for treating resistant infections. Some researchers (Oni *et al*, 2001; Livermore *et al*, 2002; Daini *et al*, 2005) have however pointed the danger of abuse of these drugs with consequent development of resistance, the effect of which we are beginning to see in our environment.

CONCLUSION

An incidence rate of 70.6% was obtained in this study, The present study revealed the presence of bacteria associated with urinary catheters in individuals with UTIs. The bacteria were found to be more associated with male UTI patients than female UTI patients. Moreover, the most frequently isolated uropathogen in this study was *E. coli* followed by *S. aureus*.

RECOMMENDATIONS

Based on the outcome of this study, it is recommended that physicians should reduce the duration of catheterization stay in order to regulate the over stay of the catheter that reduces the incidence of CAUTIs. Patients who are catheterized for longer than seven days, those that are aged 50 years or older, those that have diabetes, and those with urinary tract obstruction would benefit from more frequent urine cultures to determine the presence of bacteriuria and therapy guided by susceptibility testing instituted.

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