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ORIGINAL ARTICLE

Occurrence of candiduria in a population of chronically catheterized patients with spinal cord injury

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Study design: Prospective data collection.
Objectives: To evaluate occurrence and characteristics of candiduria in a population of individuals with spinal cord injury (SCI) or multiple sclerosis (MS) and chronic catheter usage. Candiduria, or presence of *Candida* species in the urine, is a common clinical problem. It is most frequently seen in patients with indwelling urinary catheters. Many patients have these catheters in place chronically. Previous studies have shown that despite therapy, most patients with candiduria will develop the infection again and that complications such as invasive candidiasis are rare. However, there are no studies that specifically examine the role of candiduria in patients with SCI and long-term catheter use.
Setting: Inpatients and outpatients in a US Veterans Affairs spinal cord injury center.
Methods: Urinalysis, culture, patient demographic and clinical characteristics through chart review.
Results: Of 100 total patients, 52 had paraplegia, 45 tetraplegia and 3 MS. Overall, 17 (17%) patients had candiduria, which was observed in urine culture. Antibiotic use was associated with an increased risk of developing candiduria. Indwelling catheter (urethral or suprapubic) usage was also significantly associated with candiduria; only one person on intermittent catheterization developed candiduria, which was not associated with adverse clinical outcomes.
Conclusions: Antibiotic usage and indwelling catheterization were associated with candiduria. No participant in our study population developed invasive candidiasis, and persistence of candiduria was not frequent.
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Keywords: candiduria; spinal cord injury; urinary catheter

Introduction

Candiduria, or presence of *Candida* species in the urine, is a common clinical problem. It is most frequently seen in patients with indwelling urinary catheters.[1–11] Development is strongly associated with antibiotic use[1–5,7,9–13] and intensive care unit admission.[3,4,6,8,9,12,14] Other risk factors include diabetes mellitus,[2,4,7,9,12] female gender,[4,5,8,12] organ transplantation,[4,15,16] surgery,[5,14] central venous catheters[7,17] and malnutrition or parenteral nutrition.[4,7,10,12]

Neurogenic bladder has also been associated with the development of candiduria.[4] Many patients with spinal cord injury (SCI) or dysfunction, as well as other causes of neurogenic bladder dysfunction, may require the long-term use of either indwelling or intermittent catheterization.

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Previous studies have shown that despite therapy, most patients with candiduria will develop the infection again[2,3,5,8,9,13] and that complications such as invasive candidiasis are rare.[14,18,19] However, there are no studies that specifically examine the role of candiduria in patients with SCI and long-term catheter use. In this study, we determined the occurrence of candiduria in a population of inpatients and outpatients, who were evaluated and treated at our spinal cord injury center with SCI or multiple sclerosis and chronic urinary catheter usage.

Methods

The study was approved by the institutional review board at our facility. All applicable institutional and governmental regulations regarding the ethical use of human volunteers were followed during the course of this research. After witnessed informed consent, a urine sample was obtained from each participant using standard collection techniques.

One portion was separated for urinalysis and the other sent for culture. Samples were processed according to our local microbiology laboratory protocol. Patient clinical and demographic data were collected through clinic interview and electronic medical record review.

Participants

Participants consisted of a convenience sample of asymptomatic outpatients presenting to our SCI clinics and of patients admitted to our inpatient SCI unit. Patients were enrolled sequentially as they were encountered. The enrollment period extended from December 2005 to May 2007. Excluded were individuals who were unable to give informed consent either in person or through an authorized representative, and those who did not use a urinary catheter.

Statistical analysis

Continuous parameters were reported as mean ± s.d., and discrete parameters were reported as a percent (%). Associations between pairs of discrete parameters were compared with the Pearson χ^2-test. All analyses were performed with SAS 9.1 and SPSS 14.0 for Windows.

Results

Table 1 shows demographic variables for our population. In total, 52% had paraplegia, 45% tetraplegia and 3% multiple sclerosis. Average duration of injury among individuals with SCI was 15.8 ± 13.1 years. Samples were evenly divided between those obtained in the SCI clinic and the inpatient unit. No samples were obtained from patients admitted to the intensive care unit. Etiologies of paralysis are shown in Table 2.

Of 100 patients, 66 (66%) used an indwelling (urethral or suprapubic) catheter as their current primary method of management; the remainder used intermittent catheterization (Table 3). The mean duration of catheter usage was 9.6 ± 11 years (range: 2 months–48 years).

