Pathogen Safety Data Sheets: Infectious Substances – Candida albicans

SECTION I - INFECTIOUS AGENT

NAME: *Candida albicans*

SYNONYM OR CROSS REFERENCE: Candidiasis, thrush, *Candida claussenii*, *Candida langeronii* [1] [2].

CHARACTERISTICS: *Candida albicans*, of the family *Candidaceae* [1], is encapsulated and diploid [1]. It is a polymorphic fungus as it can occur as yeast or pseudohyphal forms depending on temperature, pH, and nutrients [3]. The yeast form with blastoconidia budding is the most common, and pseudohyphae forms lack the proper structural forms such as parallel walls and septation of the true hyphae, which are sprout-like and can develop thick walled chlamydospores [3]. Asexual reproduction occurs by budding with formation of blastoconidia [1] [3]. Colonies appear within 48-72 hours when cultured on fungal media such as Sabouraud glucose agar at 37°C [1]. The original colonies are wrinkled, which revert to smooth colonies when subcultured [1].

SECTION II - HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: *C. albicans* is a commensal pathogen as it is a member of the gastrointestinal, oropharyngeal and female genital flora [3]. However, it is also an opportunistic pathogen in humans [4], as it can cause disease in immunodeficient and immunocompetent individuals that can be life-threatening [5]. The most frequent clinical form is thrush/oral candidiasis, where infection can be observed on the tongue, palate or other mucosal surfaces and is characterized by single or multiple, ragged white patches [2] [3]. Infection of the vagina, vaginal candidiasis, occurs mainly in pregnant mothers, women with intrauterine devices, or women who use oral contraceptives [2], and is characterized by thick, curd like discharge (leucorrhea), eruption and itching of the vulva [2] [3]. Prior antibiotic consumption and diabetes are also risk factors for the development of candidiasis. Esophageal candidiasis is manifested by inflammatory patches that develop on the esophagus, causing painful swallowing and substernal chest pain [3]. In immunocompromised patients (such as those with HIV infection), similar lesions can also occur on the small intestine and stomach [3] [5]. Chronic mucocutaneous candidiasis is a rare genetic disease, which occurs in individuals with defects in immune response against *Candida*. It involves chronic infections of the skin, hair, face, scalp and hands, and can further disseminate to deeper tissues and major body organs such as kidneys, heart and brain [3] [6], which may lead to septicimea (candidemia – *Candida* in blood) and death [2] [3]. Infections of the nail (paronychial and onychomycotic candidosis), superficial invasion of mucous membranes, cutaneous infections of the macerated skin (in crural folds, diaper area in infants), eye infections such as endophthalmitis are examples of other infections caused by *C. albicans* [2] [3] [5].

EPIDEMIOLOGY: C. albicansis of worldwide prevalence. It has been isolated from soil, animals, hospitals, inanimate objects and food [7] [8]. Although mucocutanaeous infections caused by C. albicans can occur in both immunocompetent and immunosuppressed individuals, invasive candidiasis such as candidemia/systemic disease are seen only in severely immunocompromised individuals [7] [9]. Risk factors associated with the development of invasive candidiasis include: antibiotic therapy; administration of steroids, immunosuppressants, or chemotherapy; prior surgery; solid organ or hematopoietic stem cell transplants; diseases such as AIDS, leukemia, diabetes, and lymphoma; as well as trauma and burn patients [2] [7] [9]. There has been a decrease in the incidence of oral candidiasis in HIV infected patients, since the introduction of HAART (highly active antiretroviral therapy) [7]. C. albicans is the most common fungal pathogen responsible for nosocomial systemic infections [7], and also the most commonly isolated pathogen from clinical samples obtained from mucous membranes such as oral cavity, gastrointestinal tract and vagina [7].

HOST RANGE: Humans.

INFECTIOUS DOSE: Unknown.

MODE OF TRANSMISSION: Most infections result from the patient's own flora, rather than from cross infection [3]. Although rare, nosocomial transmission has also been reported to occur from inanimate surface, from hands of health care workers or between patients [4] [10].

INCUBATION PERIOD: Unknown.

COMMUNICABILITY: Although rare, person to person transmission can occur between family members or between patients [4] [10].

SECTION III - DISSEMINATION

RESERVOIR: *Candida albicans* is a part of the normal flora in the gastrointestinal tract, vagina, and oropharynx of humans [5].

ZOONOSIS: None.

VECTOR: None.

