

## New Zealand Data Sheet

### 1. PRODUCT NAME

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DP-Posaconazole 40 mg/mL Oral Suspension

### 2. QUALITATIVE AND QUANTITATIVE COMPOSITION

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Each mL of oral suspension contains 40 mg of posaconazole.

#### **Excipient(s) with known effect**

DP-Posaconazole Oral Suspension contains liquid glucose. For the full list of excipients, see section 6.1.

### 3. PHARMACEUTICAL FORM

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DP-Posaconazole is a white to off-white oral suspension.

### 4. CLINICAL PARTICULARS

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#### **4.1. Therapeutic indications**

DP-Posaconazole Oral Suspension is indicated for use in the treatment of the following invasive fungal infections in patients 18 years of age or older:

- Invasive aspergillosis in patients with disease that is refractory to, or are intolerant of, amphotericin B, itraconazole or voriconazole.
- Oesophageal candidiasis or candidemia in patients with disease that is refractory to, or who are intolerant of, amphotericin B, fluconazole or itraconazole.
- Fusariosis, zygomycosis, cryptococcosis, chromoblastomycosis, and mycetoma in patients with disease refractory to other therapy, or patients who are intolerant of other therapy.
- Coccidioidomycosis.

DP-Posaconazole Oral Suspension is also indicated for use as:

- Prophylaxis of invasive fungal infections, including both yeasts and moulds, in patients 13 years of age and older who are at high risk of developing these infections, such as patients with prolonged neutropenia or haematopoietic stem cell transplant (HSCT) recipients.

DP-Posaconazole Oral Suspension is also indicated for the use in the treatment of the following fungal infections in patients 18 years of age or older:

- Treatment of oropharyngeal candidiasis in immunocompromised adults, including patients with disease that is refractory to itraconazole and fluconazole.

## 4.2. Dose and method of administration

Co-administration of drugs that can decrease the plasma concentrations of posaconazole should generally be avoided unless the benefit outweighs the risk. If such drugs are necessary, patients should be monitored closely for breakthrough fungal infections (see section 4.5).

### Dose

**Table 1: Recommended Dose for DP-Posaconazole Oral Suspension According to Indication**

Indication	Dose and Duration of Therapy
Refractory Invasive Fungal infections (IFI)/Intolerant Patients with IFI	400 mg (10 mL) twice a day* with food or a nutritional supplement. Dividing the dose further to 200 mg (5 mL) four times a day has been shown to enhance exposure to posaconazole, particularly in patients who have limited oral intake. Duration of therapy should be based on the severity of the underlying disease, recovery from immunosuppression, and clinical response.
Coccidioidomycosis	DP-Posaconazole should be administered at a dose of 400 mg (10 mL) twice a day* with food or a nutritional supplement. Dividing the dose further to 200 mg (5 mL) four times a day has been shown to enhance exposure to posaconazole, particularly in patients who have limited oral intake. Duration of therapy should be based on the severity of the underlying disease, recovery from immunosuppression, and clinical response.
Oropharyngeal Candidiasis	Loading dose of 200 mg (5 mL) once a day on the first day, then 100 mg (2.5 mL) once a day for 13 days.
Refractory Oropharyngeal or Oesophageal Candidiasis	400 mg (10 mL) twice a day*. Duration of therapy should be based on the severity of the patient's underlying disease and clinical response.
Prophylaxis of Invasive Fungal Infections	200 mg (5 mL) three times a day. The duration of therapy is based on recovery from neutropenia or immunosuppression.

\* Increasing the total daily dose above 800 mg does not further enhance the exposure to posaconazole (see section 5.2).

### ***Special populations***

#### Use in renal impairment

No dose adjustment is required for renal dysfunction and as posaconazole is not significantly renally eliminated, an effect of severe renal insufficiency on the pharmacokinetics of posaconazole is not expected and no dose adjustment is recommended (see section 5.2).

#### Use in hepatic impairment

There is limited pharmacokinetic data in patients with hepatic insufficiency; therefore, no recommendation for dose adjustment can be made. In the small number of subjects studied

who had hepatic insufficiency, there was an increase in half-life with a decrease in hepatic function (see section 5.2).

### Use in Paediatrics

Safety and efficacy in adolescents and children below the age of 13 years have not been established.

### Use in the Elderly

No dosage adjustment is recommended for elderly patients (see section 5.2).

### **Method of Administration**

For oral administration only.

DP-Posaconazole Oral Suspension should be administered with a meal, or with 240 mL of a nutritional supplement. Shake well before use.

### **4.3. Contraindications**

DP-Posaconazole Oral Suspension is contraindicated in patients with known hypersensitivity to posaconazole or to any of the excipients.

Co-administration of posaconazole and ergot alkaloids (ergotamine, dihydroergotamine) is contraindicated as posaconazole may increase the plasma concentration of ergot alkaloids, which may lead to ergotism (see section 4.5).

Co-administration with the HMG-CoA reductase inhibitors that are primarily metabolised through CYP3A4 is contraindicated since increased plasma concentration of these drugs can lead to rhabdomyolysis.

Although not studied *in vitro* or *in vivo*, co-administration of posaconazole and certain drugs metabolised through the CYP3A4 system: terfenadine, astemizole, cisapride, pimozone, and quinidine may result in increased plasma concentrations of those drugs, leading to potentially serious and/or life threatening adverse events, such as QT prolongation and rare occurrences of torsade de pointes (see section 4.5).

### **4.4. Special warnings and precautions for use**

#### **Hypersensitivity**

There is no information regarding cross-sensitivity between posaconazole and other azole antifungal agents. Caution should be used when prescribing posaconazole to patients with hypersensitivity to other azoles.

### **Hepatic toxicity**

In clinical trials, there were infrequent cases of hepatic reactions (e.g. mild to moderate elevations in ALT, AST, alkaline phosphatase, total bilirubin, and/or clinical hepatitis) during treatment with posaconazole. Elevated liver function tests were generally reversible on discontinuation of therapy and in some instances these tests normalized without interruption of therapy and rarely required drug discontinuation. Rarely, more severe hepatic reactions (including cases that have progressed to fatal outcomes) were reported in patients with serious underlying medical conditions (e.g. haematological malignancy) during treatment with posaconazole.

### **QT prolongation**

Some azoles have been associated with prolongation of the QTc interval on the electrocardiogram (ECG). Results from a multiple time-matched ECG analysis in healthy volunteers did not show an increase in the mean QTc interval. Nevertheless, posaconazole should not be administered with medications that are known to prolong the QTc interval and are metabolised through the CYP3A4 system (see sections 4.3, 4.5 and 5.2).

### **Electrolyte disturbances**

Disturbances involving potassium, magnesium or calcium levels should be monitored and corrected as necessary before and during posaconazole therapy.

### **Vincristine toxicity**

Concomitant administration of azole antifungals, including posaconazole, with vincristine has been associated with neurotoxicity and other serious adverse reactions, including seizures, peripheral neuropathy, syndrome of inappropriate antidiuretic hormone secretion, and paralytic ileus. Reserve azole antifungals, including posaconazole, for patients receiving a vinca alkaloid, including vincristine, who have no alternative antifungal treatment options (see section 4.5).

