ORIGINAL RESEARCH

Clinical and Mycological Characterization of Vulvovaginal Candidiasis: Insights into Candida Non-Albicans Prevalence and Association with Diabetes Mellitus

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ABSTRACT

Background: Vulvovaginal candidiasis (VVC) is a common fungal infection affecting women globally, with increasing recognition of non-albicans Candida species as significant contributors, particularly among diabetic individuals. This study aimed to investigate the clinical and mycological aspects of VVC, focusing on Candida non-albicans prevalence and its association with diabetes mellitus.**Methods:**A prospective study was conducted at the Institute of Venereology, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai, from April 2021 to March 2022. Female patients aged 18-60 years with VVC were included, and clinical and mycological assessments were performed.**Result:**Of 100 participants, 55% had diabetes mellitus. Candida glabrata was significantly more prevalent among diabetic patients (34%) compared to non-diabetic patients (4%) ($P < 0.001$). Itching over genitalia was significantly more common among diabetic patients (73%) compared to non-diabetic patients (44%) ($P = 0.004$).**Conclusion:**The study highlights the importance of considering non-albicans Candida species, particularly Candida glabrata, in the diagnosis and management of VVC, especially among diabetic individuals. Comprehensive clinical assessment and management strategies are crucial in this population.

Key words: Vulvovaginal candidiasis, Candida non-albicans, Diabetes mellitus, Clinical assessment, Mycological analysis, Antifungal therapy.

INTRODUCTION

Vulvovaginal candidiasis (VVC) remains one of the most prevalent fungal infections affecting women worldwide, posing significant challenges to their reproductive health and quality of life.[1] Characterized by inflammation, itching, burning, and abnormal vaginal discharge, VVC is primarily caused by the overgrowth of Candida species within the vaginal ecosystem. While Candida albicans has traditionally been considered the predominant causative agent, emerging evidence suggests an increasing prevalence of non-albicans Candida species, complicating the diagnosis and management of this condition.[2]

The rise in non-albicans Candida species, including Candida glabrata, Candida tropicalis, Candida parapsilosis, and Candida krusei, presents unique clinical and therapeutic implications due to variations in antifungal susceptibility profiles and treatment responses.[3] Moreover, the growing recognition of host-related factors, such as immune status, hormonal fluctuations, and underlying medical conditions, further underscores the multifactorial nature of VVC pathogenesis.[2]

Among the various predisposing factors implicated in VVC development, diabetes mellitus emerges as a significant and clinically relevant risk factor. Diabetes, characterized by chronic hyperglycemia and impaired immune function, creates a conducive

environment for Candida overgrowth and vaginal colonization, predisposing diabetic women to recurrent and severe VVC episodes. The intricate interplay between hyperglycemia-induced immune dysfunction, altered vaginal microflora, and Candida virulence factors contributes to the heightened susceptibility of diabetic individuals to VVC[4].

Despite the growing recognition of diabetes as a predisposing factor for VVC, the clinical and mycological characteristics of Candida infections in diabetic women remain inadequately elucidated[5]. Understanding the epidemiology, species distribution, antifungal susceptibility patterns, and associated risk factors specific to diabetic individuals is crucial for optimizing the diagnosis, management, and prevention strategies tailored to this high-risk population[6].

Therefore, this study aims to undertake a comprehensive clinico-mycological investigation of VVC, with specific emphasis on the prevalence, species distribution, and risk factors associated with Candida Non albicans infections in both diabetic and non-diabetic women. By addressing these objectives, we endeavor to bridge existing knowledge gaps, enhance clinical awareness, and inform evidence-based strategies for the prevention and management of VVC, particularly in diabetic populations.

The elucidation of Candida species diversity in VVC, including the prevalence of Candida Non albicans variants, holds significant implications for antifungal therapy selection and treatment outcomes. Given the varying susceptibilities of non-albicans Candida species to conventional antifungal agents, accurate species identification and antifungal susceptibility testing are essential for guiding appropriate therapeutic interventions and preventing the emergence of drug-resistant strains[7].

Furthermore, by delineating the risk factors associated with VVC in diabetic women, this study seeks to facilitate early identification, targeted screening, and proactive management strategies to mitigate the burden of recurrent or complicated VVC episodes in this vulnerable population. Through a multidisciplinary approach encompassing clinical, microbiological, and epidemiological perspectives, we aim to provide comprehensive insights into the complex interplay between host factors, microbial ecology, and disease pathogenesis in VVC[8]. By integrating clinical observations with laboratory findings and epidemiological data, we aspire to advance our understanding of VVC pathophysiology, refine diagnostic algorithms, and optimize therapeutic approaches tailored to the unique needs of diabetic individuals. Ultimately, our collective efforts aim to alleviate the burden of VVC and improve the overall reproductive health and well-being of women worldwide.

