

## HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use CANCIDAS safely and effectively. See full prescribing information for CANCIDAS.

**CANCIDAS® (caspofungin acetate) for injection, for intravenous use**  
Initial U.S. Approval: 2001

### INDICATIONS AND USAGE

CANCIDAS is an echinocandin antifungal drug indicated in adults and pediatric patients (3 months and older) for:

- Empirical therapy for presumed fungal infections in febrile, neutropenic patients. (1)
- Treatment of candidemia and the following *Candida* infections: intra-abdominal abscesses, peritonitis and pleural space infections. (1)
- Treatment of esophageal candidiasis. (1)
- Treatment of invasive aspergillosis in patients who are refractory to or intolerant of other therapies (e.g., amphotericin B, lipid formulations of amphotericin B, itraconazole). (1)

### DOSAGE AND ADMINISTRATION

#### For All Patients (2.1):

- Administer by slow intravenous (IV) infusion over approximately 1 hour. Not for IV bolus administration.
- Do not mix or co-infuse CANCIDAS with other medications. Do not use diluents containing dextrose ( $\alpha$ -D-glucose).

#### Adults [ $\geq$ 18 years of age] (2.2):

- Administer a single 70-mg loading dose on Day 1, followed by 50 mg once daily for all indications except esophageal candidiasis.
- For esophageal candidiasis, use 50 mg once daily with no loading dose.

#### Pediatric Patients [3 months to 17 years of age] (2.3):

- Dosing should be based on the patient's body surface area.
- For all indications, administer a single 70-mg/m<sup>2</sup> loading dose on Day 1, followed by 50 mg/m<sup>2</sup> once daily thereafter.
- **Maximum loading dose and daily maintenance dose should not exceed 70 mg, regardless of the patient's calculated dose.**

#### Dosing With Rifampin and Other Inducers of Drug Clearance (2.5):

- Use 70-mg once daily dose for adult patients on rifampin.
- Consider dose increase to 70 mg once daily for adult patients on nevirapine, efavirenz, carbamazepine, dexamethasone, or phenytoin.
- Pediatric patients receiving these same concomitant medications may also require an increase in dose to 70 mg/m<sup>2</sup> once daily (maximum daily dose not to exceed 70 mg).

### DOSAGE FORMS AND STRENGTHS

- Vials: 50 or 70 mg lyophilized powder (plus allowance for overfill). (3)

### CONTRAINDICATIONS

- CANCIDAS is contraindicated in patients with hypersensitivity to any component of this product. (4)

### WARNINGS AND PRECAUTIONS

- **Hypersensitivity:**  
Anaphylaxis has been reported. If this occurs, CANCIDAS should be discontinued and appropriate treatment administered.  
Possible histamine-mediated adverse reactions, including rash, facial swelling, angioedema, pruritus, sensation of warmth or bronchospasm have been reported and may require discontinuation and/or administration of appropriate treatment. (5.1)
- Use with cyclosporine: Limit use to patients for whom potential benefit outweighs potential risk. Monitor patients who develop abnormal liver function tests (LFTs) during concomitant therapy and evaluate risk/benefit of continuing CANCIDAS. (5.2)
- **Hepatic effects:** Can cause abnormalities in LFTs and isolated cases of clinically significant hepatic dysfunction, hepatitis, or hepatic failure. Monitor patients who develop abnormal LFTs for evidence of worsening hepatic function, and evaluate risk/benefit of continuing CANCIDAS. (5.3)

### ADVERSE REACTIONS

- **Adults:** Most common adverse reactions (incidence  $\geq$ 10%) are diarrhea, pyrexia, ALT/AST increased, blood alkaline phosphatase increased, and blood potassium decreased. (6.1)
- **Pediatric patients:** Most common adverse reactions (incidence  $\geq$ 10%) are pyrexia, diarrhea, rash, ALT/AST increased, blood potassium decreased, hypotension, and chills. (6.2)

**To report SUSPECTED ADVERSE REACTIONS, contact Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc., at 1-877-888-4231 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

### USE IN SPECIFIC POPULATIONS

- **Pregnancy:** Based on animal data, may cause fetal harm. (8.1)
- **Pediatric use:** Safety and efficacy in neonates and infants less than 3 months old have not been established. (8.4)
- **Hepatic impairment:** Reduce dose for adult patients with moderate hepatic impairment (35 mg once daily, with a 70-mg loading dose on Day 1 where appropriate). No data are available in adults with severe impairment or in pediatric patients with any degree of impairment. (8.6, 12.3)

See 17 for PATIENT COUNSELING INFORMATION.

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## FULL PRESCRIBING INFORMATION

### 1 INDICATIONS AND USAGE

CANCIDAS<sup>®</sup> is indicated in adults and pediatric patients (3 months and older) for:

- Empirical therapy for presumed fungal infections in febrile, neutropenic patients
- Treatment of candidemia and the following *Candida* infections: intra-abdominal abscesses, peritonitis and pleural space infections. CANCIDAS has not been studied in endocarditis, osteomyelitis, and meningitis due to *Candida*.
- Treatment of esophageal candidiasis [see *Clinical Studies (14.3)*]
- Treatment of invasive aspergillosis in patients who are refractory to or intolerant of other therapies (e.g., amphotericin B, lipid formulations of amphotericin B, itraconazole). CANCIDAS has not been studied as initial therapy for invasive aspergillosis.

### 2 DOSAGE AND ADMINISTRATION

#### 2.1 Instructions for Use in All Patients

CANCIDAS should be administered by slow intravenous (IV) infusion over approximately 1 hour. CANCIDAS should not be administered by IV bolus administration.

Do not mix or co-infuse CANCIDAS with other medications, as there are no data available on the compatibility of CANCIDAS with other intravenous substances, additives, or medications. DO NOT USE DILUENTS CONTAINING DEXTROSE ( $\alpha$ -D-GLUCOSE), as CANCIDAS is not stable in diluents containing dextrose.

#### 2.2 Recommended Dosing in Adult Patients [ $\geq 18$ years of age]

The usual dose is 50 mg once daily (following a 70-mg loading dose for most indications). The safety and efficacy of a dose of 150 mg daily (range: 1 to 51 days; median: 14 days) have been studied in 100 adult patients with candidemia and other *Candida* infections. The efficacy of CANCIDAS at this higher dose was not significantly better than the efficacy of the 50-mg daily dose of CANCIDAS. The efficacy of doses higher than 50 mg daily in the other adult patients for whom CANCIDAS is indicated is not known [see *Clinical Studies (14.2)*].

##### Empirical Therapy

A single 70-mg loading dose should be administered on Day 1, followed by 50 mg once daily thereafter. Duration of treatment should be based on the patient's clinical response. Empirical therapy should be continued until resolution of neutropenia. Patients found to have a fungal infection should be treated for a minimum of 14 days; treatment should continue for at least 7 days after both neutropenia and clinical symptoms are resolved. If the 50-mg dose is well tolerated but does not provide an adequate clinical response, the daily dose can be increased to 70 mg.

##### Candidemia and Other Candida Infections [see *Clinical Studies (14.2)*]

A single 70-mg loading dose should be administered on Day 1, followed by 50 mg once daily thereafter. Duration of treatment should be dictated by the patient's clinical and microbiological response. In general, antifungal therapy should continue for at least 14 days after the last positive culture. Patients who remain persistently neutropenic may warrant a longer course of therapy pending resolution of the neutropenia.

##### Esophageal Candidiasis

The dose is 50 mg once daily for 7 to 14 days after symptom resolution. A 70-mg loading dose has not been studied for this indication. Because of the risk of relapse of oropharyngeal candidiasis in patients with HIV infections, suppressive oral therapy could be considered [see *Clinical Studies (14.3)*].

##### Invasive Aspergillosis

A single 70-mg loading dose should be administered on Day 1, followed by 50 mg once daily thereafter. Duration of treatment should be based upon the severity of the patient's underlying disease, recovery from immunosuppression, and clinical response.

#### 2.3 Recommended Dosing in Pediatric Patients [3 months to 17 years of age]

For all indications, a single 70-mg/m<sup>2</sup> loading dose should be administered on Day 1, followed by 50 mg/m<sup>2</sup> once daily thereafter. **The maximum loading dose and the daily maintenance dose should**

**not exceed 70 mg, regardless of the patient's calculated dose.** Dosing in pediatric patients (3 months to 17 years of age) should be based on the patient's body surface area (BSA) as calculated by the Mosteller Formula [see References (15)]:

$$\text{BSA (m}^2\text{)} = \sqrt{\frac{\text{Height (cm)} \times \text{Weight (kg)}}{3600}}$$

Following calculation of the patient's BSA, the loading dose in milligrams should be calculated as  $\text{BSA (m}^2\text{)} \times 70 \text{ mg/m}^2$ . The maintenance dose in milligrams should be calculated as  $\text{BSA (m}^2\text{)} \times 50 \text{ mg/m}^2$ .

Duration of treatment should be individualized to the indication, as described for each indication in adults [see Dosage and Administration (2.2)]. If the 50-mg/m<sup>2</sup> daily dose is well tolerated but does not provide an adequate clinical response, the daily dose can be increased to 70 mg/m<sup>2</sup> daily (not to exceed 70 mg).

#### 2.4 Patients with Hepatic Impairment

Adult patients with mild hepatic impairment (Child-Pugh score 5 to 6) do not need a dosage adjustment. For adult patients with moderate hepatic impairment (Child-Pugh score 7 to 9), CANCIDAS 35 mg once daily is recommended based upon pharmacokinetic data [see Clinical Pharmacology (12.3)]. However, where recommended, a 70-mg loading dose should still be administered on Day 1. There is no clinical experience in adult patients with severe hepatic impairment (Child-Pugh score >9) and in pediatric patients with any degree of hepatic impairment.

#### 2.5 Patients Receiving Concomitant Inducers of Drug Clearance

Adult patients on rifampin should receive 70 mg of CANCIDAS once daily. Adult patients on nevirapine, efavirenz, carbamazepine, dexamethasone, or phenytoin may require an increase in dose to 70 mg of CANCIDAS once daily [see Drug Interactions (7)].

When CANCIDAS is co-administered to pediatric patients with inducers of drug clearance, such as rifampin, efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine, a CANCIDAS dose of 70 mg/m<sup>2</sup> once daily (not to exceed 70 mg) should be considered [see Drug Interactions (7)].

#### 2.6 Preparation and Reconstitution for Administration

Do not mix or co-infuse CANCIDAS with other medications, as there are no data available on the compatibility of CANCIDAS with other intravenous substances, additives, or medications. DO NOT USE DILUENTS CONTAINING DEXTROSE (α-D-GLUCOSE), as CANCIDAS is not stable in diluents containing dextrose.

##### **Preparation of CANCIDAS for Infusion**

- A. Equilibrate the refrigerated vial of CANCIDAS to room temperature.
- B. Aseptically add 10.8 mL of 0.9% Sodium Chloride Injection, Sterile Water for Injection, Bacteriostatic Water for Injection with methylparaben and propylparaben, or Bacteriostatic Water for Injection with 0.9% benzyl alcohol to the vial.

Each vial of CANCIDAS contains an intentional overfill of CANCIDAS. Thus, the drug concentration of the resulting solution is listed in Table 1 below.