### **Venetoclax Toxicity**

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Concomitant administration of posaconazole with venetoclax (a CYP3A4 substrate) may increase venetoclax toxicities, including the risk of tumor lysis syndrome (TLS) and neutropenia (see section 4.5). Refer to the venetoclax prescribing information for detailed guidance.

### **Paediatric Use**

Safety and effectiveness in paediatric patients below the age of 13 years have not been established (see section 5.2).

### **Use in the Elderly**

No dosage adjustment is recommended for geriatric patients (see section 5.2).

## **4.5. Interaction with other medicines and other forms of interaction**

## **Effect of Other Drugs on Posaconazole oral suspension**

Posaconazole is metabolised via UDP glucuronidation (phase 2 enzymes) and is a substrate for p-glycoprotein (P-gp) efflux. Therefore, inhibitors or inducers of these clearance pathways may affect posaconazole plasma concentrations.

### ***Rifabutin***

Rifabutin (300 mg once a day) decreased the  $C_{max}$  (maximum plasma concentration) and AUC (area under the plasma concentration time curve) of posaconazole by 43 % and 49 %, respectively. Concomitant use of posaconazole and rifabutin should be avoided unless the benefit to the patient outweighs the risk.

### ***Phenytoin***

Phenytoin (200 mg once a day) decreased the  $C_{max}$  and AUC of posaconazole by 41 % and 50 %, respectively. Concomitant use of posaconazole and phenytoin should be avoided unless the benefit to the patient outweighs the risk.

### ***H<sub>2</sub> receptor antagonists, proton pump inhibitors and antacids***

Posaconazole plasma concentrations ( $C_{max}$  and AUC) were reduced by 39 % when posaconazole oral suspension was administered with cimetidine (400 mg twice a day) due to reduced absorption possibly secondary to a decrease in gastric acid production. Co-administration of posaconazole oral suspension with H<sub>2</sub> receptor antagonists should be avoided if possible.

A 20 mL single dose of liquid antacid, equivalent to 25.4 mEq acid neutralizing capacity/5mL, had no clinically significant effect on posaconazole oral suspension  $C_{max}$  and AUC. No dosage adjustments are required.

Similarly, administration of 400 mg posaconazole oral suspension with esomeprazole (40 mg daily) decreased mean  $C_{max}$  and AUC by 46 % and 32 %, respectively, compared to dosing with 400 mg posaconazole alone. Co-administration of posaconazole oral suspension with proton pump inhibitors should be avoided if possible.

### ***Gastrointestinal Motility Agents***

Metoclopramide, when given with posaconazole oral suspension, decreases posaconazole plasma concentrations. If metoclopramide is concomitantly administered with posaconazole oral suspension, it is recommended to closely monitor for breakthrough fungal infections.

Loperamide does not affect posaconazole plasma concentrations. No dosage adjustment of posaconazole is required when loperamide and posaconazole are used concomitantly.

### ***Glipizide***

Glipizide (10 mg single dose) had no clinically significant effect on posaconazole  $C_{max}$  and AUC. No posaconazole dosage adjustments are required.

### ***Ritonavir***

Ritonavir (600 mg twice a day) had no clinically significant effect on posaconazole  $C_{max}$  and AUC. No posaconazole dosage adjustments are required.

### ***Efavirenz***

Efavirenz (400 mg once a day) decreased the  $C_{max}$  and AUC of posaconazole by 45% and 50%, respectively. Concomitant use of posaconazole and efavirenz should be avoided unless the benefit to the patient outweighs the risk.

### ***Fosamprenavir***

Combining fosamprenavir with posaconazole may lead to decreased posaconazole plasma concentrations. If concomitant administration is required, close monitoring for breakthrough fungal infections is recommended. Repeat dose administration of fosamprenavir (700 mg twice a day for 10 days) decreased the  $C_{max}$  and AUC of posaconazole (200 mg once a day on the 1st day, 200 mg twice a day on the 2nd day, then 400 mg twice a day for 8 days) by 21 % and 23 %, respectively.

### **Effects of Posaconazole oral suspension on Other Drugs**

Posaconazole is not metabolised to a clinically significant extent through the cytochrome P450 system. However, posaconazole is an inhibitor of CYP3A4 and thus the plasma levels of drugs that are metabolised through this enzyme pathway may increase when administered with posaconazole.

### **Famotidine**

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Co-administration of posaconazole oral-suspension with famotidine should be avoided if possible, since famotidine may reduce the absorption of posaconazole oral-suspension during concomitant use.

### **Flucloxacillin**

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Flucloxacillin has been reported to significantly decrease plasma posaconazole concentrations. If concomitant administration of flucloxacillin with Posaconazole cannot be avoided, monitor for potential loss of posaconazole effectiveness (e.g. by therapeutic drug monitoring); increasing the dose of posaconazole may be needed.”

### ***Terfenadine, astemizole, cisapride, pimozone, and quinidine***

Although not studied in vitro or in vivo, co-administration of posaconazole and certain drugs such as terfenadine, astemizole, cisapride, pimozone, and quinidine, metabolised through the CYP3A4 system may result in increased plasma concentrations of these drugs, leading to potentially serious and/or life threatening adverse events (QT prolongation and rare occurrences of torsade de pointes). Therefore, co-administration of these drugs with posaconazole is contraindicated (see section 4.3).

### ***Ergot alkaloids***

Although not studied in vitro or in vivo, posaconazole may increase the plasma concentration of ergot alkaloids (ergotamine and dihydroergotamine), which may lead to ergotism. Co-administration of posaconazole and ergot alkaloids is contraindicated (see section 4.3).

### ***Vinca alkaloids***

Most of the vinca alkaloids (e.g. vincristine and vinblastine) are substrates of CYP3A4. Concomitant administration ofazole antifungals, including posaconazole, with vincristine has been associated with serious adverse reactions (see section 4.4). Posaconazole may increase the plasma concentrations of vinca alkaloids which may lead to neurotoxicity and other serious adverse reactions. Therefore, reserveazole antifungals, including posaconazole, for patients receiving a vinca alkaloid, including vincristine, who have no alternative antifungal treatment options.

### ***Cyclosporine***

In heart transplant patients on stable doses of cyclosporine, posaconazole 200 mg oral suspension once daily increased cyclosporine concentrations requiring dose reductions. When initiating treatment with posaconazole in patients already receiving cyclosporine, the dose of cyclosporine should be reduced (e.g. to about three quarters of the current dose). Thereafter blood levels of cyclosporine should be monitored carefully during co-administration, and upon discontinuation of posaconazole treatment, and the dose of cyclosporine should be adjusted as necessary.