MATERIALS AND METHODS

Study Setting: The study was designed as a prospective investigation conducted at the Institute of Venereology, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai-3. The study duration spanned from April 2021 to March 2022, covering a period of one year.

Study Participants: The study population comprised female patients aged 18-60 years who sought medical care at the Institute of Venereology outpatient department during the specified study period. Inclusion criteria encompassed women diagnosed with vulvovaginal candidiasis, totaling 100 participants, who provided informed consent to participate in the study. Exclusion criteria included females below 18 years or above 60 years of age and those who declined participation.

Sample Size: A sample size of 100 participants was determined to adequately capture the study objectives and ensure statistical robustness.

Sampling Technique: Participants were recruited into the study through simple random selection from eligible individuals presenting with clinical symptoms and signs of vulvovaginal candidiasis at the outpatient department of the Institute of Venereology.

Study Methodology: Upon enrollment, detailed clinical assessments were conducted, including comprehensive medical history collection, demographic profiling, and physical examinations. For diabetic patients, additional information regarding the duration and management of diabetes was documented.

Clinical examinations comprised both general and systemic evaluations, followed by meticulous examination of the local genitalia. Per speculum examination utilizing a Cusco's bivalved self-retaining vaginal speculum was performed to facilitate visualization of the vaginal and cervical regions.

Diagnostic tests conducted on vaginal smears included microscopy techniques such as wet mount with 10% potassium hydroxide for candida pseudo-hyphae and spores, Gram stain for Candida spores and pseudo-hyphae, and wet mount with normal saline for Trichomonas vaginalis. Additionally, cultures were performed on Sabouraud Dextrose agar for Candida identification and CHROME Agar for Candida species differentiation. Detection of Trichomonas vaginalis was conducted using Diamond's medium.

Endocervical swab smears underwent Gram staining for gram-negative intracellular diplococci and pus cells, followed by gonococcal culture.

Blood samples were obtained for screening of HIV, with pre- and post-test counseling provided, along with serological assessments for VDRL, TPHA, ELISA for HSV-IgM & IgG antibodies, HbsAg, and anti-HCV antibodies. Routine baseline investigations encompassed complete blood count, urine analysis, liver function tests, renal function tests, random blood sugar, and HbA1c levels.

Statistical Analysis: Data processing and analysis were conducted using Microsoft Excel and IBM SPSS Statistics version 25. Descriptive statistics were employed to summarize the data, expressed in frequencies and percentages. Pictorial representations such as pie charts and bar diagrams were utilized for visualizing the findings.

Ethical Issues: Ethical approval was obtained from the Institutional Ethical Committee of Madras Medical College, Chennai, ensuring adherence to ethical standards and safeguarding participant rights throughout the study duration. Informed consent was obtained from all participants prior to their inclusion in the study, and confidentiality of personal information was strictly maintained.

RESULT

Table 1 presents the characteristics of the study participants, highlighting key demographic factors. In terms of age distribution, the largest proportion falls within the 31-40 years age group, constituting 38% of the sample, followed by those aged 41-50 years (30%). Notably, participants aged 18-30 years and 51-60 years represent 20% and 12% of the sample, respectively. Education status varies among participants, with the majority being illiterate (41%) and primary school-educated (29%). Marital status indicates a predominantly married population, accounting for 97% of participants, while unmarried individuals comprise only 2%, and widows represent 1% of the sample. Occupational diversity is evident, with manual laborers comprising the largest group (55%), followed by homemakers (42%) and professional workers (3%).

Table 1: Characteristics of the study participants

Variables		Number	Percentage
Age group (years)	18-30	20	20
	31-40	38	38
	41-50	30	30
	51-60	12	12
Education status	Degree	4	4
	High School	11	11
	Middle School	15	15
	Primary school	29	29
	Illiterate	41	41
Marital status	Married	97	97
	Unmarried	2	2
	Widow	1	1
Occupation status	Manual labourers	55	55
	Professional workers	3	3
	Home makers	42	42
Last sexual contact	< 1 week	24	24
	1 week to 1 month	31	31
	1 month to 6 months	23	23
	> 6 months	22	22

Out of 100 participants, 72% reported itching over the genitalia, while 28% did not exhibit this symptom. Curdy white vaginal discharge was present in 46% of the participants and absent in 54%. Dyspareunia, or painful sexual intercourse, was reported by 15% of the participants, with 85% not experiencing this symptom. Lower abdominal pain was noted in only 2% of the participants, whereas the majority (98%) did not report this symptom. Dysuria, or painful urination, was present in 12% of the participants, while 88% did not report experiencing this symptom.

