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Full Length Research

A clinical study to assess gender predisposition to catheter-associated urinary tract infections (CAUTI) by leukouria and nitrite analysis using dipstick urinalysis in Plateau Specialist Hospital Jos, Nigeria

Otobo, D. D.[1*], Abowu, P. I.[2], Peter, O. S.[1], Luka, N. Z.[1], Panguru, M.[1] and Abowu, B. E.[3]

[1]Department of Medicine and Surgery, College of Medicine, Bingham University, Nigeria.
[2]Department of Nursing, Jos University Teaching Hospital, Jos, Plateau State, Nigeria.
[3]Department of Medicine and Surgery, College of Medicine, University of Jos, Nigeria.

*Corresponding author. Email: daviddotiz@gmail.com

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ABSTRACT: Research studies have shown that urinary tract infection is most common amongst women, due to their anatomical differences from men. However, catheter-associated urinary tract infection is a nosocomial based infection. The objective of this research is to assess the gender predisposition to catheter-associated urinary tract infection by leukouria and nitrite analysis using dipstick urinalysis in a tertiary health facility. A single-blinded cross-sectional study was conducted among 4 subjects who were on hospital admission in surgical wards within October to November, 2018. All subjects were on urinary catheter as at the time of the study. Cybow combi-11 reagent strips were used for the urine analysis and the results were recorded immediately. The females in the study developed detectable leukouria within the first week, and had positive urine tests for nitrites with flank tenderness within 2 to 3 weeks of catheterization. The males in the study did not have detectable leukouria within the first week. The males developed positive urine tests for nitrites with flank tenderness within 3 to 4 weeks of catheterization. Both males and females are bound to develop significant leukouria, positive urine tests for nitrite with or without flank tenderness within a mean duration of 3 weeks. Women are more likely to come down with catheter-associated urinary tract infections before men. The catheter should be discontinued once suitable alternatives are available.

Keywords: Catheter, gender, infections, nosocomial, urinary.

Abbreviations: **CAUTI,** Catheter-Associated Urinary Tract Infection; **UTI,** Urinary Tract Infection, **DM,** Diabetes Mellitus, **BPH,** Benign Prostatic Hypertrophy/Hyperplasia.

INTRODUCTION

Urinary Tract Infection (UTI) is an infection of the urinary tract; kidney, ureter, bladder and urethra (Muslim students' society of Nigeria, 2014). It is a common disorder accounting for 1 to 3% of consultations in general medical practice. It is most prevalent amongst women and also men above 60 years (Walker et al., 2014). It may be an infection of the upper or lower urinary tract, which may be complicated or uncomplicated. However, all UTIs in men, pregnant women and children are considered complicated (Muslim students' society of Nigeria, 2014). It is simply the presence of microbial pathogens within the normally sterile urinary tract (Lindsay, 2014).

Personal hygiene is a critical attribute in the prevention of UTIs, starting from limiting nephrotoxic substances intake, to regular clean underwear changing to the usage of clean and properly maintained toilet facilities. In Nigeria, only 56% of Nigerian households use an improved sanitation facility. The proportion of households with no

toilet facility has decreased over the last 5 years, from 29% of households in 2013 to 25% of households in 2018 (Nigerian Demographic and Health Survey, 2014; National Demographic and Health Survey, 2019). Although bacteria and fungi are more likely to cause UTI. Viral UTI is uncommon but should be considered as a potential diagnosis in immunocompromised hosts (Hooton, 2003).

In patients with a urinary catheter, bacteriuria increases the risk of gramnegative bacteremia fivefold. Bacteriuria is common and almost universal during long term catheterization. Patients though may be asymptomatic; treatment is avoided in this group to prevent antibiotic resistance (Hooton, 2003; Impey and Child, 2012). Clinical signs alone are not reliable in properly diagnosing UTIs (Padawer et al., 2015).

Studies have shown as high as 25% of admitted patients use urinary catheters and 70 to 89% of nosocomial infections are caused by urinary-catheters (Clarke et al., 2019). Hence, health workers understanding the essentials and risks of urinary catheter and thus limiting its use to only when necessary is very instrumental in preventing CAUTI (Janzen et al., 2015).

Once a catheter is placed, the daily incidence of bacteriuria is 3 to 10%. On short term catheterization, there is a 10 to 30% chance of developing asymptomatic bacteriuria. Between 90 and 100% of patients who undergo long-term catheterization develop bacteriuria. About 80% of nosocomial UTIs are related to urethral catheterization; only 5 to 10% are related to genitourinary manipulation (John, 2017).

Risk factors for bacteriuria in patients who are catheterized include longer duration of catheterization, colonization of the drainage bag, diarrhea, diabetes, absence of antibiotics, female gender, renal insufficiency, errors in catheter care, catheterization late in the hospital course, and immunocompromised or debilitated state (Walker et al., 2014; Gould et al., 2010).

Studies have shown that removal of an indwelling catheter as soon as possible is the cornerstone of CAUTI prevention. In long-term, this can be prevented in critically ill patients by the use of a daily checklist and educational programs (Menegueti et al., 2019).

Health providers should note that the most important steps in preventing CAUTI is complete avoidance of urethral catheter insertion if possible, education of other health workers on CAUTI risks and prevention, and lastly, the meticulous need for a septic insertion cannot be over emphasized (Barbadoro et al., 2015).

Thus, the aim of this study is to assess the gender predisposition to catheter associated urinary tract infection (CAUTI) by leukouria and nitrite analysis using dipstick urinalysis.