**Table 1: Information for Preparation of CANCIDAS**

CANCIDAS vial	Total Drug Content (including overfill)	Reconstitution Volume to be added	Resulting Concentration following Reconstitution
50 mg	54.6 mg	10.8 mL	5 mg/mL
70 mg	75.6 mg	10.8 mL	7 mg/mL

The white to off-white cake will dissolve completely. Mix gently until a clear solution is obtained. Visually inspect the reconstituted solution for particulate matter or discoloration during reconstitution and prior to infusion. Do not use if the solution is cloudy or has precipitated.

The reconstituted solution may be stored for up to one hour at  $\leq 25^{\circ}\text{C}$  ( $\leq 77^{\circ}\text{F}$ ).

CANCIDAS vials are for single use only; the remaining solution should be discarded.

- C. Aseptically transfer the appropriate volume (mL) of reconstituted CANCIDAS to an IV bag (or bottle) containing 250 mL of 0.9%, 0.45%, or 0.225% Sodium Chloride Injection or Lactated Ringers Injection. Alternatively, the volume (mL) of reconstituted CANCIDAS can be added to a reduced volume of 0.9%, 0.45%, or 0.225% Sodium Chloride Injection or Lactated Ringers Injection, not to exceed a final concentration of 0.5 mg/mL.

This infusion solution must be used within 24 hours if stored at  $\leq 25^{\circ}\text{C}$  ( $\leq 77^{\circ}\text{F}$ ) or within 48 hours if stored refrigerated at 2 to  $8^{\circ}\text{C}$  (36 to  $46^{\circ}\text{F}$ ).

### **Special Considerations for Pediatric Patients >3 Months of Age**

Follow the reconstitution procedures described above using either the 70-mg or 50-mg vial to create the reconstituted solution [see *Dosage and Administration* (2.3)]. From the reconstituted solution in the vial, remove the volume of drug equal to the calculated loading dose or calculated maintenance dose based on a concentration of 7 mg/mL (if reconstituted from the 70-mg vial) or a concentration of 5 mg/mL (if reconstituted from the 50-mg vial).

The choice of vial should be based on total milligram dose of drug to be administered to the pediatric patient. To help ensure accurate dosing, it is recommended for pediatric doses less than 50 mg that 50-mg vials (with a concentration of 5 mg/mL) be used if available. The 70-mg vial should be reserved for pediatric patients requiring doses greater than 50 mg.

**The maximum loading dose and the daily maintenance dose should not exceed 70 mg, regardless of the patient's calculated dose.**

## **3 DOSAGE FORMS AND STRENGTHS**

CANCIDAS 50 mg is a white to off-white powder/cake for infusion in a vial with a red aluminum band and a plastic cap. CANCIDAS 50-mg vial contains 54.6 mg of caspofungin.

CANCIDAS 70 mg is a white to off-white powder/cake for infusion in a vial with a yellow/orange aluminum band and a plastic cap. CANCIDAS 70-mg vial contains 75.6 mg of caspofungin.

## **4 CONTRAINDICATIONS**

CANCIDAS is contraindicated in patients with hypersensitivity (e.g., anaphylaxis) to any component of this product [see *Adverse Reactions* (6)].

## **5 WARNINGS AND PRECAUTIONS**

### **5.1 Hypersensitivity**

Anaphylaxis has been reported during administration of CANCIDAS. If this occurs, CANCIDAS should be discontinued and appropriate treatment administered.

Possible histamine-mediated adverse reactions, including rash, facial swelling, angioedema, pruritus, sensation of warmth or bronchospasm have been reported and may require discontinuation and/or administration of appropriate treatment.

### **5.2 Concomitant Use with Cyclosporine**

Concomitant use of CANCIDAS with cyclosporine should be limited to patients for whom the potential benefit outweighs the potential risk. In one clinical study, 3 of 4 healthy adult subjects who received CANCIDAS 70 mg on Days 1 through 10, and also received two 3 mg/kg doses of cyclosporine 12 hours apart on Day 10, developed transient elevations of alanine transaminase (ALT) on Day 11 that were 2 to 3 times the upper limit of normal (ULN). In a separate panel of adult subjects in the same study, 2 of 8 who received CANCIDAS 35 mg daily for 3 days and cyclosporine (two 3 mg/kg doses administered 12 hours apart) on Day 1 had small increases in ALT (slightly above the ULN) on Day 2. In both groups, elevations in aspartate transaminase (AST) paralleled ALT elevations, but were of lesser magnitude. In another clinical study, 2 of 8 healthy men developed transient ALT elevations of less than 2X ULN. In this

study, cyclosporine (4 mg/kg) was administered on Days 1 and 12, and CANCIDAS was administered (70 mg) daily on Days 3 through 13. In one subject, the ALT elevation occurred on Days 7 and 9 and, in the other subject, the ALT elevation occurred on Day 19. These elevations returned to normal by Day 27. In all groups, elevations in AST paralleled ALT elevations but were of lesser magnitude. In these clinical studies, cyclosporine (one 4 mg/kg dose or two 3 mg/kg doses) increased the AUC of caspofungin by approximately 35%.

In a retrospective postmarketing study, 40 immunocompromised patients, including 37 transplant recipients, were treated with CANCIDAS and cyclosporine for 1 to 290 days (median 17.5 days). Fourteen patients (35%) developed transaminase elevations >5X upper limit of normal or >3X baseline during concomitant therapy or the 14-day follow-up period; five were considered possibly related to concomitant therapy. One patient had elevated bilirubin considered possibly related to concomitant therapy. No patient developed clinical evidence of hepatotoxicity or serious hepatic events. Discontinuations due to laboratory abnormalities in hepatic enzymes from any cause occurred in four patients. Of these, 2 were considered possibly related to therapy with CANCIDAS and/or cyclosporine as well as to other possible causes.

In the prospective invasive aspergillosis and compassionate use studies, there were 4 adult patients treated with CANCIDAS (50 mg/day) and cyclosporine for 2 to 56 days. None of these patients experienced increases in hepatic enzymes.

Given the limitations of these data, CANCIDAS and cyclosporine should only be used concomitantly in those patients for whom the potential benefit outweighs the potential risk. Patients who develop abnormal liver function tests during concomitant therapy should be monitored and the risk/benefit of continuing therapy should be evaluated.

### 5.3 Hepatic Effects

Laboratory abnormalities in liver function tests have been seen in healthy volunteers and in adult and pediatric patients treated with CANCIDAS. In some adult and pediatric patients with serious underlying conditions who were receiving multiple concomitant medications with CANCIDAS, isolated cases of clinically significant hepatic dysfunction, hepatitis, and hepatic failure have been reported; a causal relationship to CANCIDAS has not been established. Patients who develop abnormal liver function tests during CANCIDAS therapy should be monitored for evidence of worsening hepatic function and evaluated for risk/benefit of continuing CANCIDAS therapy.

## 6 ADVERSE REACTIONS

The following serious adverse reactions are discussed in detail in another section of the labeling:

- Hepatic effects [see *Warnings and Precautions* (5.3)]
- Hypersensitivity [see *Warnings and Precautions* (5.1)]

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in clinical trials of CANCIDAS cannot be directly compared to rates in clinical trials of another drug and may not reflect the rates observed in practice. The adverse reaction information from clinical trials does provide a basis for identifying adverse reactions that appear to be related to drug use and for approximating rates.

### 6.1 Clinical Trials Experience in Adults

The overall safety of CANCIDAS was assessed in 1865 adult individuals who received single or multiple doses of CANCIDAS: 564 febrile, neutropenic patients (empirical therapy study); 382 patients with candidemia and/or intra-abdominal abscesses, peritonitis, or pleural space infections (including 4 patients with chronic disseminated candidiasis); 297 patients with esophageal and/or oropharyngeal candidiasis; 228 patients with invasive aspergillosis; and 394 individuals in phase I studies. In the empirical therapy study patients had undergone hematopoietic stem-cell transplantation or chemotherapy. In the studies involving patients with documented *Candida* infections, the majority of the patients had serious underlying medical conditions (e.g., hematologic or other malignancy, recent major surgery, HIV) requiring multiple concomitant medications. Patients in the noncomparative *Aspergillus* studies often had serious predisposing medical conditions (e.g., bone marrow or peripheral stem cell transplants, hematologic malignancy, solid tumors or organ transplants) requiring multiple concomitant medications.

#### Empirical Therapy

In the randomized, double-blinded empirical therapy study, patients received either CANCIDAS 50 mg/day (following a 70-mg loading dose) or AmBisome® (amphotericin B liposome for injection, 3 mg/kg/day). In this study clinical or laboratory hepatic adverse reactions were reported in 39% and 45%

of patients in the CANCIDAS and AmBisome groups, respectively. Also reported was an isolated, serious adverse reaction of hyperbilirubinemia considered possibly related to CANCIDAS. Adverse reactions occurring in  $\geq 7.5\%$  of the patients in either treatment group are presented in Table 2.

**Table 2: Adverse Reactions Among Patients with Persistent Fever and Neutropenia\*  
Incidence  $\geq 7.5\%$  for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction (MedDRA v10.1 System Organ Class and Preferred Term)	CANCIDAS <sup>†</sup> N=564 (percent)	AmBisome <sup>‡</sup> N=547 (percent)
<b>All Systems, Any Adverse Reaction</b>	<b>95</b>	<b>97</b>
<b>Investigations</b>	<b>58</b>	<b>63</b>
Alanine Aminotransferase Increased	18	20
Blood Alkaline Phosphatase Increased	15	23
Blood Potassium Decreased	15	23
Aspartate Aminotransferase Increased	14	17
Blood Bilirubin Increased	10	14
Blood Albumin Decreased	7	8
Blood Magnesium Decreased	7	9
Blood Glucose Increased	6	9
Bilirubin Conjugated Increased	5	9
Blood Urea Increased	4	8
Blood Creatinine Increased	3	11
<b>General Disorders and Administration Site Conditions</b>	<b>57</b>	<b>63</b>
Pyrexia	27	29
Chills	23	31
Edema Peripheral	11	12
Mucosal Inflammation	6	8
<b>Gastrointestinal Disorders</b>	<b>50</b>	<b>55</b>
Diarrhea	20	16
Nausea	11	20
Abdominal Pain	9	11
Vomiting	9	17
<b>Respiratory, Thoracic and Mediastinal Disorders</b>	<b>47</b>	<b>49</b>
Cough	11	10
Dyspnea	9	10
Rales	7	8
<b>Infections and Infestations</b>	<b>45</b>	<b>42</b>
Pneumonia	11	10
<b>Skin and Subcutaneous Tissue Disorders</b>	<b>42</b>	<b>37</b>
Rash	16	14
<b>Nervous System Disorders</b>	<b>25</b>	<b>27</b>
Headache	11	12
<b>Metabolism and Nutrition Disorders</b>	<b>21</b>	<b>24</b>
Hypokalemia	6	8
<b>Vascular Disorders</b>	<b>20</b>	<b>23</b>
Hypotension	6	10
<b>Cardiac Disorders</b>	<b>16</b>	<b>19</b>
Tachycardia	7	9

Within any system organ class, individuals may experience more than 1 adverse reaction.

\* Regardless of causality

<sup>†</sup> 70 mg on Day 1, then 50 mg once daily for the remainder of treatment; daily dose was increased to 70 mg for 73 patients.

<sup>‡</sup> 3 mg/kg/day; daily dose was increased to 5 mg/kg for 74 patients.