Similarly, 35% exhibited soddening of the vulva, while 65% did not show this sign. Maceration of the vulva was observed in 36% of the participants, with 64% not displaying this sign. Fissures of the vulva were present in 18% of the participants, while 82% did not exhibit this sign. Curdy white vaginal discharge, a characteristic sign of vulvovaginal candidiasis, was reported by 58% of the participants, with 42% not experiencing this discharge. Vulvar erythema, or redness of the vulva, was observed in 55% of the participants, while 45% did not display this sign. Tiny erosions in the vulva were noted in 32% of the participants, with 68% not showing this sign.

About 55% were diagnosed with diabetes mellitus, while 45% did not have diabetes mellitus. Thirteen percent of diabetic participants had a duration of diabetes mellitus less than 1 year, 33% had a duration between 1 to 5 years, and the majority, comprising 54%, had a duration of diabetes mellitus exceeding 5 years.

Regarding the prevalence of Candida species among the study participants, Candida albicans was identified in 60% of the cases, while Candida non-albicans species were present in 40% of the cases. Among the

participants with Candida non-albicans species (N=40), Candida glabrata was the most prevalent species, accounting for 50% of the cases. Candida parapsilosis and Candida tropicalis were identified in 30% and 15% of the cases, respectively, while Candida krusei constituted 5% of the cases.

Table 2: Prevalence of candida non-albicans among diabetic and non-diabetic patients

Candida Non albicans	Diabetic (N=55)			Non-diabetic (N=45)			P value
	Frequency		Percentage	Frequency		Percentage	
Candida glabrata	Present	18	34%	Present	2	4%	<0.001
	Absent	37	66%	Absent	43	96%	
Candida tropicalis	Present	3	5%	Present	3	7%	0.799
	Absent	52	95%	Absent	42	93%	
Candida parapsilosis	Present	10	18%	Present	2	4%	0.035
	Absent	45	82%	Absent	43	96%	
Candida krusei	Present	2	4%	Present	0	0%	0.0196
	Absent	53	96%	Absent	45	100%	

Table 2 provides insights into the prevalence of Candida non-albicans among diabetic and non-diabetic patients. The table reveals significant differences in the prevalence of specific Candida species between the two groups. Among diabetic patients (N=55), Candida glabrata was present in 18 cases, constituting 34% of the diabetic group, whereas only 2 cases (4%) were observed among non-diabetic patients (N=45). This disparity was statistically significant ($P < 0.001$), indicating a higher prevalence of Candida glabrata among diabetic individuals. Similarly, Candida parapsilosis exhibited a higher prevalence among diabetic patients, with 18% of cases compared to only 4% among non-diabetic patients. The difference was statistically significant ($P = 0.035$). Conversely, Candida krusei was present in 4% of diabetic patients but absent in non-diabetic patients, with a significant P value of 0.0196. However, no significant differences were observed in the prevalence of Candida tropicalis between diabetic and non-diabetic patients.

Table 3: Association of presenting symptoms in diabetic and non-diabetic patients

Presenting symptoms	Diabetic (N=55)		Non-diabetic (N=45)		P value
	Frequency	Percentage	Frequency	Percentage	
Itching over genitalia	40	73%	20	44%	0.004
Dyspareunia	11	20%	4	9%	0.121
Lower abdominal pain	2	4%	0	0%	0.196
Dysuria	10	18%	2	4%	0.035

Itching over the genitalia was significantly more prevalent among diabetic patients, with 73% reporting this symptom compared to 44% among non-diabetic patients ($P = 0.004$). While dyspareunia, or painful sexual intercourse, showed a higher prevalence among diabetic patients (20%) compared to non-diabetic patients (9%), the difference was not statistically significant ($P = 0.121$). Similarly, lower abdominal pain was reported by a small proportion of diabetic patients (4%) but was absent among non-diabetic patients, though the association was not statistically significant ($P = 0.196$). Dysuria, or painful urination, exhibited a significantly higher prevalence among diabetic patients (18%) compared to non-diabetic patients (4%), with a P value of 0.035 (Table 3).

Table 4: Association of presenting signs in diabetic and non-diabetic patients.

Presenting signs	Diabetic (N=55)		Non-diabetic (N=45)		P value
	Frequency	Percentage	Frequency	Percentage	
Soddening of vulva	24	44%	11	24%	0.045
Macerations of vulva	26	47%	10	22%	0.009
Fissures in vulva	11	20%	7	16%	0.564
Curdy-white vaginal discharge	38	69%	20	44%	0.012
Vulvar erythema	34	62%	21	47%	0.129
Tiny erosions on vulva	21	38%	11	24%	0.142

Table 4 investigates the association of presenting signs between diabetic and non-diabetic patients. Soddening of the vulva was significantly more prevalent among diabetic patients, with 44% exhibiting this sign compared to 24% among non-diabetic patients ($P = 0.045$). Similarly, macerations of the vulva were more commonly observed in diabetic patients, with 47% reporting this sign compared to 22% among non-diabetic patients ($P =$

0.009). While fissures in the vulva showed a slightly higher prevalence among diabetic patients (20%) compared to non-diabetic patients (16%), the difference was not statistically significant (P = 0.564). Curdy-white vaginal discharge, a characteristic sign of vulvovaginal candidiasis, was significantly more prevalent among diabetic patients (69%) compared to non-diabetic patients (44%), with a P value of 0.012. However, no significant differences were observed in the prevalence of vulvar erythema and tiny erosions on the vulva between diabetic and non-diabetic patients.