### ***Tacrolimus***

Posaconazole increased  $C_{max}$  and AUC of tacrolimus (0.05 mg/kg single dose) by 121 % and 358 %, respectively. When initiating posaconazole treatment in patients already receiving tacrolimus, the dose of tacrolimus should be reduced (e.g. to about one third of the current dose). Thereafter blood levels of tacrolimus should be monitored carefully during co-administration, and upon discontinuation of posaconazole, and the dose of tacrolimus should be adjusted as necessary.

### ***Sirolimus***

Repeat dose administration of oral posaconazole (400 mg oral suspension twice daily for 16 days) increased the  $C_{max}$  and AUC of sirolimus (2 mg single dose) an average of 6.7-fold and 8.9 fold, respectively, in healthy subjects. When initiating therapy in patients already taking sirolimus, the dose of sirolimus should be reduced (e.g. to about 1/10 of the current dose) with frequent monitoring of sirolimus whole blood trough concentrations. Sirolimus concentrations

should be performed upon initiation, during co-administration, and at discontinuation of posaconazole treatment, with sirolimus doses adjusted accordingly.

### ***Rifabutin***

Posaconazole increased the  $C_{max}$  and AUC of rifabutin by 31 % and 72 %, respectively. Concomitant use of posaconazole and rifabutin should be avoided unless the benefit to the patient outweighs the risk. If the drugs are co-administered, careful monitoring of full blood counts and adverse effects related to increased rifabutin levels (e.g. uveitis) is recommended.

### ***Midazolam***

Repeat dose administration of oral posaconazole (200 mg oral suspension twice daily for 7 days) increased the  $C_{max}$  and AUC of IV midazolam (0.4 mg single dose) an average of 1.3- and 4.6-fold, respectively. Posaconazole 400 mg oral suspension twice daily for 7 days increased the IV midazolam  $C_{max}$  and AUC by 1.6- and 6.2-fold, respectively. Both doses of posaconazole increased  $C_{max}$  and AUC of oral midazolam (2 mg single oral dose) by 2.2- and 4.5-fold, respectively. In addition, oral posaconazole (200 mg or 400 mg oral suspension) prolonged the mean terminal half-life of midazolam from approximately 3-4 hours to 8-10 hours during co-administration. It is recommended that dose adjustments of benzodiazepines, metabolised by CYP3A4, be considered during co-administration with posaconazole.

### ***Zidovudine (AZT), lamivudine (3TC), indinavir***

In HIV infected patients on stable doses of zidovudine (300 mg twice a day or 200 mg every 8 hours), lamivudine (150 mg twice a day), and/or indinavir (800 mg every 8 hours), posaconazole had no clinically significant effect on the  $C_{max}$  and AUC of these medicinal products.

### ***HMG-CoA reductase inhibitors primarily metabolised through CYP3A4***

Repeat dose administration of oral posaconazole (50, 100, and 200 mg oral suspension once daily for 13 days) increased the  $C_{max}$  and AUC of simvastatin (40 mg single dose) an average of 7.4- to 11.4-fold, and 5.7- to 10.6-fold, respectively. Increased HMG-CoA reductase inhibitor concentrations in plasma can be associated with rhabdomyolysis. Co-administration of posaconazole and HMG-CoA reductase inhibitors primarily metabolised through CYP3A4 is contraindicated.

### ***Calcium channel blockers metabolised through CYP3A4***

Although not studied in vitro or in vivo, frequent monitoring for adverse effects and toxicity related to calcium channel blockers is recommended during co-administration with posaconazole. Dose adjustment of calcium channel blockers may be required.

### ***HIV Protease Inhibitors***

As HIV protease inhibitors are CYP3A4 substrates, it is expected that posaconazole will increase plasma levels of these antiretroviral agents. Repeat dose administration of oral posaconazole (400 mg oral suspension twice daily for 7 days) increased the  $C_{max}$  and AUC of atazanavir (300 mg once a day for 7 days) an average of 2.6-fold and 3.7-fold, respectively, in healthy subjects. Repeat dose administration of oral posaconazole (400 mg oral suspension twice daily for 7 days) increased the  $C_{max}$  and AUC of atazanavir to a lesser extent when administered as a boosted regimen with ritonavir (300 mg atazanavir plus ritonavir 100 mg once a day for 7 days) with an average of 1.5-fold and 2.5-fold, respectively, in healthy subjects. Frequent monitoring for adverse events and toxicity related to antiretroviral agents that are substrates of CYP3A4 is recommended during co-administration with posaconazole.

### ***Digoxin***

Administration of other azoles has been associated with increases in digoxin levels. Therefore, posaconazole may increase plasma concentration of digoxin and digoxin levels need to be monitored when initiating or discontinuing posaconazole treatment.

### **Venetoclax**

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Concomitant administration of posaconazole with venetoclax (a CYP3A4 substrate) increases venetoclax  $C_{max}$  and  $AUC_{0-12h}$  (see section 4.4).

## **4.6. Fertility, pregnancy and lactation**

### **Pregnancy**

Category B3. There is insufficient information on the use of posaconazole in pregnant women. Studies in animals have shown reproductive toxicity (see section 5.3). Posaconazole has been shown to cause skeletal malformations in rats at exposures lower than those obtained at therapeutic doses in humans. In rabbits, posaconazole was embryotoxic at exposures greater than those obtained at therapeutic doses. The potential risk to humans is unknown. Posaconazole must not be used during pregnancy unless the benefit to the mother clearly outweighs the potential risk to the foetus.

### ***Pregnancy categorisation definition***

Category B3: Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed. Studies in animals have shown evidence of an increased occurrence of foetal damage, the significance of which is considered uncertain in humans.

### ***Women of childbearing potential***

Women of childbearing potential must always use effective contraceptive measures during treatment with posaconazole.

### **Breast-feeding**

Posaconazole is excreted in milk of lactating rats. The excretion of posaconazole in human breast milk has not been investigated. Posaconazole should not be used by nursing mothers unless the benefit to the mother clearly outweighs the potential risk to the infant.

### **Fertility**

Posaconazole had no effect on fertility of male and female rats.

#### **4.7. Effects on ability to drive and use machines**

Since certain adverse reactions (e.g. dizziness, somnolence, etc.) have been reported with posaconazole use, which potentially may affect driving/operating machinery, caution needs to be used.

#### **4.8. Undesirable effects**

The safety of posaconazole oral suspension has been assessed in 2,400 patients and healthy volunteers enrolled in clinical trials and from post-marketing experience. One hundred and seventy-two patients received posaconazole oral suspension therapy for  $\geq 6$  months; 58 of these received posaconazole oral suspension therapy for  $\geq 12$  months.

Serious adverse events that were considered treatment related were reported in 8 % (35/428) of patients in the refractory invasive fungal infection pool. Most individual treatment related serious adverse events were reported by  $<1$  % of patients and are largely reflective of the serious underlying conditions that predisposed to the development of the invasive fungal infection. Treatment related serious adverse events reported in 1 % of subjects (3 or 4 subjects each) included altered concentration of other medicinal products, increased hepatic enzymes, nausea, rash, and vomiting. Treatment-related serious adverse events reported in 605 patients treated with posaconazole oral suspension for prophylaxis (1 % each) included bilirubinaemia, increased hepatic enzymes, hepatocellular damage, nausea, and vomiting.