The proportion of patients who experienced an infusion-related adverse reaction (defined as a systemic event, such as pyrexia, chills, flushing, hypotension, hypertension, tachycardia, dyspnea, tachypnea, rash, or anaphylaxis, that developed during the study therapy infusion and one hour following infusion) was significantly lower in the group treated with CANCIDAS (35%) than in the group treated with AmBisome (52%).

To evaluate the effect of CANCIDAS and AmBisome on renal function, nephrotoxicity was defined as doubling of serum creatinine relative to baseline or an increase of  $\geq 1$  mg/dL in serum creatinine if baseline serum creatinine was above the upper limit of the normal range. Among patients whose baseline creatinine clearance was  $>30$  mL/min, the incidence of nephrotoxicity was significantly lower in the group

treated with CANCIDAS (3%) than in the group treated with AmBisome (12%). Clinical renal events, regardless of causality, were similar between CANCIDAS (75/564, 13%) and AmBisome (85/547, 16%).

***Candidemia and Other Candida Infections***

In the randomized, double-blinded invasive candidiasis study, patients received either CANCIDAS 50 mg/day (following a 70-mg loading dose) or amphotericin B 0.6 to 1 mg/kg/day. Adverse reactions occurring in  $\geq 10\%$  of the patients in either treatment group are presented in Table 3.

**Table 3: Adverse Reactions Among Patients with Candidemia or other *Candida* Infections\*\* †**  
**Incidence  $\geq 10\%$  for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction (MedDRA v10.1 System Organ Class and Preferred Term)	CANCIDAS 50 mg <sup>‡</sup> N=114 (percent)	Amphotericin B N=125 (percent)
<b>All Systems, Any Adverse Reaction</b>	<b>96</b>	<b>99</b>
<b>Investigations</b>	<b>67</b>	<b>82</b>
Blood Potassium Decreased	23	32
Blood Alkaline Phosphatase Increased	21	32
Hemoglobin Decreased	18	23
Alanine Aminotransferase Increased	16	15
Aspartate Aminotransferase Increased	16	14
Blood Bilirubin Increased	13	17
Hematocrit Decreased	13	18
Blood Creatinine Increased	11	28
Red Blood Cells Urine Positive	10	10
Blood Urea Increased	9	23
Bilirubin Conjugated Increased	8	14
<b>Gastrointestinal Disorders</b>	<b>49</b>	<b>53</b>
Vomiting	17	16
Diarrhea	14	10
Nausea	9	17
<b>Infections and Infestations</b>	<b>48</b>	<b>54</b>
Septic Shock	11	9
Pneumonia	4	10
<b>General Disorders and Administration Site Conditions</b>	<b>47</b>	<b>63</b>
Pyrexia	13	33
Edema Peripheral	11	12
Chills	9	30
<b>Respiratory, Thoracic and Mediastinal Disorders</b>	<b>40</b>	<b>54</b>
Respiratory Failure	11	12
Pleural Effusion	9	14
Tachypnea	1	11
<b>Cardiac Disorders</b>	<b>26</b>	<b>34</b>
Tachycardia	8	12
<b>Skin and Subcutaneous Tissue Disorders</b>	<b>25</b>	<b>28</b>
Rash	4	10
<b>Vascular Disorders</b>	<b>25</b>	<b>38</b>
Hypotension	10	16
<b>Blood and Lymphatic System Disorders</b>	<b>15</b>	<b>13</b>
Anemia	11	9

Within any system organ class, individuals may experience more than 1 adverse reaction.

\* Intra-abdominal abscesses, peritonitis and pleural space infections.

† Regardless of causality

‡ Patients received CANCIDAS 70 mg on Day 1, then 50 mg once daily for the remainder of their treatment.

The proportion of patients who experienced an infusion-related adverse reaction (defined as a systemic event, such as pyrexia, chills, flushing, hypotension, hypertension, tachycardia, dyspnea, tachypnea, rash, or anaphylaxis, that developed during the study therapy infusion and one hour following infusion) was significantly lower in the group treated with CANCIDAS (20%) than in the group treated with amphotericin B (49%).

To evaluate the effect of CANCIDAS and amphotericin B on renal function, nephrotoxicity was defined as doubling of serum creatinine relative to baseline or an increase of  $\geq 1$  mg/dL in serum creatinine if baseline serum creatinine was above the upper limit of the normal range. In a subgroup of patients whose

baseline creatinine clearance was >30 mL/min, the incidence of nephrotoxicity was significantly lower in the group treated with CANCIDAS than in the group treated with amphotericin B.

In a second randomized, double-blinded invasive candidiasis study, patients received either CANCIDAS 50 mg/day (following a 70-mg loading dose) or CANCIDAS 150 mg/day. The proportion of patients who experienced any adverse reaction was similar in the 2 treatment groups; however, this study was not large enough to detect differences in rare or unexpected adverse events. Adverse reactions occurring in ≥5% of the patients in either treatment group are presented in Table 4.

**Table 4: Adverse Reactions Among Patients with Candidemia or other *Candida* Infections<sup>\*,†</sup>  
Incidence ≥5% for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction (MedDRA v11.0 System Organ Class and Preferred Term)	CANCIDAS 50 mg <sup>‡</sup> N=104 (percent)	CANCIDAS 150 mg N=100 (percent)
<b>All Systems, Any Adverse Reaction</b>	<b>83</b>	<b>83</b>
<b>Infections and Infestations</b>	<b>44</b>	<b>43</b>
Septic Shock	13	14
Pneumonia	5	7
Sepsis	5	7
<b>General Disorders and Administration Site Conditions</b>	<b>33</b>	<b>27</b>
Pyrexia	6	6
<b>Gastrointestinal Disorders</b>	<b>30</b>	<b>33</b>
Vomiting	11	6
Diarrhea	6	7
Nausea	5	7
<b>Investigations</b>	<b>28</b>	<b>35</b>
Alkaline Phosphatase Increased	12	9
Aspartate Aminotransferase Increased	6	9
Blood potassium decreased	6	8
Alanine Aminotransferase Increased	4	7
<b>Respiratory, Thoracic and Mediastinal Disorders</b>	<b>23</b>	<b>26</b>
Respiratory Failure	6	2
<b>Vascular Disorders</b>	<b>19</b>	<b>18</b>
Hypotension	7	3
Hypertension	5	6
<b>Skin and Subcutaneous Tissue Disorders</b>	<b>15</b>	<b>15</b>
Decubitus Ulcer	3	5

Within any system organ class, individuals may experience more than 1 adverse event

\* Intra-abdominal abscesses, peritonitis and pleural space infections.

† Regardless of causality

‡ Patients received CANCIDAS 70 mg on Day 1, then 50 mg once daily for the remainder of their treatment.

### Esophageal Candidiasis and Oropharyngeal Candidiasis

Adverse reactions occurring in ≥10% of patients with esophageal and/or oropharyngeal candidiasis are presented in Table 5.

**Table 5: Adverse Reactions Among Patients with Esophageal and/or Oropharyngeal Candidiasis\*  
Incidence ≥10% for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction (MedDRA v10.1 System Organ Class and Preferred Term)	CANCIDAS 50 mg <sup>†</sup> N=83 (percent)	Fluconazole IV 200 mg <sup>†</sup> N=94 (percent)
<b>All Systems, Any Adverse Reaction</b>	<b>90</b>	<b>93</b>
<b>Gastrointestinal Disorders</b>	<b>58</b>	<b>50</b>
Diarrhea	27	18
Nausea	15	15
<b>Investigations</b>	<b>53</b>	<b>61</b>
Hemoglobin Decreased	21	16
Hematocrit Decreased	18	16
Aspartate Aminotransferase Increased	13	19
Blood Alkaline Phosphatase Increased	13	17
Alanine Aminotransferase Increased	12	17
White Blood Cell Count Decreased	12	19
<b>General Disorders and Administration Site Conditions</b>	<b>31</b>	<b>36</b>
Pyrexia	21	21



<b>Vascular Disorders</b>	<b>19</b>	<b>15</b>
Phlebitis	18	11
<b>Nervous System Disorders</b>	<b>18</b>	<b>17</b>
Headache	15	9

Within any system organ class, individuals may experience more than 1 adverse reaction.

\*Regardless of causality

†Derived from a comparator-controlled clinical study.

### Invasive Aspergillosis

In an open-label, noncomparative aspergillosis study, in which 69 patients received CANCIDAS (70-mg loading dose on Day 1 followed by 50 mg daily), the following treatment-emergent adverse reactions were observed with an incidence of  $\geq 12.5\%$ : blood alkaline phosphatase increased (22%), hypotension (20%), respiratory failure (20%), pyrexia (17%), diarrhea (15%), nausea (15%), headache (15%), rash (13%), aspergillosis (13%), alanine aminotransferase increased (13%), aspartate aminotransferase increased (13%), blood bilirubin increased (13%), and blood potassium decreased (13%). Also reported infrequently in this patient population were pulmonary edema, ARDS (adult respiratory distress syndrome), and radiographic infiltrates.

### **6.2 Clinical Trials Experience in Pediatric Patients (3 months to 17 years of age)**

The overall safety of CANCIDAS was assessed in 171 pediatric patients who received single or multiple doses of CANCIDAS. The distribution among the 153 pediatric patients who were over the age of 3 months was as follows: 104 febrile, neutropenic patients; 38 patients with candidemia and/or intra-abdominal abscesses, peritonitis, or pleural space infections; 1 patient with esophageal candidiasis; and 10 patients with invasive aspergillosis. The overall safety profile of CANCIDAS in pediatric patients is comparable to that in adult patients. Table 6 shows the incidence of adverse reactions reported in  $\geq 7.5\%$  of pediatric patients in clinical studies.

One patient (0.6%) receiving CANCIDAS, and three patients (12%) receiving AmBisome developed a serious drug-related adverse reaction. Two patients (1%) were discontinued from CANCIDAS and three patients (12%) were discontinued from AmBisome due to a drug-related adverse reaction. The proportion of patients who experienced an infusion-related adverse reaction (defined as a systemic event, such as pyrexia, chills, flushing, hypotension, hypertension, tachycardia, dyspnea, tachypnea, rash, or anaphylaxis, that developed during the study therapy infusion and one hour following infusion) was 22% in the group treated with CANCIDAS and 35% in the group treated with AmBisome.