METHODOLOGY

A single-blinded cross-sectional study was conducted at the Plateau Specialist Hospital, Jos, Plateau State, Nigeria. Sixty-seven patients were admitted within October to November, 2018. Thirty-three [33 (49.3%)] of those patients were on the urinary catheter at some point while on admission. Twenty [20 (60.6%)] of those catheterized patients were in the medical ward, while Thirteen [13 (39.4%)] were surgical patients. Only surgical patients were studied and Four [4(30.8%)] of the surgical patients met the criteria for the study (2 males and 2 females). The study was conducted amongst 4 surgical patients who met the criteria and were on hospital admission in surgical wards. All subjects were on urinary catheter. Subjects were all below 50 years of age and had no history of renal disease, chronic infections or immunosuppressive disorder.

Subjects were catheterized in the hospital. Samples were obtained using a 20 ml syringe from the sample ports of the catheters. Samples collected were labeled W, X, Y and Z before handing them over for testing. Cybow combi-11 reagent strips were used for the urine analysis. The expiration date was months away. Readings were made against the resulting chat on the combi-11 container at exactly 60 seconds. The dipstick urinalysis was repeated after every seven days consecutively, day-1 was when their catheters were inserted. Results were recorded immediately. Neither the identity of samples nor the subsequent test results were exchanged amongst teams until the study was over.

Criteria for selection were; patients in the surgical ward not older than 50 years of age, with no previous history of renal pathologies and no underlying medical pathology on admission.

Ethical approval

Ethical approval/clearance was obtained from the ethical committee of the plateau state specialist hospital. However, verbal consent was still given by every subject after due explanation of the test procedures.

RESULTS

The results obtained indicated that by day 6, both women already had detectable leukouria. The females in the study developed detectable leukouria within the first week and had positive urine tests for nitrites with flank tenderness within 2 to 3 weeks of catheterization. The males in the study did not have detectable leukouria within the first week. The males developed positive urine tests for nitrites with flank tenderness within 3 to 4 weeks of catheterize-tion. Both males and females are bound to develop signify-cant leukouria, positive urine tests for nitrite with flank tenderness within a mean duration of 3 weeks (Table 1).

DISCUSSION

Urinary infection is the most common bacterial infection in humans, and can be either symptomatic or asymptomatic

Table 1. Subjects W, X, Y and Z.

Surg ward	Leukouria (WBC/uL)	Detectable nitrite	Flank tenderness
Subject W (Female 45 yrs)			
Week 1	++75	Trace	Absent
Week 2	+++500	Positive	Absent
Week 3	+++500	Positive	Absent
Subject X (Female 41 yrs)			
Week 1	+25	Absent	Absent
Week 2	++75	Trace	Absent
Week 3	+++500	Positive	Present
Subject Y (Male 37 yrs)			
Week 1	Negative	Absent	Absent
Week 2	++75	Trace	Absent
Week 3	+++500	Positive	Present
Subject Z, (Male 45 yrs)			
Week 1	Negative	Absent	Absent
Week 2	++75	Absent	Absent
Week 3	+++500	Trace	Absent

(Lindsay, 2014). In health, bacteria colonization is confined to the lower end of the urethra and the remainder of the urinary tract is sterile (Walker et al., 2014). This is further maintained by the acidity in urine that destroys the bacteria (Sembulingam and Sembulingsm, 2012). When a urinary catheter is inserted, it takes superficial bacteria colony further into the urinary tract and shields away from the urethra urothelium from the acidic purifying actions of urine (Lindsay, 2014; Vergidis and Patel, 2012).

From the result data, it was seen that women are more likely to come down with catheter-associated urinary tract infections before men. This was similar to findings of Perrin et al. (2020). This may be because of the absence of bactericidal prostatic secretion, the closeness of the female external urethral orifice to the vagina introitus and anal canal creates a larger lower urethral bacterial colony than in males (Walker et al., 2014; Impey and Child, 2012). When a catheter is inserted, it inoculates this larger colony of microorganisms at the external urethral orifice in females into the urethra, giving them initial bacteriuria before their male counterpart.

Although it was shown that both women developed leukouria within the first week of catheter insertion, it is also important to note that by day 13 when the second test was done, that both men had about the same similar leukouria values with the females. By week three leukouria was observed in both men and women (Otobo et al., 2020).

CAUTI was rare in the maternity wards because they seldom used one, and when they did, it was for very short periods; 12 to 36 hours. It was common in women who delivered via cesarean section.

This study also showed that CAUTI is a progressive pathology that gets more symptomatic with time, as was demonstrated by the weekly increase in leukouria, hence bacteriuria (Table 1). Hence the need to limit the use of a urinary catheter to essentially necessary patients and removed immediately possible cannot be overemphasized. Catheterization should be avoided when possible and properly removed immediately a natural alternative, like bedpans, are usable.

The major limitation to this research is the low test sample size. As this is due to low health seeking behavior and also financial restraints inhibiting most ill people from coming to hospitals. Similar studies need to be performed at larger urban centres, where an ample size of samples will give a better statistically applicable study.

Conclusion

Women are more likely to come down with catheter-associated urinary tract infections (CAUTI) before men. Bacteriuria is a progressive pathology when a urethral catheter is inserted and this infection progresses faster in women than men on urinary catheters. However, it may remain asymptomatic even at high leukouria levels. Thus, it is paramount that, a urethral-catheters should be discontinued immediately its purpose is served or once suitable alternatives are available.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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