International Journal of Biomedical and Health Sciences
Vol. 7, No. 3, September 30, 2011
Printed in Nigeria

0794-4748/2011 $5.00 + 0.00

http://www.asopah.org

IJBHS 2011014/7306

Urinary tract infection among cancer patients in Benin City, Nigeria

Helen Oroboghae Ogefere[*1], Richard Omoregie[2] and Samuel Ehimare Iriah[2]

[1]Department of Medical Laboratory Science, School of Basic Medical Sciences, University of Benin, Benin City, Nigeria
[2]School of Medical Laboratory Sciences, University of Benin Teaching Hospital, P.M.B. 1111, Benin City, Edo State, Nigeria

(Received January 24, 2011; Accepted March 3, 2011)

ABSTRACT: The immunocompromised nature of cancer patients increases their risk of opportunistic infections. This study aims to determine the prevalence of asymptomatic UTI among cancer and apparently healthy subjects as well as the aetiologic agents. Clean-catch mid-stream urine were collected from 350 subjects consisting of 150 cancer patients (65 males and 85 females) and 200 apparently healthy individuals (70 males and 130 females) which served as controls. Significant microbial isolates were identified in the urine samples using standard techniques. Cancer patients (80%) had a significantly ($P < 0.0001$) higher prevalence of asymptomatic UTI compared with controls (25%). Cancer status was a risk factor for asymptomatic UTI (OR = 6.40 95% CI = 3.752, 10.916). Only female controls (23.1%) had significantly ($P = 0.0105$) higher prevalence of asymptomatic UTI than their male counterparts (14.3%). *Staphylococcus aureus* was the most prevalent uropathogen (25.49%) as well as in both genders of cancer and control subjects. A prevalence of 80% of asymptomatic UTI was observed among cancer patients with a 4 – 11 fold increase risk. *Staphylococcus aureus* was the predominant pathogen in both genders of cancer and control subjects.

Keywords: Urinary Tract Infection (UTI); Cancer; Opportunistic infections; Benin City; Nigeria.

Introduction

Urinary tract infectons (UTI) remain among the most common conditions causing individuals to seek medical care [1]. UTI most readily result when natural defenses in the urinary tract are weakened [2]. Cancer patients are often immunocompromised due to the effect of chemotherapy and other treatment practices on their ummune system [3].

Reports on the prevalence of UTI among cancer patients are few and the prevalence depends on the type of cancer. A prevalence of 11% and 22% was reported among patients with haematological malignancy and solid tumor respectively [4]. However, most of these reports are mainly on nosocomial infection – which pose significant threats to immunocompromised hospitalized patients [5].

It has been suggested that chronic infection with *Schistosoma haematobium* may be responsible for higher rates of bladder cancer in some part of Africa and the Midde East and animal experiments have associated *Escherichia coli* infection with bladder neoplasia [6]. The formation of nitrosamines – a known carcinogen, in the presence of nitrates, secondary amines and nitrate-reducing bacteria (conditions present in most UTI) have been suggested as possible mechanisms [7]. To our knowledge, there is no report on the prevalence of UTI among cancer patients in Nigeria. Against this background the study aims to determine the prevalence of asymptomatic UTI among cancer patients as well as the aetiologic agents.

*Author to whom all correspondence should be addressed.
E-mail: helenogefere@yahoo.com; Telephone: +2348023509447

Materials and Methods

Study Population

A total of 350 subjects consisting of 150 cancer patients (65 males and 85 females) and 200 apparently healthy individuals (70 males and 130 females) were recruited for this study. The cancer patients were attending various cancer clinics in the University of Benin Teaching Hospital, Benin City, Nigeria, while the control subjects were from the surrounding community. Exclusion criteria included signs and symptoms of UTI, antibiotic usage within one week, and large fluid intake (less than one hour) before clinic attendance. Verbal informed consent was obtained from each subjects prior to specimen collection. Approval for the study was given by the Ethical Committee of the University of Benin Teaching Hospital.

Collection and Processing of Specimen

Clean-catch mid-stream urine was collected from each subject into sterile screw-capped universal container, containing few crystals of boric acid as preservative. A loopful (0.001mL) of well mixed uncentrifuged urine was streaked onto the surface of blood agar and cystine lactose electrolyte deficient (CLED) medium (M6: Plasmatec Laboratories, UK). The plates were incubated aerobically at 37^0C for 24hours and counts were expressed in colony forming units (cfu) per mL. A count of $\geq 10^5$cfu/mL was considered significant to indicate infection.

Each urine sample(10mL) was centrifuged at 2000 x g for 5mins. The supernatant was discarded and a drop of the deposit was examined microscopically at high magnification for pus cells, red blood cells, epithelial cells, casts, crystals, yeast-like cells and *Trichomonas vaginalis.* The presence of pus cell ($\geq$5 per higher power field) was considered significant to indicate infection. UTI was diagnosed if the bacterial or pus cell count or both were significant in an individual. The isolates were identified by standard microbiological methods [8].

Statistical Analysis

The data obtained were analysed using Chi (X^2) square test and odd ratio analysis using the statistical software INSTAT$^{(R)}$.

Results

There was a significant ($P < 0.0001$) difference in the prevalence of asymptomatic UTI between cancer patients (80%) and controls (25%), and cancer status was a risk factor for acquiring asymptomatic UTI (OR = 6.4 95% CI = 3.752, 10.916). There was no significant difference in the prevalence of asymptomatic UTI between male and female gender of cancer patients, while the prevalence in control females (23.1%) was significantly ($P = 0.0105$) higher compared with their male (14.3%) counterpart (Table 1).