**Table 6: Adverse Reactions Among Pediatric Patients (0 months to 17 years of age)\*  
Incidence  $\geq 7.5\%$  for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction (MedDRA v10.0 System Organ Class and Preferred Term)	Noncomparative Clinical Studies	Comparator-Controlled Clinical Study of Empirical Therapy	
	CANCIDAS Any Dose N=115 (percent)	CANCIDAS 50 mg/m <sup>2</sup> <sup>†</sup> N=56 (percent)	AmBisome 3 mg/kg N=26 (percent)
<b>All Systems, Any Adverse Reaction</b>	<b>95</b>	<b>96</b>	<b>89</b>
<b>Investigations</b>	<b>55</b>	<b>41</b>	<b>50</b>
Blood Potassium Decreased	18	9	27
Aspartate Aminotransferase Increased	17	2	12
Alanine Aminotransferase Increased	14	5	12
Blood Potassium Increased	3	0	8
Protein Total Decreased	0	0	8
<b>General Disorders and Administration Site Conditions</b>	<b>47</b>	<b>59</b>	<b>42</b>
Pyrexia	29	30	23
Chills	10	13	8
Mucosal Inflammation	10	4	4
Edema	3	4	8
<b>Respiratory, Thoracic and Mediastinal Disorders</b>	<b>43</b>	<b>32</b>	<b>27</b>
Respiratory Distress	8	0	4
Cough	6	9	8
<b>Gastrointestinal Disorders</b>	<b>42</b>	<b>41</b>	<b>35</b>
Diarrhea	17	7	15
Vomiting	8	11	12
Abdominal Pain	7	4	12
Nausea	4	4	8
<b>Infections and Infestations</b>	<b>40</b>	<b>30</b>	<b>35</b>
Central Line Infection	1	9	0
<b>Skin and Subcutaneous Tissue Disorders</b>	<b>33</b>	<b>41</b>	<b>39</b>
Pruritus	7	6	8

Rash	6	23	8
Erythema	4	9	0
<b>Vascular Disorders</b>	<b>24</b>	<b>21</b>	<b>19</b>
Hypotension	12	9	8
Hypertension	10	9	4
<b>Metabolism and Nutrition Disorders</b>	<b>22</b>	<b>11</b>	<b>23</b>
Hypokalemia	8	5	4
<b>Cardiac Disorders</b>	<b>17</b>	<b>13</b>	<b>19</b>
Tachycardia	4	11	19
<b>Nervous System Disorders</b>	<b>13</b>	<b>16</b>	<b>8</b>
Headache	5	9	4
<b>Musculoskeletal and Connective Tissue Disorders</b>	<b>11</b>	<b>14</b>	<b>12</b>
Back Pain	4	0	8
<b>Blood and Lymphatic System Disorders</b>	<b>10</b>	<b>2</b>	<b>15</b>
Anemia	2	0	8
<b>Immune System Disorders</b>	<b>7</b>	<b>7</b>	<b>12</b>
Graft Versus Host Disease	1	4	8

Within any system organ class, individuals may experience more than 1 adverse reaction.

\* Regardless of causality

† 70 mg/m<sup>2</sup> on Day 1, then 50 mg/m<sup>2</sup> once daily for the remainder of the treatment.

### 6.3 Overall Safety Experience of CANCIDAS in Clinical Trials

The overall safety of CANCIDAS was assessed in 2036 individuals (including 1642 adult or pediatric patients and 394 volunteers) from 34 clinical studies. These individuals received single or multiple (once daily) doses of CANCIDAS, ranging from 5 mg to 210 mg. Full safety data is available from 1951 individuals, as the safety data from 85 patients enrolled in 2 compassionate use studies was limited solely to serious adverse reactions. Treatment emergent adverse reactions, regardless of causality, which occurred in ≥5% of all individuals who received CANCIDAS in these trials, are shown in Table 7.

Overall, 1665 of the 1951 (85%) patients/volunteers who received CANCIDAS experienced an adverse reaction.

**Table 7: Treatment-Emergent\* Adverse Reactions in Patients Who Received CANCIDAS in Clinical Trials<sup>†</sup>**  
**Incidence ≥5% for at Least One Treatment Group by System Organ Class or Preferred Term**

Adverse Reaction <sup>‡</sup> (MedDRA v10 System Organ Class and Preferred Term)	CANCIDAS (N = 1951)	
	n	(%)
<b>All Systems, Any Adverse Reaction</b>	<b>1665</b>	<b>(85)</b>
<b>Investigations</b>	<b>901</b>	<b>(46)</b>
Alanine Aminotransferase Increased	258	(13)
Aspartate Aminotransferase Increased	233	(12)
Blood Alkaline Phosphatase Increased	232	(12)
Blood Potassium Decreased	220	(11)
Blood Bilirubin Increased	117	(6)
<b>General Disorders and Administration Site Conditions</b>	<b>843</b>	<b>(43)</b>
Pyrexia	381	(20)
Chills	192	(10)
Edema Peripheral	110	(6)
<b>Gastrointestinal Disorders</b>	<b>754</b>	<b>(39)</b>
Diarrhea	273	(14)
Nausea	166	(9)
Vomiting	146	(8)
Abdominal Pain	112	(6)
<b>Infections and Infestations</b>	<b>730</b>	<b>(37)</b>
Pneumonia	115	(6)
<b>Respiratory, Thoracic, and Mediastinal Disorders</b>	<b>613</b>	<b>(31)</b>
Cough	111	(6)
<b>Skin and Subcutaneous Tissue Disorders</b>	<b>520</b>	<b>(27)</b>
Rash	159	(8)
Erythema	98	(5)
<b>Nervous System Disorders</b>	<b>412</b>	<b>(21)</b>
Headache	193	(10)
<b>Vascular Disorders</b>	<b>344</b>	<b>(18)</b>
Hypotension	118	(6)

\* Defined as an adverse reaction, regardless of causality, while on CANCIDAS or during the 14-day post-CANCIDAS follow-up period.

<sup>†</sup> Incidence for each preferred term is  $\geq 5\%$  among individuals who received at least 1 dose of CANCIDAS.

<sup>‡</sup> Within any system organ class, individuals may experience more than 1 adverse event.

Clinically significant adverse reactions, regardless of causality or incidence which occurred in less than 5% of patients are listed below.

- **Blood and lymphatic system disorders:** anemia, coagulopathy, febrile neutropenia, neutropenia, thrombocytopenia
- **Cardiac disorders:** arrhythmia, atrial fibrillation, bradycardia, cardiac arrest, myocardial infarction, tachycardia
- **Gastrointestinal disorders:** abdominal distension, abdominal pain upper, constipation, dyspepsia
- **General disorders and administration site conditions:** asthenia, fatigue, infusion site pain/pruritus/swelling, mucosal inflammation, edema
- **Hepatobiliary disorders:** hepatic failure, hepatomegaly, hepatotoxicity, hyperbilirubinemia, jaundice
- **Infections and infestations:** bacteremia, sepsis, urinary tract infection
- **Metabolic and nutrition disorders:** anorexia, decreased appetite, fluid overload, hypomagnesemia, hypercalcemia, hyperglycemia, hypokalemia
- **Musculoskeletal, connective tissue, and bone disorders:** arthralgia, back pain, pain in extremity
- **Nervous system disorders:** convulsion, dizziness, somnolence, tremor
- **Psychiatric disorders:** anxiety, confusional state, depression, insomnia
- **Renal and urinary disorders:** hematuria, renal failure
- **Respiratory, thoracic, and mediastinal disorders:** dyspnea, epistaxis, hypoxia, tachypnea
- **Skin and subcutaneous tissue disorders:** erythema, petechiae, skin lesion, urticaria
- **Vascular disorders:** flushing, hypertension, phlebitis

#### 6.4 Postmarketing Experience

The following additional adverse reactions have been identified during the post-approval use of CANCIDAS. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

- *Gastrointestinal disorders:* pancreatitis
- *Hepatobiliary disorders:* hepatic necrosis
- *Skin and subcutaneous tissue disorders:* erythema multiforme, Stevens-Johnson, skin exfoliation
- *Renal and urinary disorders:* clinically significant renal dysfunction
- *General disorders and administration site conditions:* swelling and peripheral edema
- *Laboratory abnormalities:* gamma-glutamyl transferase increased

## 7 DRUG INTERACTIONS

[See *Clinical Pharmacology* (12.3).]

In clinical studies, caspofungin did not induce the CYP3A4 metabolism of other drugs. Caspofungin is not a substrate for P-glycoprotein and is a poor substrate for cytochrome P450 enzymes.

Clinical studies in adult healthy volunteers show that the pharmacokinetics of CANCIDAS are not altered by itraconazole, amphotericin B, mycophenolate, nelfinavir, or tacrolimus. CANCIDAS has no effect on the pharmacokinetics of itraconazole, amphotericin B, or the active metabolite of mycophenolate. **Cyclosporine:** In two adult clinical studies, cyclosporine (one 4 mg/kg dose or two 3 mg/kg doses) increased the AUC of caspofungin by approximately 35%. CANCIDAS did not increase the plasma levels of cyclosporine. There were transient increases in liver ALT and AST when CANCIDAS and cyclosporine were co-administered [see *Warnings and Precautions* (5.2)].

**Tacrolimus:** For patients receiving CANCIDAS and tacrolimus, standard monitoring of tacrolimus blood concentrations and appropriate tacrolimus dosage adjustments are recommended.

**Rifampin:** Adult patients on rifampin should receive 70 mg of CANCIDAS daily.

**Other inducers of drug clearance:**

**Adults:** When CANCIDAS is co-administered to adult patients with inducers of drug clearance, such as efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine, use of a daily dose of 70 mg of CANCIDAS should be considered.

Pediatric Patients: When CANCIDAS is co-administered to pediatric patients with inducers of drug clearance, such as rifampin, efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine, a CANCIDAS dose of 70 mg/m<sup>2</sup> daily (not to exceed an actual daily dose of 70 mg) should be considered.

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

#### *Pregnancy Category C*

There are no adequate and well-controlled studies with the use of CANCIDAS in pregnant women. In animal studies, caspofungin caused embryofetal toxicity, including increased resorptions, increased peri-implantation loss, and incomplete ossification at multiple fetal sites. CANCIDAS should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

In offspring born to pregnant rats treated with caspofungin at doses comparable to the human dose based on body surface area comparisons, there was incomplete ossification of the skull and torso and increased incidences of cervical rib. There was also an increase in resorptions and peri-implantation losses. In pregnant rabbits treated with caspofungin at doses comparable to 2 times the human dose based on body surface area comparisons, there was an increased incidence of incomplete ossification of the talus/calcaneus in offspring and increases in fetal resorptions. Caspofungin crossed the placenta in rats and rabbits and was detectable in fetal plasma.

### 8.3 Nursing Mothers

It is not known whether caspofungin is present in human milk. Caspofungin was found in the milk of lactating, drug-treated rats. Because many drugs are excreted in human milk, caution should be exercised when caspofungin is administered to a nursing woman.

### 8.4 Pediatric Use

The safety and effectiveness of CANCIDAS in pediatric patients 3 months to 17 years of age are supported by evidence from adequate and well-controlled studies in adults, pharmacokinetic data in pediatric patients, and additional data from prospective studies in pediatric patients 3 months to 17 years of age for the following indications [*see Indications and Usage (1)*]:

- Empirical therapy for presumed fungal infections in febrile, neutropenic patients.
- Treatment of candidemia and the following *Candida* infections: intra-abdominal abscesses, peritonitis, and pleural space infections.
- Treatment of esophageal candidiasis.
- Treatment of invasive aspergillosis in patients who are refractory to or intolerant of other therapies (e.g., amphotericin B, lipid formulations of amphotericin B, itraconazole).

The efficacy and safety of CANCIDAS has not been adequately studied in prospective clinical trials involving neonates and infants under 3 months of age. Although limited pharmacokinetic data were collected in neonates and infants below 3 months of age, these data are insufficient to establish a safe and effective dose of caspofungin in the treatment of neonatal candidiasis. Invasive candidiasis in neonates has a higher rate of CNS and multi-organ involvement than in older patients; the ability of CANCIDAS to penetrate the blood-brain barrier and to treat patients with meningitis and endocarditis is unknown.

CANCIDAS has not been studied in pediatric patients with endocarditis, osteomyelitis, and meningitis due to *Candida*. CANCIDAS has also not been studied as initial therapy for invasive aspergillosis in pediatric patients.