Uncommon and rare treatment related medically significant adverse events reported during clinical trials with posaconazole oral suspension have included adrenal insufficiency, pancreatitis, allergic and/or hypersensitivity reactions.

Some azoles have been associated with prolongation of the QT interval on the electrocardiogram. A pooled analysis of 173 posaconazole oral suspension-dosed healthy volunteers utilizing time matched ECGs did not show a potential to prolong the QT interval. In addition, rare cases of torsade de pointes have been reported in patients taking posaconazole.

In addition, rare cases of haemolytic uraemic syndrome and thrombotic thrombocytopenic purpura have been reported primarily among patients who had been receiving concomitant cyclosporine or tacrolimus for management of transplant rejection or graft vs. host disease.

### **Treatment-related adverse reactions (TRAEs) reported in posaconazole studies**

The most common treatment-related adverse reactions reported in posaconazole studies across the whole population of healthy volunteers and patients are shown in Table 2.

**Table 2: Treatment-related adverse reactions reported in posaconazole dosed subjects by body system. Common (>1/100, <1/10)**

Blood and lymphatic system disorders	
Common	Neutropenia
Metabolism and nutrition disorders	
Common	Anorexia, electrolyte imbalance, hypokalaemia
Nervous system disorders	
Common	Dizziness, headache, paraesthesia, somnolence
Gastrointestinal disorders	
Common	Abdominal pain, diarrhoea, dyspepsia, flatulence, dry mouth, nausea, vomiting, constipation
Hepatobiliary disorders	
Common	Elevated liver function tests (including AST, ALT, alkaline phosphatase, GGT, bilirubin)
Skin and subcutaneous tissue disorders	
Common	Rash, pruritus
General disorders and administration site conditions	
Common	Asthenia, fatigue, pyrexia (fever)

### **Clinical Laboratory Values**

In (uncontrolled) trials of patients with invasive fungal infections treated with posaconazole oral suspension doses of 800 mg/day, the incidence of clinically significant liver function test abnormalities was; ALT and AST (> 3 X Upper Limit Normal {ULN}) 11 % and 10 %, respectively; total bilirubin (> 1.5 X ULN) 22 %; and alkaline phosphatase (> 3 X ULN) 14 %. In healthy volunteers, elevation of hepatic enzymes did not appear to be associated with higher plasma concentrations of posaconazole. In patients, the majority of abnormal liver function tests results showed minor and transient changes and rarely led to discontinuation of therapy.

In the comparative trials of patients infected with HIV (or another indication) treated with posaconazole oral suspension at doses up to 400 mg, the incidence of clinically significant liver function test abnormalities was as follows; ALT and AST (> 3 X ULN), 3 % and 6 %, respectively; total bilirubin (> 1.5 X ULN), 3 %; and alkaline phosphatase (> 3 X ULN), 3 %.

### **Post-marketing Experience**

The following post-marketing adverse experience has been reported:

Endocrine Disorders: pseudoaldosteronism

### **Reporting of suspected adverse reactions**

Reporting suspected adverse reactions after authorisation of the medicine is important. It allows continued monitoring of the benefit/risk balance of the medicine. Healthcare professionals are asked to report any suspected reactions <https://nzphvc.otago.ac.nz/reporting/>

## 4.9. Overdose

During clinical trials, some patients received posaconazole oral suspension doses up to 1600 mg/day with no adverse reactions noted that were different from the lower doses. In addition, accidental overdose was noted in one patient who took 1200 mg posaconazole oral suspension twice a day for 3 days. No adverse reactions were noted by the investigator.

In a trial of patients with severe haemodialysis-dependent renal dysfunction (Cl<sub>cr</sub> < 20 mL/min), posaconazole was not removed by haemodialysis. Thus, haemodialysis is unlikely to be effective in removing posaconazole from the systemic circulation.

Posaconazole is not removed by haemodialysis.

For advice on the management of overdose please contact the National Poisons Centre on 0800 POISON (0800 764766).

## 5. PHARMACOLOGICAL PROPERTIES

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### 5.1. Pharmacodynamic properties

Pharmacotherapeutic group: Anti-infective for systemic use, triazole derivative; ATC code: J02AC04

#### **Mechanism of action**

Posaconazole is a triazole antifungal agent. It is a potent inhibitor of the enzyme lanosterol 14 $\alpha$ -demethylase, which catalyses an essential step in ergosterol biosynthesis. Ergosterol depletion, coupled with the accumulation of methylated sterol precursors, is thought to impair membrane integrity and the function of some membrane-associated proteins. This results in the inhibition of cell growth and/or cell death.

#### **Microbiology**

Posaconazole has been shown *in vitro* and in clinical infections to be active against the following micro-organisms: (see section 4.1): *Aspergillus* species (*Aspergillus fumigatus*, *A. flavus*, *A. terreus*, *A. nidulans*, *A. niger*, *A. ustus*, *A. ochraceus*), *Candida* species (*Candida albicans*, *C. glabrata*, *C. krusei*, *C. parapsilosis*), *Cryptococcus neoformans*, *Coccidioides immitis*, *Fonsecaea pedrosoi*, *Histoplasma capsulatum*, *Pseudallescheria boydii* and species of *Alternaria*, *Exophiala*, *Fusarium*, *Ramichloridium*, *Rhizomucor*, *Mucor*, and *Rhizopus*.

Posaconazole also exhibits *in vitro* activity against the following yeasts and moulds: *Candida dubliniensis*, *C. famata*, *C. guilliermondii*, *C. lusitaniae*, *C. kefyr*, *C. rugosa*, *C. tropicalis*, *C. zeylanoides*, *C. inconspicua*, *C. lipolytica*, *C. norvegensis*, *C. pseudotropicalis*, *Cryptococcus laurentii*, *Kluyveromyces marxianus*, *Saccharomyces cerevisiae*, *Yarrowia lipolytica*, species of

*Pichia*, and *Trichosporon*, *Aspergillus sydowii*, *Bjerkandera adusta*, *Blastomyces dermatitidis*, *Epidermophyton floccosum*, *Paracoccidioides brasiliensis*, *Scedosporium apiospermum*, *Sporothrix schenckii*, *Wangiella dermatitidis* and species of *Absidia*, *Apophysomyces*, *Bipolaris*, *Curvularia*, *Microsporum*, *Paecilomyces*, *Penicillium*, and *Trichophyton*. However, the safety and effectiveness of posaconazole in treating clinical infections due to these micro-organisms have not been established in clinical trials.

