March 2010 | VOLUME 3 No. 1 | Quarterly Publication

➤ ***Journal Watch***
Summaries of recent topical publications in the medical literature
Full Article ..... pg 2

➤ ***Test Announcement***
Tests now available in the clinical laboratory
Full Article ..... pg 3

➤ ***Research & Development***
Vaginitis
Continued ..... pg 5

The Laboratorian SM

Vulvovaginal Candidiasis (VVC)

Author: John-Paul Vermitsky, Ph.D.

Host Risk Factors Associated with Vulvovaginal Candidiasis (VVC)

Candida species are important opportunistic pathogens that can colonize the vaginal and oral mucosa and often lead to vulvovaginal candidiasis (VVC) in many women. VVC is a common infection that affects 3 out of 4 women at least once in their lifetime, with 40% of women having two or more VVC episodes (2, 4). Although these infections are not life-threatening, they can often lead to much discomfort for the patient. Often the woman will experience vaginal soreness, irritation, burning, dysuria, itching, vulvar pruritus, and vaginal discharge. VVC is commonly caused by *Candida albicans;* however, there has been a significant increase in infections caused by non-albicans species, especially *Candida glabrata* and *Candida tropicalis.* These non-albicans species can often exhibit reduced susceptibility to the fungistatic azole antifungal, the most commonly used class of drugs to treat Candida infections (4, 6) often leading to treatment failure. There are numerous risk factors that have been associated with VVC, such as pregnancy, diabetes and the use of broad-spectrum antibiotics, hormone-replacement therapy, and oral contraceptives (4). In addition, higher incidences of non-albicans species, such as *Candida glabrata* causing VVC have been observed in diabetic patients and the elderly.

Pregnancy increases the frequency of VVC in women.

During pregnancy the incidence of VVC increases dramatically, especially during the third trimester, however, recurrent infections can persist throughout the entire gestational period. The increase in frequency of VVC during pregnancy is presumably due to the higher estrogen levels and increase in glycogen content in vaginal secretions (7). It is thought that estrogen can increase the avidity of the vaginal epithelial cells allowing Candida cells to adhere more readily to the mucosal layer. This theory can be supported by observing a decrease in VVC of menopausal women when estrogen levels fall

Continued.....pg 4

Vaginitis

Author: John-Paul Vermitsky, Ph.D.

Vaginitis is an inflammation of the vaginal tract in which symptoms include discharge, itching, odor and pain; which is often caused by bacterial, parasitic, or fungal infections. Women living in the United States have a 75% chance of experiencing at least one episode of vulvovaginal candidiasis (VVC) with 40% to 50% of these women experiencing a second attack and up to 8% of women experiencing recurrent vulvovaginal candidiasis (RVVC) consisting of four or more infections in one year (1, 2). VVC is now recognized as the second most common vaginal infection behind bacterial vaginosis. In addition, *Candida* species have been isolated in 10% to 20% of asymptomatic, healthy women suggesting that these organisms live as an opportunistic commensal (1, 2). It is thought that *Candida* species can gain access to the vaginal tract from the nearby perianal area where it can adhere to the vaginal epithelium. Understanding the underlying factors by which this opportunistic pathogen moves from a simple commensal to an infectious agent is required for proper treatment and prevention of VVC.

The first question often asked is how do *Candida* species colonize and/or infect the vaginal mucosa. There are a few theories to explain VVC. First is the intestinal reservoir theory, in which the simple closeness of the female reproductive tract to the anal canal is enough to allow the organism to adhere to the vaginal epithelium (3). However, repeated introduction of the yeast from the gut is unlikely to sustain RVVC. Second is the sexual transmission theory, which is based on sexual and/or oral colonization of the vaginal tract by the partner who is also colonized (3). Some studies have shown that treatment of both partners showed no reduction in the frequency of RVVC. Finally, a third theory involves that of vaginal relapse, in which treatment of the infection with an antifungal agent will reduce the number of *Candida* species and alleviate many of the symptoms; however, infection can re-emerge due to the fungistatic nature of the antifungal agents (3). The small amount of Candida that persist after treatment could cause recurrent infection if the proper host environmental factors are present, resulting in a new clinical episode.