In clinical trials, 171 pediatric patients (0 months to 17 years of age), including 18 patients who were less than 3 months of age, were given intravenous CANCIDAS. Pharmacokinetic studies enrolled a total of 66 pediatric patients, and an additional 105 pediatric patients received CANCIDAS in safety and efficacy studies [*see Clinical Pharmacology (12.3) and Clinical Studies (14.5)*]. The majority of the pediatric patients received CANCIDAS at a once-daily maintenance dose of 50 mg/m<sup>2</sup> for a mean duration of 12 days (median 9, range 1-87 days). In all studies, safety was assessed by the investigator throughout study therapy and for 14 days following cessation of study therapy. The most common adverse reactions in pediatric patients treated with CANCIDAS were pyrexia (29%), blood potassium decreased (15%), diarrhea (14%), increased aspartate aminotransferase (12%), rash (12%), increased alanine aminotransferase (11%), hypotension (11%), and chills (11%) [*see Adverse Reactions (6.2)*].

Postmarketing hepatobiliary adverse reactions have been reported in pediatric patients with serious underlying medical conditions [see *Warnings and Precautions* (5.3)].

### 8.5 Geriatric Use

Clinical studies of CANCIDAS did not include sufficient numbers of patients aged 65 and over to determine whether they respond differently from younger patients. Although the number of elderly patients was not large enough for a statistical analysis, no overall differences in safety or efficacy were observed between these and younger patients. Plasma concentrations of caspofungin in healthy older men and women ( $\geq 65$  years of age) were increased slightly (approximately 28% in AUC) compared to young healthy men. A similar effect of age on pharmacokinetics was seen in patients with candidemia or other *Candida* infections (intra-abdominal abscesses, peritonitis, or pleural space infections). No dose adjustment is recommended for the elderly; however, greater sensitivity of some older individuals cannot be ruled out.

### 8.6 Patients with Hepatic Impairment

Adult patients with mild hepatic impairment (Child-Pugh score 5 to 6) do not need a dosage adjustment. For adult patients with moderate hepatic impairment (Child-Pugh score 7 to 9), CANCIDAS 35 mg once daily is recommended based upon pharmacokinetic data [see *Clinical Pharmacology* (12.3)]. However, where recommended, a 70-mg loading dose should still be administered on Day 1 [see *Dosage and Administration* (2.4) and *Clinical Pharmacology* (12.3)]. There is no clinical experience in adult patients with severe hepatic impairment (Child-Pugh score  $>9$ ) and in pediatric patients 3 months to 17 years of age with any degree of hepatic impairment.

### 8.7 Patients with Renal Impairment

No dosage adjustment is necessary for patients with renal impairment. Caspofungin is not dialyzable; thus, supplementary dosing is not required following hemodialysis [see *Clinical Pharmacology* (12.3)].

## 10 OVERDOSAGE

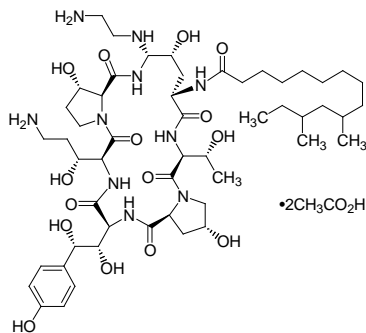
In 6 healthy subjects who received a single 210-mg dose, no significant adverse reactions were reported. Multiple doses above 150 mg daily have not been studied. Caspofungin is not dialyzable. The minimum lethal dose of caspofungin in rats was 50 mg/kg, a dose which is equivalent to 10 times the recommended daily dose based on relative body surface area comparison.

In clinical trials, one pediatric patient (16 years of age) unintentionally received a single dose of caspofungin of 113 mg (on Day 1), followed by 80 mg daily for an additional 7 days. No clinically significant adverse reactions were reported.

## 11 DESCRIPTION

CANCIDAS is a sterile, lyophilized product for intravenous (IV) infusion that contains a semisynthetic lipopeptide (echinocandin) compound synthesized from a fermentation product of *Glarea lozoyensis*. CANCIDAS is an echinocandin that inhibits the synthesis of  $\beta$  (1,3)-D-glucan, an integral component of the fungal cell wall.

CANCIDAS (caspofungin acetate) is 1-[(4*R*,5*S*)-5-[(2-aminoethyl)amino]-*N*<sup>2</sup>-(10,12-dimethyl-1-oxotetradecyl)-4-hydroxy-L-ornithine]-5-[(3*R*)-3-hydroxy-L-ornithine] pneumocandin B<sub>0</sub> diacetate (salt). CANCIDAS 50 mg also contains: 39 mg sucrose, 26 mg mannitol, glacial acetic acid, and sodium hydroxide. CANCIDAS 70 mg also contains 54 mg sucrose, 36 mg mannitol, glacial acetic acid, and sodium hydroxide. Caspofungin acetate is a hygroscopic, white to off-white powder. It is freely soluble in water and methanol, and slightly soluble in ethanol. The pH of a saturated aqueous solution of caspofungin acetate is approximately 6.6. The empirical formula is C<sub>52</sub>H<sub>88</sub>N<sub>10</sub>O<sub>15</sub>•2C<sub>2</sub>H<sub>4</sub>O<sub>2</sub> and the formula weight is 1213.42. The structural formula is:



## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Caspofungin is an antifungal drug [see *Clinical Pharmacology* (12.4)].

### 12.3 Pharmacokinetics

Adult and pediatric pharmacokinetic parameters are presented in Table 8.

#### Distribution

Plasma concentrations of caspofungin decline in a polyphasic manner following single 1-hour IV infusions. A short  $\alpha$ -phase occurs immediately postinfusion, followed by a  $\beta$ -phase (half-life of 9 to 11 hours) that characterizes much of the profile and exhibits clear log-linear behavior from 6 to 48 hours postdose during which the plasma concentration decreases 10-fold. An additional, longer half-life phase,  $\gamma$ -phase, (half-life of 40-50 hours), also occurs. Distribution, rather than excretion or biotransformation, is the dominant mechanism influencing plasma clearance. Caspofungin is extensively bound to albumin (~97%), and distribution into red blood cells is minimal. Mass balance results showed that approximately 92% of the administered radioactivity was distributed to tissues by 36 to 48 hours after a single 70-mg dose of [ $^3\text{H}$ ] caspofungin acetate. There is little excretion or biotransformation of caspofungin during the first 30 hours after administration.

#### Metabolism

Caspofungin is slowly metabolized by hydrolysis and N-acetylation. Caspofungin also undergoes spontaneous chemical degradation to an open-ring peptide compound, L-747969. At later time points ( $\geq 5$  days postdose), there is a low level ( $\leq 7$  picomoles/mg protein, or  $\leq 1.3\%$  of administered dose) of covalent binding of radiolabel in plasma following single-dose administration of [ $^3\text{H}$ ] caspofungin acetate, which may be due to two reactive intermediates formed during the chemical degradation of caspofungin to L-747969. Additional metabolism involves hydrolysis into constitutive amino acids and their degradates, including dihydroxyhomotyrosine and N-acetyl-dihydroxyhomotyrosine. These two tyrosine derivatives are found only in urine, suggesting rapid clearance of these derivatives by the kidneys.

#### Excretion

Two single-dose radiolabeled pharmacokinetic studies were conducted. In one study, plasma, urine, and feces were collected over 27 days, and in the second study plasma was collected over 6 months. Plasma concentrations of radioactivity and of caspofungin were similar during the first 24 to 48 hours postdose; thereafter drug levels fell more rapidly. In plasma, caspofungin concentrations fell below the limit of quantitation after 6 to 8 days postdose, while radiolabel fell below the limit of quantitation at 22.3 weeks postdose. After single intravenous administration of [ $^3\text{H}$ ] caspofungin acetate, excretion of caspofungin and its metabolites in humans was 35% of dose in feces and 41% of dose in urine. A small amount of caspofungin is excreted unchanged in urine (~1.4% of dose). Renal clearance of parent drug is low (~0.15 mL/min) and total clearance of caspofungin is 12 mL/min.

#### **Special Populations**

##### Renal Impairment

In a clinical study of single 70-mg doses, caspofungin pharmacokinetics were similar in healthy adult volunteers with mild renal impairment (creatinine clearance 50 to 80 mL/min) and control subjects. Moderate (creatinine clearance 31 to 49 mL/min), severe (creatinine clearance 5 to 30 mL/min), and end-stage (creatinine clearance  $< 10$  mL/min and dialysis dependent) renal impairment moderately increased caspofungin plasma concentrations after single-dose administration (range: 30 to 49% for AUC).

However, in adult patients with invasive aspergillosis, candidemia, or other *Candida* infections (intra-abdominal abscesses, peritonitis, or pleural space infections) who received multiple daily doses of CANCIDAS 50 mg, there was no significant effect of mild to end-stage renal impairment on caspofungin concentrations. No dosage adjustment is necessary for patients with renal impairment. Caspofungin is not dialyzable, thus supplementary dosing is not required following hemodialysis.

#### Hepatic Impairment

Plasma concentrations of caspofungin after a single 70-mg dose in adult patients with mild hepatic impairment (Child-Pugh score 5 to 6) were increased by approximately 55% in AUC compared to healthy control subjects. In a 14-day multiple-dose study (70 mg on Day 1 followed by 50 mg daily thereafter), plasma concentrations in adult patients with mild hepatic impairment were increased modestly (19 to 25% in AUC) on Days 7 and 14 relative to healthy control subjects. No dosage adjustment is recommended for patients with mild hepatic impairment.

Adult patients with moderate hepatic impairment (Child-Pugh score 7 to 9) who received a single 70-mg dose of CANCIDAS had an average plasma caspofungin increase of 76% in AUC compared to control subjects. A dosage reduction is recommended for adult patients with moderate hepatic impairment based upon these pharmacokinetic data [see *Dosage and Administration (2.4)*].

There is no clinical experience in adult patients with severe hepatic impairment (Child-Pugh score >9) or in pediatric patients with any degree of hepatic impairment.

#### Gender

Plasma concentrations of caspofungin in healthy adult men and women were similar following a single 70-mg dose. After 13 daily 50-mg doses, caspofungin plasma concentrations in women were elevated slightly (approximately 22% in area under the curve [AUC]) relative to men. No dosage adjustment is necessary based on gender.

#### Race

Regression analyses of patient pharmacokinetic data indicated that no clinically significant differences in the pharmacokinetics of caspofungin were seen among Caucasians, Blacks, and Hispanics. No dosage adjustment is necessary on the basis of race.

#### Geriatric Patients

Plasma concentrations of caspofungin in healthy older men and women ( $\geq 65$  years of age) were increased slightly (approximately 28% AUC) compared to young healthy men after a single 70-mg dose of caspofungin. In patients who were treated empirically or who had candidemia or other *Candida* infections (intra-abdominal abscesses, peritonitis, or pleural space infections), a similar modest effect of age was seen in older patients relative to younger patients. No dosage adjustment is necessary for the elderly [see *Use in Specific Populations (8.5)*].

#### Pediatric Patients

CANCIDAS has been studied in five prospective studies involving pediatric patients under 18 years of age, including three pediatric pharmacokinetic studies [initial study in adolescents (12-17 years of age) and children (2-11 years of age) followed by a study in younger patients (3-23 months of age) and then followed by a study in neonates and infants (<3 months)] [see *Use in Specific Populations (8.4)*].

Pharmacokinetic parameters following multiple doses of CANCIDAS in pediatric and adult patients are presented in Table 8.