Of 100 patients, 17 had urine cultures positive for *Candida* species (Table 4). This represented an occurrence of 17% (3.76% s.e., ± 7.48%, 95% confidence interval (CI)) over the study period. Of 97 patients, 58 had received antibiotics within 2 months of the study of their urine culture. Three patients had unknown status because they resorted to care outside our facility. Of 58 patients, 41 did not have urine cultures positive for *Candida*. All of the 17 patients with positive *Candida* cultures were verified as having received antibiotics within the previous 2 months. Of these 17 patients, 12 with positive cultures for *Candida* were inpatients at the time of their sampling. Three patients also had diabetes mellitus. One patient was later found to have colon cancer.

Antibiotic use was also significantly associated with the presence of candiduria ($\chi^2(1) = 11.9$, $P < 0.01$). Patients taking antibiotics were over 14 times more likely to develop candiduria. The use of indwelling (urethral or suprapubic)

Table 1 Patient demographics

Patient classification	*ASIA impairment scale*	n
Paraplegia	A	34
	B	7
	C	6
	D	5
	Total	52
Tetraplegia	A	20
	B	10
	C	7
	D	8
	Total	45
Multiple sclerosis		3
Total		100
Gender		
Male		97
Female		3
Age (years)		
Mean		57.8
s.d.		14.4
Status		
Inpatient		48
Outpatient		52

Abbreviation: ASIA, American Spinal Injury Association.

Table 2 Etiology of paralysis

MVC	46
Fall	8
Diving	5
Sports	2
Violence	9
Wartime	3
Tumor	2
Infection/inflammation	7
Arthritis	10
Vascular	4
MS	3
Other traumatic	1
Total	100

Abbreviation: MS, multiple sclerosis.

Table 3 Bladder management and duration of catheter usage (in years)

Bladder method	*N*	*Mean*	*Range*	*s.d.*
Indwelling urethral	38	7.7	2 months–44 years	11.2 years
Suprapubic	28	9.6	4 months–48 years	12.7 years
Intermittent	34	11.9	6 months–34 years	9.2 years
Total	100	9.6	2 months–48 years	11 years

Table 4 Candida results

Candida species	
C. albicans	9[a]
C. glabrata	2
C. lambica	1
C. parapsilosis	4[a]
C. tropicalis	3

[a]Two patients had both *C. albicans* and *C. parapsilosis*.

catheters was significantly associated with the presence of candiduria ($\chi^2(1) = 7.2$, $P < 0.01$). Patients who used indwelling catheters were over 10 times more likely to develop candiduria (OR = 10.6; 95% CI: 1.3–83.5). When the method of catheterization was analyzed specifically, Foley and SPT catheters were associated with a significantly larger likelihood of developing candiduria than CIC catheters ($\chi^2(2) = 7.0$, $P = 0.03$). There were no differences in the occurrence of candiduria between Foley and SPT catheter use ($\chi^2(1) = 0.2$, $P = 0.65$).

Of the patients with positive *Candida* urine cultures, 1 died in 3 months, 1 was lost to follow-up and 15 were alive at 1-year follow-up. Four patients had recurrence of *Candida* in urine cultures $\geqslant 3$ months after the original culture. All of these patients had continued to receive frequent antibiotics. In one of these patients, the species of *Candida* was different from that originally identified.

No patients had unstable vital signs at the time of sample collection. Of 17 (94%) patients, 16 with candiduria had indwelling (urethral or suprapubic) catheters; only one patient was using intermittent catheterization (Table 5). No patients in our sample required treatment for symptomatic or invasive candidiasis.

Overall, the cultures of 59 patients had bacterial but not yeast growth and those of 24 patients had no growth of any organism (Table 6). Of these 24 patients, 14 used indwelling (urethral or suprapubic) catheters and 10 used CIC. Of 24 patients, 11 with no urine growth had received antibiotics within the previous 2 months. Of these 11 patients, 7 used indwelling catheters, and the other 4 used CIC.

No patients were found with cultures that grew both bacteria and yeast. Urinalysis results were available from 95 persons and are shown in Table 7. All patients with candiduria had positive leukocyte esterase in their urine, and 7 of 17 patients had a positive reaction for nitrite (Table 8). The most common antibiotics used in patients who developed candiduria were fluoroquinolones (7 patients) and vancomycin (6 patients). Two patients were on suppressive therapy with nitrofurantoin. The indications for antibiotic

Table 5 Bladder management of patients with candiduria

Indwelling urethral	11
Suprapubic	5
Intermittent	1
Total	17*

*17%; 3.74% s.e., ±7.48% (95% confidence interval).