There are several factors that play a role in the increase in colonization of *Candida* species which can often lead to VVC. These involve changes in host, genetic, and behavioral factors. This includes pregnancy, the use of oral contraceptives, broad-spectrum antibiotics, sexual activity, age and uncontrolled diabetes mellitus (4, 5, 6). Due to the many factors that play a role in VVC, choosing the right therapeutic path is often a challenge. Many women are often misdiagnosed with VVC because of other infectious or non-infectious conditions that exhibit the same symptoms. The first step in treating VVC is the proper diagnosis of the microbial organism involved and, more specifically, which species are involved.

An increase in VVC is often seen during pregnancy due to the increase in reproductive hormones (6). These hormones are thought to increase the sugar content within the vaginal environment, providing a carbon source for *Candida* species to grow and germinate. Similar mechanisms are seen with women who have diabetes, in which uncontrolled glucose levels may precipitate symptomatic VVC, presumably also due to the increased carbon source. The use of systemic, broad-spectrum antibiotics along with other predisposing factors can lead to VVC because they eliminate normal protective vaginal bacterial flora (3). It has been previously shown that *Lactobacillus* species provide a mechanism which

Continued.....pg 5

WHAT'S INSIDE ➤➤

UPCOMING EVENTS ➤➤

04/8-9	42nd Annual Matt Weiss Symposium St. Louis, MO
04/9-11	**ACOG:** American Congress of Obstetricians & Gynecologists Oregon section Clinical Meeting Sun River, OR
05/5	New England Obstetrical And Gynecological Society 81st Annual Spring Meeting Sturbridge, MA
05/15-19	**ACOG:** American Congress of Obstetricians & Gynecologists 2008 Annual Meeting San Francisco, CA
08/6-7	**ACOG:** Florida OB/GYN Society & FL Section American Congress of Obstetricians & Gynecologists Miami Beach, FL
10/8-10	**ACOG:** American Congress of Obstetricians & Gynecologists District I Annual Bar Harbor, ME
10/8-10	**ACOG:** American Congress of Obstetricians & Gynecologists Annual District Meeting (Districts III, & VI) Key Biscayne, FL
10/17-20	**ACOG:** American Congress of Obstetricians & Gynecologists Armed Forces District Annual Meeting San Antonio, TX

JOURNAL WATCH

Shahid Z, Sobel J. 2009. Reduced fluconazole susceptibility of *Candida albicans* isolates in women with recurrent vulvovaginal candidiasis: effects of long-term fluconazole therapy. *Diagn Microbiol Infect Dis.* 64: 354-356.

This study investigates the incidence of reduced antifungal drug susceptibility of *Candida albicans* isolates in 18 women with recurrent vulvovaginal candidiasis (RVVC) during the period of March 1999 to March 2006. For the purposes of this study, RVVC was defined as greater than 3 episodes of vulvovaginal candidiasis during a 12 month period, while also receiving weekly doses of 150 mg of the antifungal drug fluconazole. In 10 of the 18 women there was no change in the minimum inhibitory concentration (MIC) of fluconazole, during an average follow up period of 35.5 months, and infection reoccurrence was only seen when drug therapy was discontinued. Initial isolates from two women demonstrated what the authors termed "significant but transient" MIC increases, while subsequent isolates were highly susceptible and sequential isolates from 11% of the women showed a two-fold decrease in fluconazole MIC. Four of the women had initial isolates which were susceptible, with isolates taken during follow-up examinations showing sustained increases in MIC. Interestingly, the isolates from these women showed cross-resistance to other antifungal drugs such as miconazole and itraconazole, without previous exposure. Although fluconazole resistance in *C. albicans* is rare, the data provides evidence that subsequent isolates from women with RVVC should be monitored to ensure that proper treatment and dosing regiments are given to those in which the MIC increases upon subsequent infection.