SECTION IV - STABILITY AND VIABILITY

DRUG SUSCEPTIBILITY: Susceptibility has been shown for amphotericin B, nystatin, flucytosine, the azoles, echinocandins, and combination drug therapies [3]. Topical and oral azoles such as butoconazole, clotrimazole, triazole, and econazole lipogel can be used against vaginal candidiasis. Systemic antifungals such as fluconazole or itraconazole can be used to treat mucocutaneous candida infections. Voriconazole, and echinocandins can be effective against cutaneous candidiasis [2] although an azole is preferred, and invasive candidiasis can be treated with caspofungin, or lipid formulations of amphotericin B [2] [3]. Posaconazole is used to treat oral, but not systemic candidiasis [11].

DRUG RESISTANCE: Resistance of *C. albicans* to fluconazole has been associated with repeated use of this drug, particularly in immunosuppressed patients who are taking this drug chronically for prophylaxis [7] [11]. Resistance to echinocandins has also been reported [11].

SUSCEPTIBILITY TO DISINFECTANTS: *Candida albicans* strains can be killed effectively with sodium hyphochlorite (5% and 0.5%), iodine (2%) and potassium iodide (4%) within 30 seconds [12]. Chlorhexidine acetate (0.5%) is able to completely kill *C. albicans* strains within 5 minutes [12]. *C. albicans* strains are resistant to calcium hydroxide [12]. *C. albicans* isolates are also susceptible to 70% ethanol, 0.5% ecodiol and a combination of 1.2% sodium hyphochlorite and 0.5% ecodiol [13].

PHYSICAL INACTIVATION: UV light has been shown to reduce fungal load, but is ineffective in killing the yeast completely [13]. Most microorganisms are also inactivated by moist heat (121°C for 15 min- 30 min) [14].

SURVIVAL OUTSIDE HOST: *C. albicans* can survive on inanimate surfaces for 24 hours to 120 days, and on palms for about 45 minutes [10]. *C. albicans* has been isolated from bed-sheets, cots, and wash-basins of nurseries, and it has also been found to be able to survive and grow in distilled water at room temperature [15]. The fungus can survive on drying in darkness for 5 hours, and 1 hour if also exposed to light.

SECTION V - FIRST AID / MEDICAL

SURVEILLANCE: Monitor for symptoms. Direct examination of the fungus or the fungus in culture in the clinical specimen can confirm the presence of infection if key characteristics (size and shape of yeast, presence of pseudophypahe, blastoconidia, chlamydospores, and absence of arthroconidia and capsule) are observed [1]. Other methods include biochemical tests, serological methods such as RIA and ELISA, and molecular biology methods such as REA (restriction enzyme analysis) PCR, and PGFE (pulse-field gel electrophoresis) [1] [2].

Note: All diagnostic methods are not necessarily available in all countries.

FIRST AID/TREATMENT: Administer proper drug therapy. Eliminating predisposing factors such as administration of antibiotics, steroids, and immunosuppressants; humidity, local maceration, vaginal pH, removal of infected catheter can help in resolving infections [2] [3].

IMMUNIZATION: None.

PROPHYLAXIS: Although fluconazole has been used for prophylaxis of *C. albicans* infections in HIV infected patients, its prolonged exposure has been associated with emergence of fluconazole resistant strains [7].

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Low risk of infection to laboratory worker [5]. A medical student has been reported to develop rash and folliculitis 2 days after she spilled a heavy suspension of *C. albicans* on her leg while conducting a laboratory experiment [5].

SOURCE/SPECIMENS: Epithelial scrapings or exudates from lesions; sputum; bronchoalveolar lavage; blood [3].

PRIMARY HAZARDS: Accidental parenteral inoculation, direct exposure of the skin to the pathogen.

SPECIAL HAZARDS: None.

SECTION VII - EXPOSURE CONTROLS / PERSONAL PROTECTION

RISK GROUP CLASSIFICATION: Risk group 2 [16].

CONTAINMENT REQUIREMENTS: Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures.

PROTECTIVE CLOTHING: Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes [17].

OTHER PRECAUTIONS: All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities [17].

SECTION VIII - HANDLING AND STORAGE

SPILLS: Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply an appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient time contact time before clean up [17].

DISPOSAL: Decontaminate all wastes that contain or have come in contact with the infectious organism by autoclave, chemical disinfection, gamma irradiation, or incineration before disposing [17].

STORAGE: The infectious agent should be stored in leak-proof containers that are appropriately labeled [17].

SECTION IX - REGULATORY AND OTHER INFORMATION

REGULATORY INFORMATION: The import, transport, and use of pathogens in Canada is regulated under many regulatory bodies, including the Public Health Agency of Canada, Health Canada, Canadian Food Inspection Agency, Environment Canada, and Transport Canada. Users are responsible for ensuring they are compliant with all relevant acts, regulations, guidelines, and standards.

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PREPARED BY: Pathogen Regulation Directorate, Public Health Agency of Canada. Although the information, opinions and recommendations contained in this Pathogen Safety Data sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

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