**Table 8: Pharmacokinetic Parameters Following Multiple Doses of CANCIDAS in Pediatric (3 months to 17 years) and Adult Patients**

Population	N	Daily Dose	Pharmacokinetic Parameters (Mean $\pm$ Standard Deviation)				
			AUC <sub>0-24hr</sub> ( $\mu\text{g}\cdot\text{hr}/\text{mL}$ )	C <sub>1hr</sub> ( $\mu\text{g}/\text{mL}$ )	C <sub>24hr</sub> ( $\mu\text{g}/\text{mL}$ )	t <sub>1/2</sub> (hr)*	CI (mL/min)
<b>PEDIATRIC PATIENTS</b>							
Adolescents, Aged 12-17 years	8	50 mg/m <sup>2</sup>	124.9 $\pm$ 50.4	14.0 $\pm$ 6.9	2.4 $\pm$ 1.0	11.2 $\pm$ 1.7	12.6 $\pm$ 5.5
Children, Aged 2-11 years	9	50 mg/m <sup>2</sup>	120.0 $\pm$ 33.4	16.1 $\pm$ 4.2	1.7 $\pm$ 0.8	8.2 $\pm$ 2.4	6.4 $\pm$ 2.6
Young Children, Aged 3-23 months	8	50 mg/m <sup>2</sup>	131.2 $\pm$ 17.7	17.6 $\pm$ 3.9	1.7 $\pm$ 0.7	8.8 $\pm$ 2.1	3.2 $\pm$ 0.4
<b>ADULT PATIENTS</b>							
Adults with Esophageal Candidiasis	6 <sup>†</sup>	50 mg	87.3 $\pm$ 30.0	8.7 $\pm$ 2.1	1.7 $\pm$ 0.7	13.0 $\pm$ 1.9	10.6 $\pm$ 3.8
Adults receiving Empirical Therapy	119 <sup>‡</sup>	50 mg <sup>§</sup>	--	8.0 $\pm$ 3.4	1.6 $\pm$ 0.7	--	--

\* Harmonic Mean  $\pm$  jackknife standard deviation

<sup>†</sup> N=5 for C<sub>1hr</sub> and AUC<sub>0-24hr</sub>; N=6 for C<sub>24hr</sub>

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<sup>‡</sup> N=117 for C<sub>24hr</sub>; N=119 for C<sub>1hr</sub>  
<sup>§</sup> Following an initial 70-mg loading dose on day 1

### Drug Interactions [see Drug Interactions (7)]

Studies *in vitro* show that caspofungin acetate is not an inhibitor of any enzyme in the cytochrome P450 (CYP) system. In clinical studies, caspofungin did not induce the CYP3A4 metabolism of other drugs. Caspofungin is not a substrate for P-glycoprotein and is a poor substrate for cytochrome P450 enzymes.

Clinical studies in adult healthy volunteers show that the pharmacokinetics of CANCIDAS are not altered by itraconazole, amphotericin B, mycophenolate, nelfinavir, or tacrolimus. CANCIDAS has no effect on the pharmacokinetics of itraconazole, amphotericin B, or the active metabolite of mycophenolate.

Cyclosporine: In two adult clinical studies, cyclosporine (one 4 mg/kg dose or two 3 mg/kg doses) increased the AUC of caspofungin by approximately 35%. CANCIDAS did not increase the plasma levels of cyclosporine. There were transient increases in liver ALT and AST when CANCIDAS and cyclosporine were co-administered [see *Warnings and Precautions (5.2)*].

Tacrolimus: CANCIDAS reduced the blood AUC<sub>0-12</sub> of tacrolimus (FK-506, Prograf<sup>®</sup>) by approximately 20%, peak blood concentration (C<sub>max</sub>) by 16%, and 12-hour blood concentration (C<sub>12hr</sub>) by 26% in healthy adult subjects when tacrolimus (2 doses of 0.1 mg/kg 12 hours apart) was administered on the 10th day of CANCIDAS 70 mg daily, as compared to results from a control period in which tacrolimus was administered alone. For patients receiving both therapies, standard monitoring of tacrolimus blood concentrations and appropriate tacrolimus dosage adjustments are recommended.

Rifampin: A drug-drug interaction study with rifampin in adult healthy volunteers has shown a 30% decrease in caspofungin trough concentrations. Adult patients on rifampin should receive 70 mg of CANCIDAS daily.

#### Other inducers of drug clearance

Adults: In addition, results from regression analyses of adult patient pharmacokinetic data suggest that co-administration of other inducers of drug clearance (efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine) with CANCIDAS may result in clinically meaningful reductions in caspofungin concentrations. It is not known which drug clearance mechanism involved in caspofungin disposition may be inducible. When CANCIDAS is co-administered to adult patients with inducers of drug clearance, such as efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine, use of a daily dose of 70 mg of CANCIDAS should be considered.

Pediatric patients: In pediatric patients, results from regression analyses of pharmacokinetic data suggest that co-administration of dexamethasone with CANCIDAS may result in clinically meaningful reductions in caspofungin trough concentrations. This finding may indicate that pediatric patients will have similar reductions with inducers as seen in adults. When CANCIDAS is co-administered to pediatric patients with inducers of drug clearance, such as rifampin, efavirenz, nevirapine, phenytoin, dexamethasone, or carbamazepine, a CANCIDAS dose of 70 mg/m<sup>2</sup> daily (not to exceed an actual daily dose of 70 mg) should be considered.

## **12.4 Microbiology**

### Mechanism of Action

Caspofungin, an echinocandin, inhibits the synthesis of beta (1,3)-D-glucan, an essential component of the cell wall of susceptible *Aspergillus* species and *Candida* species. Beta (1,3)-D-glucan is not present in mammalian cells. Caspofungin has shown activity against *Candida* species and in regions of active cell growth of the hyphae of *Aspergillus fumigatus*.

### Drug Resistance

There have been reports of clinical failures in patients receiving caspofungin therapy due to the development of drug resistance. Some of these reports have identified specific mutations in the Fks subunits of the glucan synthase enzyme. These mutations are associated with higher MICs and breakthrough infection. *Candida* species that exhibit reduced susceptibility to caspofungin as a result of an increase in the chitin content of the fungal cell wall have also been identified, although the significance of this phenomenon *in vivo* is not well known.

### Drug Interactions

Studies *in vitro* and *in vivo* of caspofungin, in combination with amphotericin B, suggest no antagonism of antifungal activity against either *A. fumigatus* or *C. albicans*. The clinical significance of these results is unknown.



### Activity in Vitro and in Clinical Infections

Caspofungin has been shown to be active both *in vitro* and in clinical infections against most strains of the following microorganisms:

*Aspergillus fumigatus*  
*Aspergillus flavus*  
*Aspergillus terreus*  
*Candida albicans*  
*Candida glabrata*  
*Candida guilliermondii*  
*Candida krusei*  
*Candida parapsilosis*  
*Candida tropicalis*

### Susceptibility Testing Methods

The interpretive standards for caspofungin against *Candida* species are applicable only to tests performed using Clinical Laboratory and Standards Institute (CLSI) microbroth dilution reference methods<sup>2,3</sup> for MIC (partial inhibition endpoint) read at 24 hours. No interpretive criteria have been established for *Aspergillus* species or other filamentous fungi.

When available, the clinical microbiology laboratory should provide the results of *in vitro* susceptibility test results for antimicrobial drug products used in resident hospitals to the physician as periodic reports that describe the susceptibility profile of pathogens. These reports should aid the physician in selecting an antifungal drug product for treatment. The techniques for Broth Microdilution are described below.

### Broth Microdilution Techniques

Quantitative methods are used to determine antifungal minimum inhibitory concentrations (MICs). These MICs provide estimates of the susceptibility of *Candida* spp. to antifungal agents. MICs should be determined using a standardized procedure at 24 hours<sup>2,3</sup>. Standardized procedures are based on a microdilution method (broth) with standardized inoculum concentrations and standardized concentrations of caspofungin powder. The MIC values should be interpreted according to the criteria provided in Table 9.

**Table 9: Susceptibility Interpretive Criteria for Caspofungin**

Pathogen	Broth Microdilution MIC* (mcg/mL) at 24 hours	
	Susceptible (S)	Non-Susceptible (NS)
<i>Candida</i> species	≤2	>2

\*A report of "Susceptible" indicates that the pathogen is likely to be inhibited if the antimicrobial compound in the blood reaches the concentrations usually achievable.

### Quality Control

Standardized susceptibility test procedures require the use of quality control organisms to control the technical aspects of the test procedures. Standard caspofungin powder should provide the following range of values noted in Table 10<sup>3</sup>. Quality control microorganisms are specific strains of organisms with intrinsic biological properties relating to resistance mechanisms and their genetic expression within fungi; the specific strains used for microbiological control are not clinically significant.

**Table 10: Acceptable Quality Control Ranges for caspofungin to be used in Validation of Susceptibility Test Results**

QC Strain	Broth Microdilution (MIC in mcg/mL) at 24 hours*
<i>Candida parapsilosis</i> ATCC 22019	0.25 – 1.0
<i>Candida krusei</i> ATCC 6258	0.12 – 1.0

The MIC for caspofungin is the lowest concentration at which a score of 2 (prominent decrease in turbidity [ $> 50\%$  inhibition of growth as compared to the growth control]; see CLSI document M27-A3<sup>2</sup>, Section 7.6.3) is observed after 24 hours of incubation.

## 13 NONCLINICAL TOXICOLOGY

### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

No long-term studies in animals have been performed to evaluate the carcinogenic potential of caspofungin.

Caspofungin did not show evidence of mutagenic or genotoxic potential when evaluated in the following *in vitro* assays: bacterial (Ames) and mammalian cell (V79 Chinese hamster lung fibroblasts)

mutagenesis assays, the alkaline elution/rat hepatocyte DNA strand break test, and the chromosome aberration assay in Chinese hamster ovary cells. Caspofungin was not genotoxic when assessed in the mouse bone marrow chromosomal test at doses up to 12.5 mg/kg (equivalent to a human dose of 1 mg/kg based on body surface area comparisons), administered intravenously.

Fertility and reproductive performance were not affected by the intravenous administration of caspofungin to rats at doses up to 5 mg/kg. At 5 mg/kg exposures were similar to those seen in patients treated with the 70-mg dose.

### 13.2 Animal Toxicology and/or Pharmacology

In one 5-week study in monkeys at doses which produced exposures approximately 4 to 6 times those seen in adult patients treated with a 70-mg dose, scattered small foci of subcapsular necrosis were observed microscopically in the livers of some animals (2/8 monkeys at 5 mg/kg and 4/8 monkeys at 8 mg/kg); however, this histopathological finding was not seen in another study of 27 weeks duration at similar doses.

No treatment-related findings were seen in a 5-week study in infant monkeys at doses which produced exposures approximately 3 times those achieved in pediatric patients receiving a maintenance dose of 50 mg/m<sup>2</sup> daily.

## 14 CLINICAL STUDIES

The results of the adult clinical studies are presented by indications in Section 14.1 to 14.4. Results of pediatric clinical trials are in Section 14.5.

### 14.1 Empirical Therapy in Febrile, Neutropenic Patients

A double-blind study enrolled 1111 febrile, neutropenic (<500 cells/mm<sup>3</sup>) patients who were randomized to treatment with daily doses of CANCIDAS (50 mg/day following a 70-mg loading dose on Day 1) or AmBisome (3 mg/kg/day). Patients were stratified based on risk category (high-risk patients had undergone allogeneic stem cell transplantation or had relapsed acute leukemia) and on receipt of prior antifungal prophylaxis. Twenty-four percent of patients were high risk and 56% had received prior antifungal prophylaxis. Patients who remained febrile or clinically deteriorated following 5 days of therapy could receive 70 mg/day of CANCIDAS or 5 mg/kg/day of AmBisome. Treatment was continued to resolution of neutropenia (but not beyond 28 days unless a fungal infection was documented).