Weissenbacher TM, Witkin SS, Gingelmaier A, et al. 2009. Relationship between recurrent vulvovaginal candidosis and immune mediators in vaginal fluid. *Eur J Obstet Gynecol Reprod Biol.* 144: 59-63.

The authors sought to determine whether women who were symptomatic with regard to recurring vulvovaginal candidiasis (RVVC), were in fact experiencing symptoms of a local immune response, or true cases of RVVC. The study included 104 RVVC symptomatic patients that suffered from at least 4 episodes in the last 12 months, and 41 asymptomatic control patients, and was conducted from 2002 to 2004. The vaginal fluid from each participant was tested for the presence of *Candida* species, as well as IL-4 which stimulates the proliferation of activated B-cells, IL-5 which is produced by T-helper 2 cells and also stimulates B cell growth, IL-13 which is a mediator of allergic inflammation, Prostaglandin (Pg) E2 which induces fever, total IgE which functions during allergic and hypersensitivity reactions, and *Candida*-specific IgE. Interestingly, the authors found that only 29.8% of the symptomatic and 7.3% of the asymptomatic patients tested positive for *Candida* species via PCR. They also found that the symptomatic RVVC patients had statistically significant higher levels of IL-4 ($p < 0.0001$), PgE2 ($p < 0.0001$) and *Candida*-specific IgE ($p < 0.02$) in their vaginal fluid, as compared to the asymptomatic patients. Conversely, there were no statistically significant differences found in the vaginal fluid of the symptomatic and asymptomatic patients with regard to IL-5, IL-13, and total-IgE, regardless of a positive or negative *Candida*-specific PCR result. The study suggests that testing patients with RVVC for IL-4, PgE2 and *Candida*-specific IgE might be beneficial to determine the best treatment options, as treatment with an anti-histamine or prostaglandin synthesis inhibitor as opposed to, or in conjunction with an antifungal agent may be the best course of action.

Ferwerda B, Ferwerda G, Plantinga TS, et al. 2009. Human Dectin-1 Deficiency and Mucotaneous Fungal Infections. *N Engl J Med.* 361(18):1760-7.

Recurrent vulvovaginal candidiasis (VVC) is a common condition in women often without known risk factors such as diabetes or immunodeficiency. The vast majority of VVC infections are due to the pathogen *Candida albicans* which is recognized by the immune system via TLR2 and TLR4 signaling.TLR2 works cooperatively with dectin-1, a β-glucan receptor, to amplify cytokine production. In this study, mononuclear cells from recurrent VVC patients were collected and tested for defective cytokine function. One patient with recurrent VVC displayed significantly decreased cytokine production in response to *C. albicans*, presumably due to decreased β-glucan recognition by dectin-1. The dectin-1 gene of the patient was sequenced and sequencing revealed a SNP responsible for a Y238X amino acid change leading to a premature stop codon in the carbohydrate recognition domain of the gene. Sequences from family members of the patient determined that her two sisters were homozygous (as she was) for the mutation and her parents were heterozygous for the mutant allele. One sister had recurrent VVC, and the entire family was susceptible to onychomycosis (fungal infections of finger nail beds). Monocytes and macrophages of the family members with the mutation showed significantly reduced IL-6, TNF, and IL-17 levels in response to *C. albicans.* Neutrophils of the family members functioned normally in the phagocytosis of *C. albicans*, likely preventing invasive systemic infections and suggesting the involvement of alternate pathways in the complete immune response to *C. albicans.* These findings suggest a possible role for mutations to dectin-1 in VVC and other *Candida* infections.

Ortega M, Marco F, Soriano A, et al. 2010. *Candida spp.* bloodstream infection: influence of antifungal treatment on outcome. *J Antimicrob Chemother.* 65(3):562-8.