A total of 255 microbial isolates were recovered and *Staphylococcus aureus* was the most predominat isolate irrespective of subject type (Table 2). Table 3 shows [*Pseudomonas aeruginosa* and *Trichomonas vaginals* were recovered from cancer patients only] the distribution of uropathogen samong gender. With the exception of female control subjects, *Staphylococcus aureus* was the predominant isolate in both genders. In female control subjects, *Candida albicans* was the predominant isolate followed by *Staphylococcus aureus.*

Discussion

This study reveals that 170 (48.57%) out of 350 subjects had asymptomatic UTI. Cancer was a significant risk factor for acquiring asymptomatic UTI. The lower immunity in cancer patients as a result of chemotherapy and other forms of treatment [3], may be responsible for the higher prevalence of asymptomatic UTI observed. The prevalence of UTI among cancer patients in this study is higher than previously reported [4]. The reason for the difference may be due to the fact that the cancer patients in previous reports were symptomatic for UTI as against asymptomatic patients in this study. Also, previous study use particular type of cancer patients, while all cancer types were considered in this study. It is important to note that UTI have been associated with increased risk of bladder cancer [9,10]. Formation of nitrosamines has been suggested as possible mechanism [7]. Thus

the subjects in this study with UTI may be at increased risk of bladder cancer. However, a recent report indicates that reduced risk of bladder cancer was associated with a history of bladder infection among women [6].

Types of UTI have been reported to have different impact on bladder cancer risk [6]. For example, a history of cystitis has been reported to be associated with an increased bladder cancer risk, but a history of kidney infection was associated with a significantly decreased risk [11]. This together with anti-cancer properties of commonly used antibiotics in the treatment of UTI, were suggested as reasons for the reduced risk of bladder cancer associated with UTI [6]. Thus, UTI may not increase risk of bladder cancer in our setting, as abuse of antibiotics is rife [12]. However, further studies are needed to verify this.

Table 1: Prevalence and gender distribution of urinary tract infection among cancer and control subjects

Characteristics	n	n infected (%)	OR	95% CI	P value
Subjects					
Cancer patients	150	120(80.0)	6.400	3.752,10.916	
Controls	200	5(25.0)	0.156	0.092, 0.267	<0.0001
Gender					
Cancer patients					
Male	65	55(84.6)	1.692	0.731, 3.920	
Female	85	65(76.5)	0.591	0.255,1.369	0.301
Controls					
Male	70	10(14.3)	0.375	0.174,0.807	
Female	130	40(23.1)	2.667	1.239,5.738	0.0105

Table 2: Prevalence of uropathogens among cancer and control subjects

Organisms	Cancer patients (%)	Controls (%)	Total (%)
Escherichia coli	35(18.42)	10(15.38)	45(17.65)
Klebsiella pneumoniae	25(13.16)	5(7.69)	30(11.64)
Proteus species	20(10.53)	5(7.69)	25(9.80)
Pseudomonas aeruginosa	10(5.26)	0(0.00)	10(3.92)
Staphylococcus aureus	45(23.68)	20(30.77)	65(25.49)
Coagulase negative staphylococci	30(15.79)	10(15.38)	40(15.69)
Candida albicans	15(7.89)	15(23.08)	30(11.64)
Trichomonas vaginalis	10(5.26)	0(0.00)	10(3.92)
Total	190(74.51)	65(25.49)	255

Table 3: Distribution of uropathogens among gender of the studied population

Organisms	Cancer patients		Controls	
	Male (%)	Female (%)	Male (%)	Female (%)
Escherichia coli	10(15.63)	25(19.84)	5(20.00)	5(12.50)
Klebsiella pneumoniae	14(21.88)	11(8.73)	5(20.00)	0(0.00)
Proteus species	10(15.63)	10(7.94)	3(12.00)	2(5.00)
Pseudomonas aeruginosa	10(15.63)	0(0.00)	0(0.00)	0(0.00)
Staphylococcus aureus	15(23.44)	30(23.81)	7(28.00)	13(32.50)
Coagulase negative staphylococci	5(7.81)	25(19.84)	5(20.00)	5(12.50)
Candida albicans	0(0.00)	15(11.90)	0(0.00)	15(37.50)
Trichomonas vaginalis	0(0.00)	10(7.94)	0(0.00)	0(0.00)

Cancer patients are more likely to have mixed infections than non-cancer patients (cancer vs controls: 58.33% vs 30% OR = 3.267 95% CI = 1.613, 6.615, p = 0.0014) (data not shown). This agrees with reports that polymicrobial infections are common among cancer patients [4]. Polymicrobial infections in cancer patients are associated with greater morbidity and mortality than monomicrobial infections [13].

The effect of gender on the prevalence of asymptomatic UTI was significant (P = 0.0105) only among non-cancer subjects with females having higher prevalence. Other studies involving non-cancer subjects have reported similar findings [12,14].

The finding that *Staphylococcus aureus* was the predominant isolate had previously been reported among non-cancer subjects in our setting [12,14]. The reason why *Trichomonas vaginalis* was seen only among cancer patients is unclear. However, other sexually transmitted infections have been associated with increased risk of bladder cancer [15,16]. The distribution of aetiologic agents of asymptomatic UTI follows previous reported patterns in our setting [12,14].

Conclusively, an overall prevalence of 80% of asymptomatic UTI among cancer patients was observed. Cancer patients had 4 – 11 fold increased risk of developing asymptomatic UTI. *Staphylococcus aureus* was the most prevalent uropathogen in both genders of cancer and apparently healthy subjects. Strategies to reduce the impact of asymptomatic UTI on cancer patients is advocated.

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