DISCUSSION

Vulvovaginal candidiasis (VVC) is a common fungal infection affecting women worldwide, with Candida albicans being the predominant causative agent. However, there is growing recognition of non-albicans Candida species as significant contributors to VVC, particularly in certain patient populations such as those with diabetes mellitus[9].

The demographic profile of the study participants revealed interesting trends. Most participants fell within the 31-40 years age group, which is consistent with the peak reproductive age in women. The high prevalence of illiteracy and primary school education among participants highlights potential socioeconomic factors influencing healthcare-seeking behavior and disease prevalence. Additionally, the predominance of manual laborers and homemakers in the occupation status reflects the socioeconomic background of the study population.

The prevalence of presenting symptoms and signs of VVC among participants underscores the clinical manifestations of the condition. Itching over the genitalia was the most common symptom, reported by 72% of participants, followed by curdy white vaginal discharge, dyspareunia, and dysuria. These findings align with established clinical features of VVC, emphasizing the importance of recognizing these symptoms for prompt diagnosis and treatment[10].

Interestingly, certain symptoms and signs showed differential prevalence between diabetic and non-diabetic participants. Itching over the genitalia was significantly more prevalent among diabetic patients, suggesting a potential association between diabetes mellitus and pruritus, possibly due to alterations in vaginal pH and glucose levels facilitating Candida overgrowth. Similarly, soddening and macerations of the vulva were significantly more common among diabetic patients, indicating a predisposition to mucocutaneous candidiasis in this population[11].

The mycological analysis revealed notable insights into the prevalence and distribution of Candida species among study participants. While Candida albicans remained the most isolated species, accounting for 60% of cases, Candida non-albicans species were present in 40% of cases. Among these non-albicans species, Candida glabrata emerged as the most prevalent, followed by Candida parapsilosis, Candida tropicalis, and Candida krusei. This distribution highlights the importance of considering non-albicans Candida species in the diagnosis and management of VVC, particularly in diabetic patients[12].

The prevalence of specific Candida species differed significantly between diabetic and non-diabetic participants. Candida glabrata was notably more prevalent among diabetic patients, highlighting its potential association with diabetes mellitus. This finding is consistent with previous studies suggesting that Candida glabrata may be more virulent and less susceptible to antifungal treatment, posing challenges in the management of VVC, especially in diabetic individuals[13].

The association between presenting symptoms and diabetic status further emphasizes the interplay between diabetes mellitus and VVC [14]. Itching over the genitalia was significantly more common among diabetic patients, suggesting a potential link between hyperglycemia and pruritus, which may exacerbate the symptoms of VVC in diabetic individuals. Similarly, dysuria was significantly more prevalent among diabetic patients, reflecting the increased susceptibility to urinary tract infections in this population, which may complicate the clinical presentation of VVC[14].

The association of presenting signs with diabetic status revealed similar trends, with soddening and macerations of the vulva being significantly more common among diabetic patients. These findings emphasize the importance of comprehensive clinical assessment in diabetic individuals presenting with symptoms suggestive of VVC, as the presence of additional signs such as soddening and macerations may indicate more severe or recurrent infections requiring tailored management strategies[14].

The findings of this study have important clinical implications for the diagnosis and management of VVC, particularly in diabetic patients. The recognition of non-albicans Candida species as significant contributors to VVC highlights the need for targeted antifungal therapy based on species identification and susceptibility testing. Additionally, the association between specific symptoms and signs with diabetic status highlights the importance of multidisciplinary care involving gynecologists, endocrinologists, and primary care physicians in the management of VVC in diabetic individuals[15].

Limitations of this study include its cross-sectional design, which precludes the establishment of causal relationships between diabetes mellitus and VVC. Additionally, the study was conducted at a single center, limiting the generalizability of the findings to other populations. Future research should focus on prospective longitudinal studies to elucidate the temporal relationship between diabetes mellitus and

VVC and to explore potential risk factors and mechanisms underlying the association.

CONCLUSION

This study provides valuable insights into the clinical and mycological aspects of VVC, with specific emphasis on Candida non-albicans in diabetic and non-diabetic women. The findings highlight the complex interplay between diabetes mellitus and VVC and emphasize the importance of comprehensive clinical assessment and tailored management strategies in diabetic individuals presenting with symptoms suggestive of VVC.

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