In this study, the Infectious Disease Unit of the University of Barcelona Hospital in Spain performed a surveillance study to track *Candida spp*. bloodstream infections and monitor patient outcomes after antifungal treatment during two time points; before the introduction of the echinocandin class of antifungals (1994-2003) and after widespread use of echinocandins began (2004-2008). The echinocandins are a particularly effective antifungal due to high tolerability in humans and limited resistance in *Candida* species. Prior to the echinocandins, amphotericin B and fluconazole were the primary drugs used to treat fungal infections, but both drugs were limited. Amphotericin B can be toxic to people, and fluconazole is only fungistatic, which has led to the emergence of resistance in a number of organisms. The surveillance showed that candidaemia accounted for 3% (433) of 15,628 bloodstream infections, of which *Candida albicans* represented 49% (211). When comparing the two treatment periods, a number of important results were observed. From 1994 to 2003, amphotericin B had a 46% mortality rate whereas fluconazole was 27%. In 2004-2008, fluconazole had a 23% mortality rate, echinocandins had a 10% mortality rate, and a combined echinocandin and fluconazole therapy had a 0% mortality rate. The data presented suggests that echinocandins alone or in combination with fluconazole are associated with better patient survival after *Candida* bloodstream infection.

Leu-Sagie A., et al. 2009. Hyaluronan in vaginal secretions: association with recurrent vulvovaginal candidiasis. *Am J Obstet Gynecol.* 201(2):206.e1-206.e5

Recurrent vulvovaginal candidiasis (RVVC) is a continuing problem for patients and clinicians because successful treatment is problematic and reoccurrence is common. Hyaluronan is a complex carbohydrate, which in response to tissue injury and infection is broken down into smaller subunits that activate immune response. The hyaluronase enzyme produced by many *Candida albicans* strains may be responsible for this. In this study, women with RVVC were tested for extracellular release of hyaluronan into the vaginal environment. Seventeen RVVC women with an acute infection, 27 RVVC women that were currently asymptomatic, and 24 women who had been diagnosed with non-infectious vulvovaginal disorder or with previously negative *Candida* cultures were examined and had a swab taken from the vaginal sidewalls. ELISA was used to test swabs for hyaluronan, IL-6, 12, and 23 concentrations. RVVC women with acute infection had the highest median hyaluronan concentration (33.8 ng/ml), RVVC women that were currently asymptomatic had the second highest median hyaluronan concentration (15.0 ng/ml), and all other subjects had a median hyaluronan concentration of <9 ng/ml. Detectable levels of IL-6, 12, and 23 did not reach statistical significance. Levels of hyaluronan and IL-6 in vaginal fluid were correlated positively. Extracellular hyaluronan concentrations in vaginal fluid were elevated significantly in women with a current acute RVVC. Hyaluronan levels in vaginal secretions are typically low and its release is likely to be induced by candidal infections. The yeast form of *C. albicans* induces IL-12 and the hyphal form induces IL-23. This study suggests that hyaluronan release in response to vaginal *C. albicans* infection is independent of IL-12 and IL-23 production and that IL-12 and IL-23 may not be major factors in the defense against candidaisis. The findings of this study were limited due to small sample size and possible misclassification of patients.

Recent Publications

MEDICAL DIAGNOSTIC LABORATORIES, L.L.C. (MDL)

Abstracts

1. **Vermitsky J, Chadwick SG, Toner GJ, Mordechai E, Adelson ME, Gygax SE. CgUPc2** is the master regulator of ergosterol biosynthetic genes in Candida glabrata. 10th American Society for Microbiology (ASM) Conference on Candida & Candidiasis, Miami, FL. March 22-26, 2010
2. **Eble S, Adelson ME, Mordechai E, Trama J**. Separate Functions of Caspase-3 in Cell Migration and Apoptosis. American Association for Cancer Research (AACR) 101st Annual Meeting, Washington, D.C. April 17-21, 2010.
3. **Datta A, Trama J, Adelson ME, Mordechai E.** April Oncoprotein DEK as a tissue and urinary biomarker for bladder cancer. American Association for Cancer Research (AACR) 101st Annual Meeting, Washington, D.C. 17-21, 2010.