An overall favorable response required meeting each of the following criteria: no documented breakthrough fungal infections up to 7 days after completion of treatment, survival for 7 days after completion of study therapy, no discontinuation of the study drug because of drug-related toxicity or lack of efficacy, resolution of fever during the period of neutropenia, and successful treatment of any documented baseline fungal infection.

Based on the composite response rates, CANCIDAS was as effective as AmBisome in empirical therapy of persistent febrile neutropenia (see Table 11).

**Table 11: Favorable Response of Patients with Persistent Fever and Neutropenia**

	CANCIDAS*	AmBisome*	% Difference (Confidence Interval) <sup>†</sup>
Number of Patients <sup>‡</sup>	556	539	
Overall Favorable Response	190 (33.9%)	181 (33.7%)	0.2 (-5.6, 6.0)
No documented breakthrough fungal infection	527 (94.8%)	515 (95.5%)	-0.8
Survival 7 days after end of treatment	515 (92.6%)	481 (89.2%)	3.4
No discontinuation due to toxicity or lack of efficacy	499 (89.7%)	461 (85.5%)	4.2
Resolution of fever during neutropenia	229 (41.2%)	223 (41.4%)	-0.2

\* CANCIDAS: 70 mg on Day 1, then 50 mg once daily for the remainder of treatment (daily dose increased to 70 mg for 73 patients); AmBisome: 3 mg/kg/day (daily dose increased to 5 mg/kg for 74 patients).

<sup>†</sup> Overall Response: estimated % difference adjusted for strata and expressed as CANCIDAS – AmBisome (95.2% CI); Individual criteria presented above are not mutually exclusive. The percent difference calculated as CANCIDAS – AmBisome.

<sup>‡</sup> Analysis population excluded subjects who did not have fever or neutropenia at study entry.

The rate of successful treatment of documented baseline infections, a component of the primary endpoint, was not statistically different between treatment groups.

The response rates did not differ between treatment groups based on either of the stratification variables: risk category or prior antifungal prophylaxis.

## 14.2 Candidemia and the Following other *Candida* Infections: Intra-Abdominal Abscesses, Peritonitis and Pleural Space Infections

In a randomized, double-blind study, patients with a proven diagnosis of invasive candidiasis received daily doses of CANCIDAS (50 mg/day following a 70-mg loading dose on Day 1) or amphotericin B deoxycholate (0.6 to 0.7 mg/kg/day for non-neutropenic patients and 0.7 to 1 mg/kg/day for neutropenic patients). Patients were stratified by both neutropenic status and APACHE II score. Patients with *Candida* endocarditis, meningitis, or osteomyelitis were excluded from this study.

Patients who met the entry criteria and received one or more doses of IV study therapy were included in the modified intention-to-treat [MITT] analysis of response at the end of IV study therapy. A favorable response at this time point required both symptom/sign resolution/improvement and microbiological clearance of the *Candida* infection.

Two hundred thirty-nine patients were enrolled. Patient disposition is shown in Table 12.

**Table 12: Disposition in Candidemia and Other *Candida* Infections (Intra-abdominal abscesses, peritonitis, and pleural space infections)**

	CANCIDAS*	Amphotericin B
Randomized patients	114	125
Patients completing study <sup>†</sup>	63 (55.3%)	69 (55.2%)
<b>DISCONTINUATIONS OF STUDY<sup>†</sup></b>		
All Study Discontinuations	51 (44.7%)	56 (44.8%)
Study Discontinuations due to clinical adverse events	39 (34.2%)	43 (34.4%)
Study Discontinuations due to laboratory adverse events	0 (0%)	1 (0.8%)
<b>DISCONTINUATIONS OF STUDY THERAPY</b>		
All Study Therapy Discontinuations	48 (42.1%)	58 (46.4%)
Study Therapy Discontinuations due to clinical adverse events	30 (26.3%)	37 (29.6%)
Study Therapy Discontinuations due to laboratory adverse events	1 (0.9%)	7 (5.6%)
Study Therapy Discontinuations due to all drug-related <sup>‡</sup> adverse events	3 (2.6%)	29 (23.2%)

\* Patients received CANCIDAS 70 mg on Day 1, then 50 mg once daily for the remainder of their treatment.

<sup>†</sup> Study defined as study treatment period and 6-8 week follow-up period.

<sup>‡</sup> Determined by the investigator to be possibly, probably, or definitely drug-related.

Of the 239 patients enrolled, 224 met the criteria for inclusion in the MITT population (109 treated with CANCIDAS and 115 treated with amphotericin B). Of these 224 patients, 186 patients had candidemia (92 treated with CANCIDAS and 94 treated with amphotericin B). The majority of the patients with candidemia were non-neutropenic (87%) and had an APACHE II score less than or equal to 20 (77%) in both arms. Most candidemia infections were caused by *C. albicans* (39%), followed by *C. parapsilosis* (20%), *C. tropicalis* (17%), *C. glabrata* (8%), and *C. krusei* (3%).

At the end of IV study therapy, CANCIDAS was comparable to amphotericin B in the treatment of candidemia in the MITT population. For the other efficacy time points (Day 10 of IV study therapy, end of all antifungal therapy, 2-week post-therapy follow-up, and 6- to 8-week post-therapy follow-up), CANCIDAS was as effective as amphotericin B.

Outcome, relapse and mortality data are shown in Table 13.

**Table 13: Outcomes, Relapse, & Mortality in Candidemia and Other *Candida* Infections (Intra-abdominal abscesses, peritonitis, and pleural space infections)**

	CANCIDAS*	Amphotericin B	% Difference <sup>†</sup> after adjusting for strata (Confidence Interval) <sup>‡</sup>
Number of MITT <sup>§</sup> patients	109	115	
<b>FAVORABLE OUTCOMES (MITT) AT THE END OF IV STUDY THERAPY</b>			
All MITT patients	81/109 (74.3%)	78/115 (67.8%)	7.5 (-5.4, 20.3)
Candidemia	67/92 (72.8%)	63/94 (67.0%)	7.0 (-7.0, 21.1)
Neutropenic	6/14 (43%)	5/10 (50%)	
Non-neutropenic	61/78 (78%)	58/84 (69%)	
Endophthalmitis	0/1	2/3	
Multiple Sites	4/5	4/4	
Blood / Pleural	1/1	1/1	
Blood / Peritoneal	1/1	1/1	
Blood / Urine	-	1/1	
Peritoneal / Pleural	1/2	-	
Abdominal / Peritoneal	-	1/1	
Subphrenic / Peritoneal	1/1	-	
<b>DISSEMINATED INFECTIONS, RELAPSES AND MORTALITY</b>			
Disseminated Infections in neutropenic patients	4/14 (28.6%)	3/10 (30.0%)	
All relapses <sup>¶</sup>	7/81 (8.6%)	8/78 (10.3%)	

Culture-confirmed relapse	5/81 (6%)	2/78 (3%)	
Overall study <sup>#</sup> mortality in MITT	36/109 (33.0%)	35/115 (30.4%)	
Mortality during study therapy	18/109 (17%)	13/115 (11%)	
Mortality attributed to <i>Candida</i>	4/109 (4%)	7/115 (6%)	

\* Patients received CANCIDAS 70 mg on Day 1, then 50 mg once daily for the remainder of their treatment.

† Calculated as CANCIDAS – amphotericin B

‡ 95% CI for candidemia, 95.6% for all patients

§ Modified intention-to-treat

¶ Includes all patients who either developed a culture-confirmed recurrence of *Candida* infection or required antifungal therapy for the treatment of a proven or suspected *Candida* infection in the follow-up period.

# Study defined as study treatment period and 6-8 week follow-up period.

In this study, the efficacy of CANCIDAS in patients with intra-abdominal abscesses, peritonitis and pleural space *Candida* infections was evaluated in 19 non-neutropenic patients. Two of these patients had concurrent candidemia. *Candida* was part of a polymicrobial infection that required adjunctive surgical drainage in 11 of these 19 patients. A favorable response was seen in 9 of 9 patients with peritonitis, 3 of 4 with abscesses (liver, parasplenic, and urinary bladder abscesses), 2 of 2 with pleural space infections, 1 of 2 with mixed peritoneal and pleural infection, 1 of 1 with mixed abdominal abscess and peritonitis, and 0 of 1 with *Candida* pneumonia.

Overall, across all sites of infection included in the study, the efficacy of CANCIDAS was comparable to that of amphotericin B for the primary endpoint.

In this study, the efficacy data for CANCIDAS in neutropenic patients with candidemia were limited. In a separate compassionate use study, 4 patients with hepatosplenic candidiasis received prolonged therapy with CANCIDAS following other long-term antifungal therapy; three of these patients had a favorable response.

In a second randomized, double-blind study, 197 patients with proven invasive candidiasis received CANCIDAS 50 mg/day (following a 70-mg loading dose on Day 1) or CANCIDAS 150 mg/day. The diagnostic criteria, evaluation time points, and efficacy endpoints were similar to those employed in the prior study. Patients with *Candida* endocarditis, meningitis, or osteomyelitis were excluded. Although this study was designed to compare the safety of the two doses, it was not large enough to detect differences in rare or unexpected adverse events [see *Adverse Reactions (6.1)*]. A significant improvement in efficacy with the 150-mg daily dose was not seen when compared to the 50-mg dose.

#### 14.3 Esophageal Candidiasis (and information on oropharyngeal candidiasis)

The safety and efficacy of CANCIDAS in the treatment of esophageal candidiasis was evaluated in one large, controlled, noninferiority, clinical trial and two smaller dose-response studies.

In all 3 studies, patients were required to have symptoms and microbiological documentation of esophageal candidiasis; most patients had advanced AIDS (with CD4 counts <50/mm<sup>3</sup>).

Of the 166 patients in the large study who had culture-confirmed esophageal candidiasis at baseline, 120 had *Candida albicans* and 2 had *Candida tropicalis* as the sole baseline pathogen whereas 44 had mixed baseline cultures containing *C. albicans* and one or more additional *Candida* species.

In the large, randomized, double-blind study comparing CANCIDAS 50 mg/day versus intravenous fluconazole 200 mg/day for the treatment of esophageal candidiasis, patients were treated for an average of 9 days (range 7-21 days). Favorable overall response at 5 to 7 days following discontinuation of study therapy required both complete resolution of symptoms and significant endoscopic improvement. The definition of endoscopic response was based on severity of disease at baseline using a 4-grade scale and required at least a two-grade reduction from baseline endoscopic score or reduction to grade 0 for patients with a baseline score of 2 or less.

The proportion of patients with a favorable overall response was comparable for CANCIDAS and fluconazole as shown in Table 14.

**Table 14: Favorable Response Rates for Patients with Esophageal Candidiasis\***

	CANCIDAS	Fluconazole	% Difference <sup>†</sup> (95% CI)
Day 5-7 post-treatment	66/81 (81.5%)	80/94 (85.1%)	-3.6 (-14.7, 7.5)

\* Analysis excluded patients without documented esophageal candidiasis or patients not receiving at least 1 day of study therapy.