Posaconazole exhibits broad-spectrum antifungal activity against some yeasts and moulds not generally responsive to azoles, or resistant to other azoles:

- species of *Candida* (including *C. albicans* isolates resistant to fluconazole, voriconazole and itraconazole,
- *C. krusei* and *C. glabrata* which are inherently less susceptible to fluconazole,
- *C. lusitanae* which is inherently less susceptible to amphotericin B),
- *Aspergillus* (including isolates resistant to fluconazole, voriconazole, itraconazole and amphotericin B)
- organisms not previously regarded as being susceptible to azoles such as the zygomycetes (e.g. species of *Absidia*, *Mucor*, *Rhizopus* and *Rhizomucor*).

*In vitro* posaconazole exhibited fungicidal activity against species of:

- *Aspergillus*,
- dimorphic fungi (*Blastomyces dermatitidis*, *Histoplasma capsulatum*, *Penicillium marneffeii*,
- *Coccidioides immitis*)
- some species of *Candida*

In animal infection models posaconazole was active against a wide variety of fungal infections caused by moulds or yeasts. However, there was no consistent correlation between minimum inhibitory concentration and efficacy.

Specimens for fungal culture and other relevant laboratory studies (including histopathology) should be obtained prior to therapy to isolate and identify causative organism(s). Therapy may be instituted before the results of the cultures and other laboratory studies are known. However, once these results become available, antifungal therapy should be adjusted accordingly.

### **Drug Resistance**

*C. albicans* strains resistant to posaconazole could not be generated in the laboratory; spontaneous laboratory *Aspergillus fumigatus* mutants exhibiting a decrease in susceptibility to posaconazole arose at a frequency of  $1 \times 10^{-8}$  to  $1 \times 10^{-9}$ . Clinical isolates of *Candida albicans* and *Aspergillus fumigatus* exhibiting significant decreases in posaconazole susceptibility are rare. In those rare instances where decreased susceptibility was noted, there was no clear correlation between decreased susceptibility and clinical failure. Clinical success has been observed in patients infected with organisms resistant to other azoles; consistent with these observations posaconazole was active *in vitro* against many *Aspergillus* and *Candida* strains that developed

resistance to other azoles and/or amphotericin B. Breakpoints for posaconazole have not been established for any fungi.

### ***Antifungal drug combinations***

When combinations of posaconazole with either amphotericin B or caspofungin were tested *in vitro* and *in vivo* there was little or no antagonism and in some instances there was an additive effect. The clinical significance of these results is unknown.

### **Clinical efficacy and safety**

#### ***Invasive Aspergillosis***

Efficacy in patients with refractory disease or intolerance to prior therapy: The efficacy and survival benefit of oral posaconazole for the treatment of invasive aspergillosis in patients with disease refractory to amphotericin B (including liposomal formulations), itraconazole or voriconazole or in patients who were intolerant of these medicinal products, was demonstrated in 107 patients enrolled in a salvage therapy trial. Patients were administered posaconazole 800 mg/day in divided doses for up to 585 days.

The majority of patients were severely immunocompromised with underlying conditions such as haematological malignancies, including bone marrow transplantation; solid organ transplantation; solid tumours and/or AIDS. An independent expert panel reviewed all patient data, including diagnosis of invasive aspergillosis, refractoriness and intolerance to previous therapy, and clinical outcome in a parallel and blinded fashion with an external control group of 86 patients treated with standard therapy mostly at the same time and at the same sites as the patients enrolled in the posaconazole trial. A success was defined as either complete resolution (complete response) or a clinically meaningful improvement (partial response) of all signs, symptoms and radiographic findings attributable to the fungal infection. Stable, non-progressive disease and failure were considered to be a non-success. Most of the cases of aspergillosis were considered to be refractory in both the posaconazole group (88 %) and in the external control group (79 %). As shown in Table 3, a successful global response at end of treatment was seen in 42 % of posaconazole-treated patients compared to 26 % of the external group (P=0.006).

At one year, the survival rate for posaconazole was 38 % compared to 22 % for the external control group. However, this was not a prospective, randomised controlled study and so all comparisons with the external control group must be viewed in this context.

**Table 3: Overall efficacy of posaconazole oral suspension at the end of treatment\* for invasive aspergillosis in comparison to an external control group**

	Posaconazole Oral Suspension	External Control Group
Overall Response	45/107 (42 %)	22/86 (26 %)
Odds Ratio 4.06 (95 % CI: 1.50, 11.04) P=0.006		
<b>Survival at day 365</b>	(38 %)	(22 %)
<b>Success by Species</b>		

	Posaconazole Oral Suspension		External Control Group	
All mycologically confirmed <i>Aspergillus spp.</i> *	34/76	(45 %)	19/74	(26 %)
<i>A. fumigatus</i>	12/29	(41 %)	12/34	(35 %)
<i>A. flavus</i>	10/19	(53 %)	3/16	(19 %)
<i>A. terreus</i>	4/14	(29 %)	2/13	(15 %)
<i>A. niger</i>	3/5	(60 %)	2/7	(29 %)

\* includes other less common species or species unknown

### ***Other Serious Fungal Pathogens***

Posaconazole oral suspension has been shown to be effective against the following additional pathogens when other therapy had been ineffective or when the patient had developed intolerance of the prior therapy:

#### Candida

11 of 23 (48 %) patients were successfully treated with posaconazole. Of the responders, 5 were HIV infected patients with oesophageal disease and 4 were patients with candidemia. Furthermore, in fluconazole-resistant non *albicans* species a successful outcome was noted in 4/5 cases with *C. krusei* infection.

#### Zygomycosis

Successful responses to posaconazole oral suspension therapy were noted in 7/13 (54 %) of patients with zygomycete infections. Sites of infection included the sinuses, lung, and skin. Organisms included Rhizopus, Mucor and Rhizomucor. Most of the patients had underlying haematological malignancies, half of which required a bone marrow transplant. Half of the patients were enrolled with intolerance to previous therapy and the other half as a result of disease that was refractory to prior therapy. Three patients were noted to have disseminated disease, one of which had a successful outcome after failing amphotericin B therapy.

#### Fusarium spp.

Successful responses to posaconazole oral suspension therapy were seen in 11 of 24 (46 %) of patients with fusariosis. Four of the responders had disseminated disease and one patient had disease localized to the eye; the remainder had a variety of sites of infection. Seven of 24 patients had profound neutropenia at baseline. In addition, 3/5 patients with infection due to *F. solani* which is typically resistant to most antifungal agents, were successfully treated.

#### Cryptococcus

Successful responses to posaconazole oral suspension therapy were seen in 15 of 31 (48 %) of patients with cryptococcus. Most of the patients were HIV infected with refractory cryptococcal meningitis.

#### Chromoblastomycosis/Mycetoma

Successful responses to posaconazole oral suspension therapy were seen in 9 of 11 (82 %) of patients with chromoblastomycosis or mycetoma. Five of these patients had chromoblastomycosis due to *Fonsecaea pedrosoi* and 4 had mycetoma, mostly due to *Madurella* species.