Peer-Reviewed Papers

1. **Peña KC, Adelson ME, Mordechai E, Blaho JA.** 2010. Genital herpes simplex virus type 1 in women: Detection in cervicovaginal specimens from gynecological practices in the United States. J Clin Microbiol. 48(1):150-153.
2. **Blaho JA.** 2010. Oncoapoptosis: A novel molecular therapeutic for cancer treatment. IUBMB Life. 62(2):87-91.
3. **Biggs C, Walsh P, Overmyer CL, Gonzalez D, Feola M, Mordechai E, Adelson ME, Iacono KT**. 2010. Performance of influenza rapid antigen testing in influenza in emergency department patients. Emerg Med J. 27(1): 5-7.

HUMIGEN

Peer-Reviewed Papers

1. **Gallagher GE, Gallagher G, Megjugorac N**. 2009. Modulation of human plasmacytoid DC function by IFN-λ1 (IL-29). J Leukoc Biol. 86: 1359-1363.
2. **Ucisik-Akkaya E, Dorak MT**. 2009. HLA Complex-linked Heat Shock Protein Genes and Chil hood Acute Lymphoblastic Leukemia Susceptibility. Cell Stress Chaperones. Accepted Dec. 2009. Epub ahead of print.
3. **Do T, Dorak MT**. 2010. An Intronic Polymorphism of IRF4 Gene Influences Gene Transcription in vitro and Shows a Risk Association with Childhood Acute Lymphoblastic Leukemia in Males. Biochim Biophys Acta, 1802(2): 292-300.
3. **Morrison B, Dorak MT**. The HLA-DRA and HLA-C-linked Multiple Sclerosis Risk Markers are shared by Childhood ALL with Sex Effect. Autoimmunity. Accepted Jan. 2010.

e-Quiz

For results to the electronic Epidemiology Quiz, please visit www.mdlab.com and click on the e-Quiz link.

1. **True or False.** Three out of four women will experience VVC sometime during their life.
2. **True or False.** VVC is caused only by *Candida albicans.*
3. **True or False.** Non-albicans species are often less susceptible to azole antifungals than *C. albicans.*
4. **True or False.** *Candida glabrata* is the primary species isolated in diabetic patients and the elderly.
5. **True or False.** You have an increased risk of developing VVC during pregnancy.

Vulvovaginal Candidiasis (VVC)*....Continued*

or an increase in infection when women go on hormone-replacement therapy. Although VVC is not life-threatening, the use of certain antifungal agents needs to be limited during pregnancy for the safety of the baby. According to the Centers for Disease Control and Prevention (CDC) guidelines, pregnant women should only use topical azole antifungals for a period of seven days due to the safety of these drugs and that systemic absorption is minimal. The seven day period is recommended over the shorter dose periods to ensure the effectiveness of the treatment. A few case reports have shown that high doses (≥ 400 mg) of fluconazole treatment have been associated with developmental malformations in the baby. However low-doses (150 mg) show no further increase in risk for developmental disorders.

Diabetes is now recognized as a risk factor for VVC.

Diabetes mellitus (DM) in the United States is an emerging problem for many Americans. According to the American Diabetes Association, 10.2% of women over the age of 20 have some form of DM. Many studies have shown that women who have DM are at an increased risk of VVC infections, most often recurrent. This increase is often seen in many individuals who have uncontrolled or poorly controlled blood sugar levels. In fact, many women that present with recurrent infections are recommended to receive glucose tolerance tests. Women that also have diets high in refined sugar intakes may also see an increase in VVC. There are many factors in which DM can contribute to VVC, such as an increase in sugar content in the vaginal secretions, dampened immune response, and alterations in endocrine (hormone) secretions. To complicate matters, many studies have shown that a large proportion of infections in women with DM are due to non-albicans species such as *Candida glabrata* along with *Candida albicans* (1, 3).