† Calculated as CANCIDAS – fluconazole

The proportion of patients with a favorable symptom response was also comparable (90.1% and 89.4% for CANCIDAS and fluconazole, respectively). In addition, the proportion of patients with a favorable endoscopic response was comparable (85.2% and 86.2% for CANCIDAS and fluconazole, respectively).

As shown in Table 15, the esophageal candidiasis relapse rates at the Day 14 post-treatment visit were similar for the two groups. At the Day 28 post-treatment visit, the group treated with CANCIDAS had a numerically higher incidence of relapse; however, the difference was not statistically significant.

**Table 15: Relapse Rates at 14 and 28 Days Post-Therapy in Patients with Esophageal Candidiasis at Baseline**

	CANCIDAS	Fluconazole	% Difference* (95% CI)
Day 14 post-treatment	7/66 (10.6%)	6/76 (7.9%)	2.7 (-6.9, 12.3)
Day 28 post-treatment	18/64 (28.1%)	12/72 (16.7%)	11.5 (-2.5, 25.4)

\* Calculated as CANCIDAS – fluconazole

In this trial, which was designed to establish noninferiority of CANCIDAS to fluconazole for the treatment of esophageal candidiasis, 122 (70%) patients also had oropharyngeal candidiasis. A favorable response was defined as complete resolution of all symptoms of oropharyngeal disease and all visible oropharyngeal lesions. The proportion of patients with a favorable oropharyngeal response at the 5- to 7-day post-treatment visit was numerically lower for CANCIDAS; however, the difference was not statistically significant. Oropharyngeal candidiasis relapse rates at Day 14 and Day 28 post-treatment visits were statistically significantly higher for CANCIDAS than for fluconazole. The results are shown in Table 16.

**Table 16: Oropharyngeal Candidiasis Response Rates at 5 to 7 Days Post-Therapy and Relapse Rates at 14 and 28 Days Post-Therapy in Patients with Oropharyngeal and Esophageal Candidiasis at Baseline**

	CANCIDAS	Fluconazole	% Difference* (95% CI)
Response Rate Day 5-7 post-treatment	40/56 (71.4%)	55/66 (83.3%)	-11.9 (-26.8, 3.0)
Relapse Rate Day 14 post-treatment	17/40 (42.5%)	7/53 (13.2%)	29.3 (11.5, 47.1)
Relapse Rate Day 28 post-treatment	23/39 (59.0%)	18/51 (35.3%)	23.7 (3.4, 43.9)

\* Calculated as CANCIDAS – fluconazole

The results from the two smaller dose-ranging studies corroborate the efficacy of CANCIDAS for esophageal candidiasis that was demonstrated in the larger study.

CANCIDAS was associated with favorable outcomes in 7 of 10 esophageal *C. albicans* infections refractory to at least 200 mg of fluconazole given for 7 days, although the *in vitro* susceptibility of the infecting isolates to fluconazole was not known.

#### 14.4 Invasive Aspergillosis

Sixty-nine patients between the ages of 18 and 80 with invasive aspergillosis were enrolled in an open-label, noncomparative study to evaluate the safety, tolerability, and efficacy of CANCIDAS. Enrolled patients had previously been refractory to or intolerant of other antifungal therapy(ies). Refractory patients were classified as those who had disease progression or failed to improve despite therapy for at least 7 days with amphotericin B, lipid formulations of amphotericin B, itraconazole, or an investigational azole with reported activity against *Aspergillus*. Intolerance to previous therapy was defined as a doubling of creatinine (or creatinine  $\geq 2.5$  mg/dL while on therapy), other acute reactions, or infusion-related toxicity. To be included in the study, patients with pulmonary disease must have had definite (positive tissue histopathology or positive culture from tissue obtained by an invasive procedure) or probable (positive radiographic or computed tomography evidence with supporting culture from bronchoalveolar lavage or sputum, galactomannan enzyme-linked immunosorbent assay, and/or polymerase chain reaction) invasive aspergillosis. Patients with extrapulmonary disease had to have definite invasive aspergillosis. The definitions were modeled after the Mycoses Study Group Criteria [see References (15)]. Patients were administered a single 70-mg loading dose of CANCIDAS and subsequently dosed with 50 mg daily. The mean duration of therapy was 33.7 days, with a range of 1 to 162 days.

An independent expert panel evaluated patient data, including diagnosis of invasive aspergillosis, response and tolerability to previous antifungal therapy, treatment course on CANCIDAS, and clinical outcome.

A favorable response was defined as either complete resolution (complete response) or clinically meaningful improvement (partial response) of all signs and symptoms and attributable radiographic findings. Stable, nonprogressive disease was considered to be an unfavorable response.

Among the 69 patients enrolled in the study, 63 met entry diagnostic criteria and had outcome data; and of these, 52 patients received treatment for >7 days. Fifty-three (84%) were refractory to previous antifungal therapy and 10 (16%) were intolerant. Forty-five patients had pulmonary disease and 18 had extrapulmonary disease. Underlying conditions were hematologic malignancy (N=24), allogeneic bone marrow transplant or stem cell transplant (N=18), organ transplant (N=8), solid tumor (N=3), or other

conditions (N=10). All patients in the study received concomitant therapies for their other underlying conditions. Eighteen patients received tacrolimus and CANCEIDAS concomitantly, of whom 8 also received mycophenolate mofetil.

Overall, the expert panel determined that 41% (26/63) of patients receiving at least one dose of CANCEIDAS had a favorable response. For those patients who received >7 days of therapy with CANCEIDAS, 50% (26/52) had a favorable response. The favorable response rates for patients who were either refractory to or intolerant of previous therapies were 36% (19/53) and 70% (7/10), respectively. The response rates among patients with pulmonary disease and extrapulmonary disease were 47% (21/45) and 28% (5/18), respectively. Among patients with extrapulmonary disease, 2 of 8 patients who also had definite, probable, or possible CNS involvement had a favorable response. Two of these 8 patients had progression of disease and manifested CNS involvement while on therapy.

CANCEIDAS is effective for the treatment of invasive aspergillosis in patients who are refractory to or intolerant of itraconazole, amphotericin B, and/or lipid formulations of amphotericin B. However, the efficacy of CANCEIDAS for initial treatment of invasive aspergillosis has not been evaluated in comparator-controlled clinical studies.

#### 14.5 Pediatric Patients

The safety and efficacy of CANCEIDAS were evaluated in pediatric patients 3 months to 17 years of age in two prospective, multicenter clinical trials.

The first study, which enrolled 82 patients between 2 to 17 years of age, was a randomized, double-blind study comparing CANCEIDAS (50 mg/m<sup>2</sup> IV once daily following a 70-mg/m<sup>2</sup> loading dose on Day 1 [not to exceed 70 mg daily]) to AmBisome (3 mg/kg IV daily) in a 2:1 treatment fashion (56 on caspofungin, 26 on AmBisome) as empirical therapy in pediatric patients with persistent fever and neutropenia. The study design and criteria for efficacy assessment were similar to the study in adult patients [see *Clinical Studies (14.1)*]. Patients were stratified based on risk category (high-risk patients had undergone allogeneic stem cell transplantation or had relapsed acute leukemia). Twenty-seven percent of patients in both treatment groups were high risk. Favorable overall response rates of pediatric patients with persistent fever and neutropenia are presented in Table 17.

**Table 17: Favorable Overall Response Rates of Pediatric Patients with Persistent Fever and Neutropenia**

	CANCEIDAS	AmBisome*
Number of Patients	56	25
Overall Favorable Response	26/56 (46.4%)	8/25 (32.0%)
High risk	9/15 (60.0%)	0/7 (0.0%)
Low risk	17/41 (41.5%)	8/18 (44.4%)

\*One patient excluded from analysis due to no fever at study entry.

The second study was a prospective, open-label, non-comparative study estimating the safety and efficacy of caspofungin in pediatric patients (ages 3 months to 17 years) with candidemia and other *Candida* infections, esophageal candidiasis, and invasive aspergillosis (as salvage therapy). The study employed diagnostic criteria which were based on established EORTC/MSG criteria of proven or probable infection; these criteria were similar to those criteria employed in the adult studies for these various indications. Similarly, the efficacy time points and endpoints used in this study were similar to those employed in the corresponding adult studies [see *Clinical Studies (14.2, 14.3, and 14.4)*]. All patients received CANCEIDAS at 50 mg/m<sup>2</sup> IV once daily following a 70-mg/m<sup>2</sup> loading dose on Day 1 (not to exceed 70 mg daily). Among the 49 enrolled patients who received CANCEIDAS, 48 were included in the efficacy analysis (one patient excluded due to not having a baseline *Aspergillus* or *Candida* infection). Of these 48 patients, 37 had candidemia or other *Candida* infections, 10 had invasive aspergillosis, and 1 patient had esophageal candidiasis. Most candidemia and other *Candida* infections were caused by *C. albicans* (35%), followed by *C. parapsilosis* (22%), *C. tropicalis* (14%), and *C. glabrata* (11%). The favorable response rate, by indication, at the end of caspofungin therapy was as follows: 30/37 (81%) in candidemia or other *Candida* infections, 5/10 (50%) in invasive aspergillosis, and 1/1 in esophageal candidiasis.

## 15 REFERENCES

1. Mosteller RD: Simplified Calculation of Body Surface Area. N Engl J Med 1987 Oct 22;317(17): 1098 (letter).
2. Clinical and Laboratory Standards Institute (CLSI). *Reference Method for Broth Dilution Antifungal Susceptibility Testing of Yeasts; Approved Standard-Third Edition*. CLSI document M27-A3. Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087, USA, 2008.
3. Clinical and Laboratory Standards Institute (CLSI). *Reference Method for Broth Dilution Antifungal Susceptibility Testing of Yeasts; Third Informational Supplement*. CLSI document M27-S3. Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087, USA, 2008.
4. Denning DW, Lee JY, Hostetler JS, et al. NIAID Mycoses Study Group multicenter trial of oral itraconazole therapy for invasive aspergillosis. Am J Med 1994; 97:135-144.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### How Supplied

CANCIDAS 50 mg is a white to off-white powder/cake for infusion in a vial with a red aluminum band and a plastic cap.

**NDC 0006-3822-10** supplied as one single-use vial.

CANCIDAS 70 mg is a white to off-white powder/cake for infusion in a vial with a yellow/orange aluminum band and a plastic cap.

**NDC 0006-3823-10** supplied as one single-use vial.

### Storage and Handling

#### Vials

The lyophilized vials should be stored refrigerated at 2° to 8°C (36° to 46°F).

#### Reconstituted Concentrate

Reconstituted CANCIDAS in the vial may be stored at ≤25°C (≤77°F) for one hour prior to the preparation of the patient infusion solution.

#### Diluted Product

The final patient infusion solution in the IV bag or bottle can be stored at ≤25°C (≤77°F) for 24 hours or at 2 to 8°C (36 to 46°F) for 48 hours.

## 17 PATIENT COUNSELING INFORMATION

### 17.1 Hypersensitivity


Inform patients that anaphylactic reactions have been reported during administration of CANCIDAS. CANCIDAS can cause hypersensitivity reactions, including rash, facial swelling, angioedema, pruritus, sensation of warmth, or bronchospasm. Inform patients to report these signs or symptoms to their healthcare providers.

### 17.2 Hepatic Effects

Inform patients that there have been isolated reports of serious hepatic effects from CANCIDAS therapy. Physicians will assess the risk/benefit of continuing CANCIDAS therapy if abnormal liver function tests occur during treatment.

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