### Coccidioidomycosis

The efficacy of posaconazole oral suspension in the primary treatment of non-meningeal coccidioidomycosis was demonstrated in 15 clinically evaluable patients enrolled in an open-label, non-comparative trial to receive posaconazole 400 mg daily for 6 months. Most patients were otherwise healthy and had infections at a variety of sites. A satisfactory response (defined as an improvement of at least 50 % of the Cocci score as defined by the BAMSG Coccidioidomycosis trial group) was seen in 12 of 15 patients (80 %) after an average of 4 months of posaconazole treatment. In a separate open-label, non-comparative trial, the safety and efficacy of posaconazole 400 mg twice a day was assessed in 16 patients with coccidioidomycosis infection refractory to standard treatment. Most had been treated with amphotericin B (including lipid formulations) and/or itraconazole or fluconazole for months to years prior to posaconazole treatment. At the end of treatment with posaconazole, a satisfactory response (complete or partial resolution of signs and symptoms present at baseline) as determined by an independent panel was achieved for 11/16 (69 %) of patients. One patient with CNS disease that had failed fluconazole therapy had a successful outcome following 12 months of posaconazole therapy.

### ***Treatment of Azole-susceptible Oropharyngeal Candidiasis (OPC)***

A randomised, double-blind, controlled study was completed in HIV-infected patients with azole-susceptible oropharyngeal candidiasis. The primary efficacy variable was the clinical success rate (defined as cure or improvement) after 14 days of treatment. Patients were treated with posaconazole or fluconazole oral suspension (both posaconazole and fluconazole were given as follows: 100 mg twice a day for 1 day followed by 100 mg once a day for 13 days).

The clinical and mycological response rates from the above study are shown in Table 4 below. Posaconazole and fluconazole demonstrated equivalent clinical success rates at Day 14 as well as 4 weeks after the end of treatment. However, posaconazole oral suspension demonstrated a significantly better sustained mycological response rate than fluconazole.

**Table 4: Clinical Success Rates and Mycological Response Rates in Oropharyngeal Candidiasis**

Endpoint	Posaconazole Oral Suspension	Fluconazole
Clinical Success Rate at Day 14	91.7 % (155/169)	92.5 % (148/160)
Clinical Success Rate 4 Weeks After End of Treatment	68.5 % (98/143)	61.8 % (84/136)
Mycological Response Rate 4 Weeks After End of Treatment*	40.6 % (41/101)	26.4 % (24/91)

\*Statistically significant (P=0.0376)

Clinical success rate was defined as the number of cases assessed as having a clinical response (cure or improvement) divided by the total number of cases eligible for analysis.

Mycological response rate was defined as mycological success ( $\leq 20$  CFU/ml) divided by the total number of cases eligible for analysis.

### ***Treatment of Azole-refractory Oropharyngeal Candidiasis (rOPC) (Studies 330 and 298)***

The primary efficacy parameter in Study 330 was the clinical success rate (cure or improvement) after 4 weeks of treatment. HIV-infected patients were treated with posaconazole oral suspension 400 mg twice a day with an option for further treatment during a 3-month maintenance period. A 75 % (132/176) clinical success rate and a 36.5 % (46/126) mycological response rate ( $\leq 20$  CFU/ml) were achieved after 4 weeks of posaconazole treatment. Clinical success rates ranged from 71 % to 100 %, inclusive, for all azole-resistant *Candida* species identified at Baseline, including *C. glabrata* and *C. krusei*.

Of the total patients treated in this study, 43 had azole-refractory oesophageal candidiasis (EC), either alone or in combination with OPC. All patients with azole-refractory EC had endoscopically confirmed EC at baseline. The clinical success rate after 4 weeks was 74.4 %.

In Study 298 the primary efficacy endpoint was the clinical success rate (cure or improvement) after 3 months of treatment. A total of 100 HIV-infected patients with OPC and/or EC were treated with posaconazole 400 mg twice a day for up to 15 months. Sixty of these patients had been previously treated in Study 330. An 85.6 % (77/90) clinical success rate overall (cure or improvement) was achieved after 3 months of posaconazole treatment; 80.6 % (25/31) for previously untreated subjects.

The mean exposure to posaconazole based on the actual days dosed was 102 days (range: 1-544 days). Sixty-seven percent (67 %, 10/15) of patients treated with posaconazole for at least 12 months had continued clinical success at the last assessment.

Of the patients treated in Study 298, 15 with azole-refractory EC had been previously treated in Study 330. Sixty-seven percent (67 %, 10/15) were considered cured by the end of treatment and 33 % (5/15) were considered improved. For those patients, treatment durations ranged from 81 to 651 days.

### ***Prophylaxis of Invasive Fungal Infections (IFIs) (Studies 316 and 1899)***

Two large, randomised, controlled studies were conducted using posaconazole oral suspension as prophylaxis for the prevention of IFIs among patients at high risk.

Study 316 was a randomised, double-blind trial that compared posaconazole oral suspension (200 mg three times a day) with fluconazole capsules (400 mg once daily) as prophylaxis against invasive fungal infections in allogeneic HSCT recipients with graft-versus-host disease (GVHD). The primary efficacy endpoint was the incidence of proven/probable IFIs at 16 weeks post-

randomisation as determined by an independent, blinded external expert panel. A key secondary endpoint was the incidence of proven/probable IFIs during the on-treatment period (first dose to last dose of study medication + 7 days). The mean duration of therapy was comparable between the two treatment groups (80 days, posaconazole; 77 days, fluconazole). Study 1899 was a randomised, evaluator-blinded study that compared posaconazole oral suspension (200 mg three times a day) with fluconazole suspension (400 mg once daily) or itraconazole oral solution (200 mg twice a day) as prophylaxis against IFIs in neutropenic patients who were receiving cytotoxic chemotherapy for acute myelogenous leukaemia or myelodysplastic syndromes. The primary efficacy endpoint was the incidence of proven/probable IFIs as determined by an independent, blinded external expert panel during the on-treatment period. A key secondary endpoint was the incidence of proven/probable IFIs at 100 days post-randomisation. The mean duration of therapy was comparable between the two treatment groups (29 days, posaconazole; 25 days, fluconazole/itraconazole).

In both prophylaxis studies, aspergillosis was the most common breakthrough infection. There were significantly fewer breakthrough *Aspergillus* infections in patients receiving posaconazole prophylaxis when compared to control patients receiving fluconazole or itraconazole. See Table 5 for results from both studies.

**Table 5: Results from Clinical Studies in Prophylaxis of Invasive Fungal Infections**

Study	Posaconazole Oral Suspension	Control <sup>a</sup>	P-Value
<b>Proportion (%) of Patients With Proven/Probable IFIs</b>			
<b>On-Treatment Period<sup>b</sup></b>			
1,899 <sup>d</sup>	7/304 (2)	25/298 (8)	0.0009
316 <sup>e</sup>	7/291 (2)	22/288 (8)	0.0038
<b>Fixed-Time Period<sup>c</sup></b>			
1,899 <sup>d</sup>	14/304 (5)	33/298 (11)	0.0031
316 <sup>d</sup>	16/301 (5)	27/299 (9)	0.0740
<b>Proportion (%) of Patients With Proven/Probable Aspergillosis</b>			
<b>On-Treatment Period<sup>b</sup></b>			
1,899 <sup>d</sup>	2/304 (1)	20/298 (7)	0.0001
316 <sup>e</sup>	3/291 (1)	17/288 (6)	0.0013
<b>Fixed-Time Period<sup>c</sup></b>			
1,899 <sup>d</sup>	4 /304 (1)	26 /298 (9)	< 0.0001
316 <sup>d</sup>	7/301 (2)	21/299 (7)	0.0059

FLU = fluconazole; ITZ = itraconazole; POS = posaconazole.

a: FLU/ITZ (1899); FLU (316).

b: In 1899 this was the period from randomization to last dose of study medication plus 7 days; in 316 it was the period from first dose to last dose of study medication plus 7 days.