In one study by Goswami *et al., Candida glabrata* was the primary species isolated in DM patients (52.5%). Treating patients infected with non-albicans species, such as *C. glabrata,* can be problematic as they tend to be less susceptible to azole antifungals and often develop resistance rapidly. The same group saw an increase in treatment success with use of boric acid suppositories for 14 days, for *C. glabrata* treatment, in lieu of azole antifungals. However, because of the host (patient) environmental changes due to poorly or uncontrolled DM, recurrent infections are common. In these cases, the underlying conditions must also be treated along with any treatment for VVC.

Broad-spectrum antibiotics, hormone replacement therapy and oral contraceptives increase the frequency of VVC in women.

The use of broad-spectrum antibiotics often puts many healthy women at risk for a VVC infection (4). Antibiotics are often prescribed to treat many bacterial infections. Although they have no effect on fungal infections, their use will often disrupt the normal microbial environment of the oral, gastrointestinal, and vaginal mucosa. Often this bacterial environment keeps many other microbes, such as many *Candida* species, "in check". However, when this normal microbial flora is eradicated with broad spectrum antibiotic use, Candida species have the ability to colonize and invade the vaginal mucosa often leading to infection. Finally, the use of hormone replacement therapy and oral contraceptives often leads to changes in estrogen levels which as mentioned above can often have effects on the colonization and pathogenesis of Candida species.

An increase in non-albicans species with age.

Although the incidence of VVC decreases once a woman has entered menopause, infections can still occur presumably due to other underlying risk factors such as decreased immune function or diabetes. In a retrospective study performed by Medical Diagnostic Laboratories, L.L.C. (MDL), we examined 93,775 samples which tested positive during Candida species-specific Polymerase Chain Reaction (PCR) tests performed on cervico-vaginal swabs. We examined results over a four year period and observed consistent yearly distributions (8). In this study, 89% of isolates were *Candida albicans* followed by *Candida glabrata* with 8%. However, we noticed that the species distributions among different age groups revealed increases in the percentages of non-albicans species with an increase in age (8). In this study *Candida glabrata* infections accounted for more than 20% of infections of post-menopausal women as compared to 4.8% of women in their twenties (8). Although the overall incidence of infection is decreased in women greater than 50 years of age, the incidence of colonization by the more problematic non-albicans species is increased.

Most healthy women during their lifetime will inevitably experience some form of VVC, often leading to much discomfort with many having to experience recurrent infections. These infections, although not life threatening, can lead to much discomfort to the female. In addition to normal colonization and infection, there are many risk factors that can increase the incidence of infection and often complicate the treatment of these infections. As shown in Figure 1, there are often many host (patient), genetic, and behavioral factors that can increase the colonization and therefore the pathogenesis of Candida species. In addition, recent studies have indicated a few host factors that are responsible for the increase in non-albicans species. Treatment of these infections needs to be carefully considered, especially with infections caused by *Candida glabrata,* as azole antifungal therapy can often fail. These underlying risk factors need to be addressed along with proper speciation in considering the most effective course of treatment for the patient.

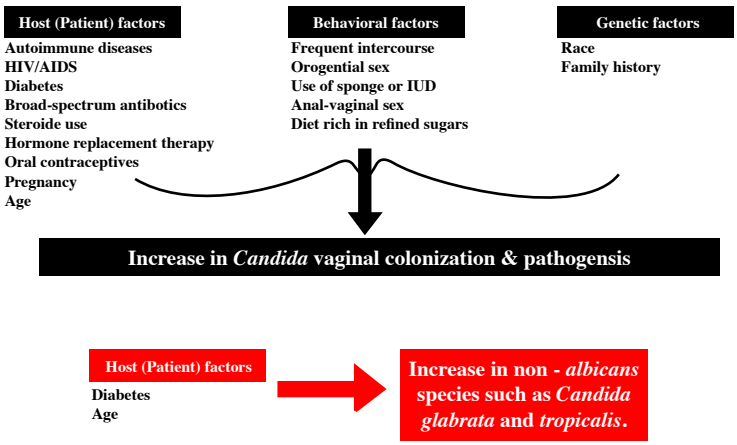

Figure 1. Risk factors often associated with VVC.