Table 6 Bacterial cultures

No. of organisms	*No. of patients*
No growth	24
1	31
2	16
$\geqslant 3$	12
Total	83

Table 7 Urinalyses

Leukocyte esterase	
Positive (any degree)	82
Negative	13
Total	95
Nitrite	
Positive	38
Negative	57
Total	95

Table 8 Characteristics of subjects with candiduria

Patient no.	*Age (years)*	*Catheter type*	*Duration of catheter use*	*Receipt of antibiotics (at the time of positive culture)*	*Treatment for candiduria*	*1-Year outcome*	*UA results*
1	47	CIC	23 years	Minocycline	No	Alive	LE+nitrite−
2	55	Foley	0.75 years	Vancomycin, doxycycline	No	Alive	LE+Nitrite−
3	56	SPT	14 months	Vancomycin, piperacillin, gatifloxacin, metronidazole	Yes nystatin suspension, fluconazole	Expired on 5 December 2006	LE+nitrite−
4	56	SPT	29 years	Gatifloxacin	No	Alive	LE+nitrite−
5	61	Foley	1.5 months	Gatifloxacin, moxifloxacin, vancomycin	No	Alive	LE+nitrite+
6	57	Foley	2 months	Vancomycin, ceftriaxone, levofloxacin	No	Alive	LE+nitrite−
7	75	SPT	1 year	Tobramycin, imipenem	No	Alive	LE+nitrite−
8	70	SPT	20 years	Gatifloxacin, vancomycin	—	Alive	LE+nitrite−
9	36	SPT	2 years	Penicillin	—	Alive	LE+nitrite+
10	55	Foley	2 months	Cephalexin	—	Unknown	LE+nitrite−
11	52	Foley	24 years	Vancomycin, levofloxacin, cefepime	—	Alive	LE+nitrite−
12	90	Foley	2 years	nitrofurantoin	—	Alive	LE+nitrite+
13	82	Foley	14 years	Unknown	—	Alive	LE+nitrite+
14	89	Foley	4 years	Ciprofloxacin	—	Alive	LE+nitrite+
15	60	Foley	1.5 years	Nitrofurantoin	—	Alive	LE+nitrite+
16	49	Foley	4 years	Amoxicillin	—	Alive	LE+nitrite+
17	72	SPT	5 years	Piperacillin/tazobactam	—	—	LE+nitrite+

use varied, including urinary tract infection, osteomyelitis and other infections.

Discussion

The occurrence of candiduria was fairly low in our sample, despite heavy antibiotic use. In addition, candiduria was not persistent in most (76%) of these patients. Our sample was fairly evenly divided between inpatients and outpatients, and among catheter usage groups. These data indicate an association between antibiotic use and indwelling catheter use and the development of candiduria. However, its association was dependent on antibiotic use. Indwelling catheters are known to be associated with an increased risk of urinary tract infection and subsequent need for antibiotics.

Prior antibiotic use was necessary for the development of candiduria, but only a small percentage of patients who had received antibiotics had positive urine cultures for *Candida* species. Antibiotics are used more frequently in the SCI population as opposed to the general population, with the most common indications being urinary tract infections, osteomyelitis or pneumonia. Patients who used indwelling catheters were much more likely to have candiduria documented than patients using intermittent catheterization. Patients who developed candiduria were also more likely to be inpatients.

Candiduria did not serve as a marker for adverse outcomes in this study, although our study population did not have significant comorbidities such as transplantation, HIV-positive status or immunosuppression owing to chemotherapy.

One limitation of this study was that we did not include patients who were in an intensive care unit at the time of their sample; instead, we sampled patients in our inpatient unit and outpatient clinic. The presence of Candiduria may be associated with poor outcomes in this population. Conversely, patients who are severely ill and/or have recurrent symptomatic infections requiring multiple courses of antibiotics would be expected to contract candiduria with increasing frequency.

Conclusion

Candiduria was a common occurrence in this sample and was exclusively associated with prior antibiotic use. Patients with indwelling catheters were much more likely to have candiduria than patients using intermittent catheterization. No adverse outcomes were associated with candiduria in this SCI population.

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