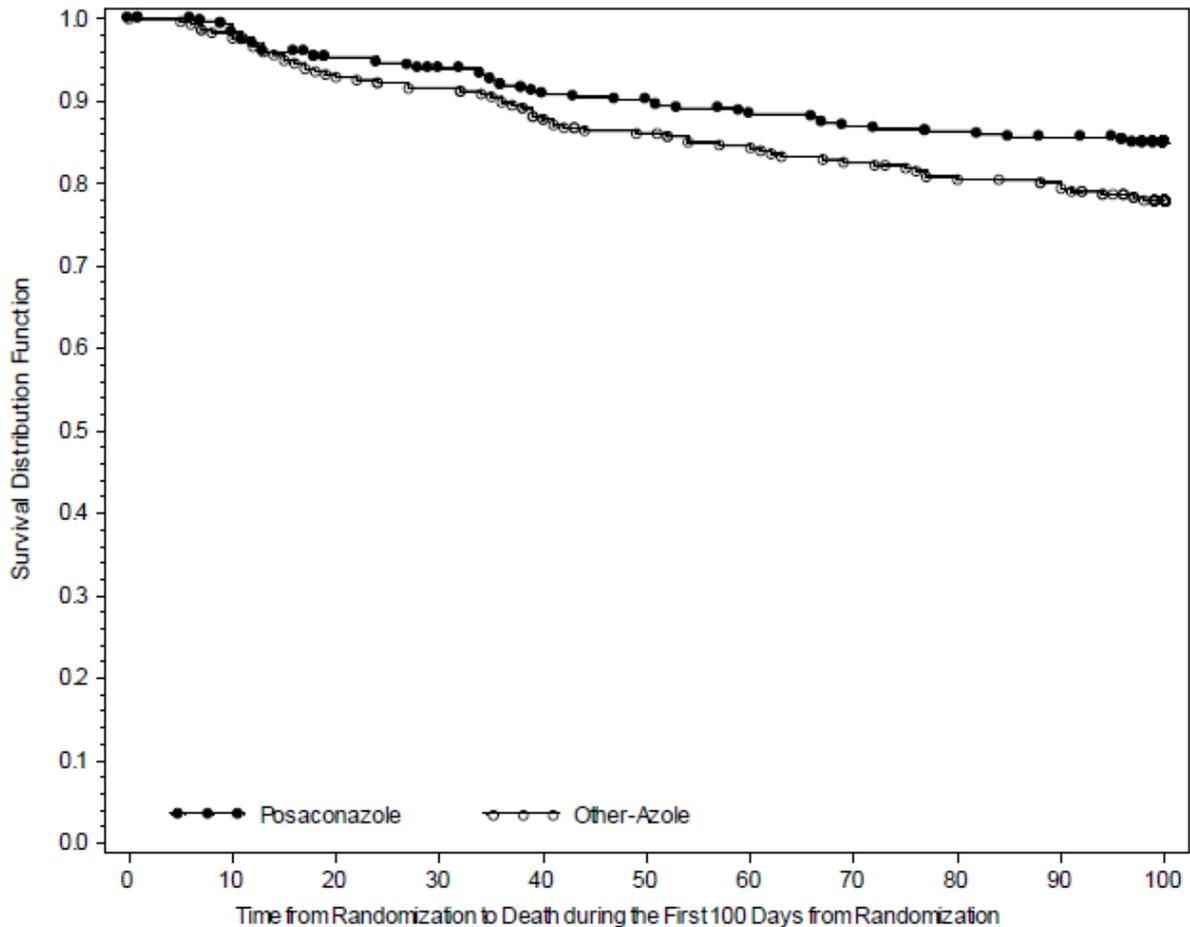
c: In 1899, this was the period from randomization to 100 days post-randomization; in 316 it was the period from the Baseline day to 111 days post-baseline.

d: All Randomized

e: All Treated

In Study 1899, a significant decrease in all cause mortality in favour of posaconazole was observed [POS 49/304 (16 %) vs. FLU/ITZ 67/298 (22 %) p= 0.048]. Based on Kaplan-Meier estimates, the probability of survival up to day 100 after randomization, was significantly higher for posaconazole recipients; this survival benefit was demonstrated when the analysis considered all causes of death (P= 0.0354) (Figure 1) as well as IFI-related deaths (P = 0.0209).

**Figure 1: All cause mortality in Study 1899 (POS vs FLU/ITZ; P= 0.0354)**



In Study 316, overall mortality was similar (POS, 25 %; FLU, 28 %); however, the proportion of IFI-related deaths was significantly lower in the POS group (4/301) compared with the FLU group (12/299; P= 0.0413).

### ***Use in paediatric patients***

A total of 16 patients aged 8 to 17 years were included in the posaconazole oral suspension therapeutic trials of invasive fungal infections. Five patients were < 13 years of age and 11 were 13 -17 years old. Infections included aspergillosis, candidiasis and fusariosis. Successful response after treatment with posaconazole at divided doses up to 800 mg/day was seen in 50 % (8/16) of patients. Pharmacokinetic parameters obtained from 12 of these patients were not different from those obtained from the patients in the 18 - 65 year age group, and the safety profile appeared similar.

Additionally, 12 patients aged 13 to 17 years received 600 mg/day of posaconazole oral suspension for prophylaxis of invasive fungal infections (Studies 316 and 1899). The safety profile in these patients < 18 years of age appears similar to the safety profile observed in adults. Based on pharmacokinetic data in 10 of these paediatric patients, the pharmacokinetic profile appears to be similar to patients ≥ 18 years of age.

Safety and efficacy in paediatric patients below the age of 13 years have not been established.

## **5.2. Pharmacokinetic properties**

### **Absorption**

Posaconazole oral suspension is absorbed with a median  $T_{max}$  of 3 hours (patients) and ~ 5 hours (healthy volunteers). Steady-state plasma concentrations attained at 7 to 10 days following multiple-dose administration.

The pharmacokinetics of posaconazole oral suspension are linear following single and multiple dose administration of up to 800 mg. No further increases in exposure were observed when oral suspension doses above 800 mg daily were administered to patients and healthy volunteers. Dividing the total posaconazole daily dose (800 mg) as 400 mg twice a day results in a 184% higher exposure relative to once-a-day administration in patients.