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1. **Bader MS, Lai SM, Kumar V, Hinthorn D.** 2004. Candidemia in patients with diabetes mellitus: epidemiology and predictors of mortality. *Scand J Infect Dis.* **36**:860-864.
2. **Eschenbach DA.** 2004. Chronic vulvovaginal candidiasis. *New England J Med.* **35119**:851-852.
3. **Goswami D, Goswami R, Banerjee U, Dadhwal V, Miglani S, Lattif AA, Kochupillai N.** 2006. Pattern of Candida species isolated from patients with diabetes mellitus and vuvlvovaginal candidiasis and their response to single dose oral fluconazole therapy. *J Infect.* **52**:111-117.
4. **Patel DA, Gillespie B, Sobel JD, Leaman D, Nyirjesy P, Weitz MV, Foxman B.** 2004. Risk factors for recurrent vulvovaginal candidiasis in women receiving maintenance antifungal therapy: results of a prospective cohort study. *Amer J Obstet Gynecol.* **190**:644-653.
5. **Richter SS, Galask RP, Messer SA, Hollis RJ, Diekema DJ, Pfaller MA.** 2005. Antifungal susceptibilities of Candida species causing vulvovaginitis and epidemiology of recurrent cases. *J Clin Microbiol.* **43**:2155-2162.
6. **Sobel JD.** 1998. Vulvovaginitis due to *Candida glabrata.* An emerging problem. *Mycoses.* **41**:18-22.
7. **Soong D, Einarson A.** 2009. Vaginal yeast infections during pregnancy. *Can Fam Physician.* **55**:255-256.
8. **Vermitsky JP, Self MJ, Chadwick SG, Trama JP, Adelson ME, Mordechai E, Gygax SE.** 2008. Survey of vaginal-flora Candida species isolates from women of different age groups by use of species-specific PCR detection. *J Clin Microbiol.* **46**:1501-1503.

Vaginitis....*Continued*

inhibits the colonization of *Candida* species. Finally, women who have a decrease in cell-mediated immunity (i.e. AIDS or immunosuppressive therapy) will often see an increase in oral and vaginal candidiasis, because it is thought that T-lymphocytes play an important role in regulating the defense mechanisms involved in preventing mucosal invasion.

Because so many factors can play a role in the progression of VVC, it is important to understand any underlying conditions along with proper diagnosis. For example, a female patient who has uncontrolled diabetes along with VVC needs to control the diabetes along with VVC treatment in order to control the underlying problem of the infection. Treating the pathogen in most cases of VVC will not work; it must be addressed along with any host factors that might be playing a role in the transition from a commensal to a pathogen. In most symptomatic patients with VVC, the physician will often use several diagnostic assays to determine species identification, which can include microscopic examination, commercially available assays, and PCR diagnostics. Microscopic examination and commercially available assays often have a sensitivity of 40% to 60%, whereas diagnosis by PCR will have the most sensitivity. Positive identification of any species needs to be taken into consideration with any other clinical manifestations.

Treatment of VVC can vary on the diagnosis. If the species identified is *Candida albicans,* which is often the case, the Centers for Disease Control and Prevention (CDC) recommends treatment with a topical azole antifungal for 3 to 7 days. If the infection is RVVC caused by *Candida albicans*, most patients will respond to a short duration of oral or topical azole therapy. An increase in non-*ablicans* species in the elderly and diabetic patients is often observed. The optimal treatment for non-*albicans* VVC remains unknown, mainly due to the decreased susceptibility of these species to azole antifungals. The CDC recommends a longer duration of therapy (up to 14 days) with a non-fluconazole azole antifungal. If RVVC occurs, then other non-azole antifungals may be used (i.e. boric acid capsules, nystatin or flucytosine).

References:

1. **Eschenbach DA.** 2004. Chronic vulvovaginal candidiasis. *New England J Med.* **35119**:851-852.
2. **Soong D, Einarson A.** 2009. Vaginal yeast infections during pregnancy. *Canadian Family Phys.* **55**:255-256.
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4. **Bader MS, Lai SM, Kumar V, Hinthorn D.** 2004. Candidemia in patients with diabetes mellitus: epidemiology and predictors of mortality. *Scand. J Infect. Dis.* **36**:860-864.
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6. **Soong D, Einarson A.** 2009. Vaginal yeast infections during pregnancy. *Canadian Family Phys.* **55**:255-256.

Quality Assurance Q&A

Q: If the requisition form has "Yeast" or "*Candida* Species" written/listed; why is my specimen being placed on hold to verify testing?

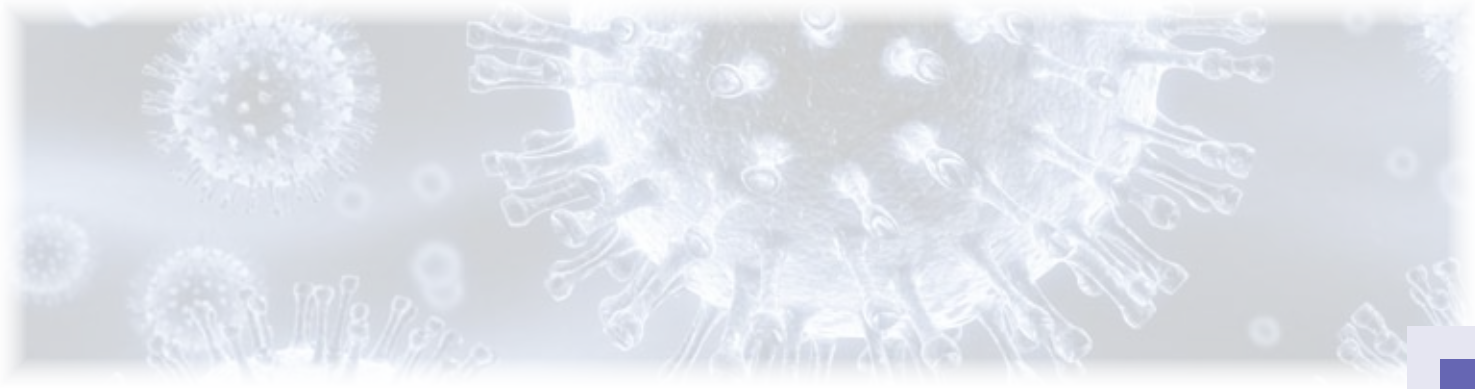
A: MDL offers testing for several species of *Candida*. For example, the listing below includes the various tests that are available on the ***OneSwab***®.

551 *Candida albicans* by Real-Time PCR
581 *Candida albicans* fluconazole resistance by X-Plate Technology™** (#551 Req.)
576 *Candida dubliniensis* by Real-Time PCR
559 *Candida glabrata* by Real-Time PCR
582 *Candida glabrata* fluconazole resistance by X-Plate Technology™** (#559 Req.)
578 *Candida kefyr* by Real-Time PCR
566 *Candida krusei* by Real-Time PCR
577 *Candida lusitaniae* by Real-Time PCR
558 *Candida parapsilosis* by Real-Time PCR
583 *Candida parapsilosis* fluconazole resistance by X-Plate Technology™** (#558 Req.)
557 *Candida tropicalis* by Real-Time PCR
584 *Candida tropicalis* fluconazole resistance by X-Plate Technology™** (#557 Req.)
560 Candida Vaginitis Panel by Real-Time PCR (*Candida albicans, Candida glabrata, Candida parapsilosis, Candida tropicalis*)
560 Candida Vaginitis Panel by Real-Time PCR
56 *Candida krusei* by Real-Time PCR

Therefore, in order to ensure that we perform only those tests which your are requesting due to medical necessity, it is required that our clients specify testing in one of the following ways:

- marking the box on the test requisition form which corresponds to the test(s) you require
- handwriting in the test number
- handwriting both the Genus and species name
- handwriting the complete panel name in full.

If you have a question you would like addressed in future issues, please email your question(s) to **QAQ&A@mdlab.com**



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