### ***Effect of food on oral absorption in healthy volunteers***

The AUC of posaconazole oral suspension is about 2.6 times greater when administered with a nonfat meal or nutritional supplement (14 g fat) and 4 times greater when administered with a high-fat meal (~ 50 g fat) relative to the fasted state. Posaconazole oral suspension should be administered with food or a nutritional supplement (see section 4.2).

### **Distribution**

Posaconazole oral suspension has a large apparent volume of distribution (1774 L) suggesting extensive penetration into the peripheral tissues.

Posaconazole is highly protein bound (> 98.0 %), predominantly to serum albumin.

### **Biotransformation**

Posaconazole does not have any major circulating metabolites and its concentrations are unlikely to be altered by inhibitors of CYP450 enzymes. Of the circulating metabolites, the majority are glucuronide conjugates of posaconazole with only minor amounts of oxidative (CYP450 mediated) metabolites observed. The excreted metabolites in urine and faeces account for approximately 17 % of the administered radio-labelled dose.

### **Elimination**

Posaconazole oral suspension is slowly eliminated with a mean half-life ( $t_{1/2}$ ) of 35 hours (range 20 to 66 hours) and a total body clearance (Cl/F) of 32 L/hr. Steady state is attained following 7

to 10 days of multiple-dose administration.

Posaconazole is predominantly excreted in the faeces (77 % of the radio-labelled dose) with the major component eliminated as parent drug (66 % of the radio-labelled dose). Renal clearance is a minor elimination pathway, with 14 % of the radio-labelled dose excreted in urine (<0.2 % of the radio-labelled dose is parent drug).

### **Summary of the mean pharmacokinetic parameters in patients**

The general pharmacokinetic findings across the clinical program in both healthy volunteers and patients were consistent, in that posaconazole oral suspension was slowly absorbed and slowly eliminated with an extensive volume of distribution. In addition, the phenomenon of dose-limited absorption of posaconazole at 800 mg/day was observed both in healthy volunteers and patients. The mean pharmacokinetic parameters in patients and healthy volunteers following administration of posaconazole 400 mg twice a day for 7 days are displayed in Table 6.

**Table 6: Pharmacokinetics of posaconazole oral suspension in patients and healthy volunteers**

Population	Dose	Mean (%CV)		
		C <sub>max</sub> (ng/mL)	T <sub>max</sub> <sup>a</sup> (hr)	AUC(τ) (ng·hr/mL)
Healthy Volunteers	400 mg twice a day (n=174)	2850 (36 )	5 (0-12 )	29453 (37 )
Patients	400 mg twice a day (n=24)	851 (82)	3 (0-12.5)	8619 (86 )

<sup>a</sup> Median (range)

The exposure to posaconazole oral suspension following administration of 400 mg twice a day was ~3 times higher in healthy volunteers than in patients, without additional safety findings at the higher concentrations (Table 6).

### **Special populations**

#### ***Paediatric***

Following administration of 800 mg per day of posaconazole oral suspension as a divided dose for treatment of invasive fungal infections, mean trough plasma concentrations from 12 paediatric patients 8 -17 years of age (776 ng/mL) were similar to concentrations from 194 patients 18 - 64 years of age (817 ng/mL). No pharmacokinetic data are available from paediatric patients less than 8 years of age. Similarly, in the prophylaxis studies, the mean steady-state posaconazole average concentration (C<sub>avg</sub>) was comparable among ten adolescents (13 - 17 years of age) to C<sub>avg</sub> achieved in adults (≥ 18 years of age).

In a study of 136 neutropenic pediatric patients 11 months – 17 years treated with posaconazole oral suspension, at doses up to 18 mg/kg/day divided TID, approximately 50% met the prespecified target (Day 7 C<sub>avg</sub> between 500 ng/mL-2500 ng/mL).

In general, exposures tended to be higher in the older patients (7 to <18 years) than in younger

patients (2 to <7 years). See Table 7.

**Table 7: Distribution of C<sub>avg</sub> by Dose and Age Group at Day 7 in Study P03579**

Dose	Age Group	N	C <sub>avg</sub> (ng/mL)				
			<200	200 - <500	<b>500 - &lt;2500</b>	2500 - <3650	>3650
12 mg/kg/day divided BID	2 to <7 years	16	19% (3/16)	44% (7/16)	<b>31% (5/16)</b>	6% (1/16)	0
	7 to <18 years	14	14% (2/14)	21% (3/14)	<b>65% (9/14)</b>	0	0
18 mg/kg/day divided BID	2 to <7 years	12	25% (3/12)	25% (3/12)	<b>50% (6/12)</b>	0	0
	7 to <18 years	12	8% (1/12)	25% (3/12)	<b>50% (6/12)</b>	8% (1/12)	8% (1/12)
18 mg/kg/day divided TID	2 to <7 years	5	20% (1/5)	20% (1/5)	<b>60% (3/5)</b>	0	0
	7 to <18 years	10	20% (2/10)	0	<b>80% (8/10)</b>	0	0
12 mg/kg/day divided TID	3 months to <2 years	1	0	100% (1/1)	<b>0</b>	0	0
Numbers in parentheses = (Number of subjects in category/Total number of subjects)							
Target C <sub>avg</sub> range (500-<2500 ng/ml) required for ~90% of subjects to meet criteria for study success							

### **Gender**

The pharmacokinetics of posaconazole are comparable in men and women. No adjustment in the dosage of posaconazole oral suspension is necessary based on gender.

### **Elderly**

Results from a multiple dose study of posaconazole oral suspension in healthy volunteers (N=48) indicated that at steady state, there was an increase in C<sub>max</sub> (26 %) and AUC (29 %) observed in elderly subjects (24 subjects ≥ 65 years of age) relative to younger subjects (24 subjects 18 - 45 years of age). A similar trend was observed in the clinical program based on a small proportion of elderly subjects ≥ 65 years of age (N=25 vs. 194 patients 18 – 64 years of age). However, in a population pharmacokinetic analysis (Study 1899) age did not influence the pharmacokinetics of posaconazole oral suspension. The safety profile of posaconazole oral suspension between the young and elderly patients was similar. Therefore, no dose adjustment is required for age.

### **Race**

Results from a multiple dose study in healthy volunteers (n = 56) indicated that there was only a slight decrease (16%) in the AUC and C<sub>max</sub> of posaconazole oral suspension in Black subjects relative to Caucasian subjects, therefore, no dose adjustment for race is required.

### **Weight**

Pharmacokinetic modeling for posaconazole suggests that patients weighing greater than 120 kg may have lower posaconazole exposure. It is, therefore, suggested to closely monitor for

breakthrough fungal infections in patients weighing more than 120 kg.

### ***Renal insufficiency***

Following single-dose administration of posaconazole oral suspension, there was no effect of mild and moderate renal insufficiency (n=18, Cl cr  $\geq$  20 mL/min/1.73 m<sup>2</sup>) on posaconazole pharmacokinetics, therefore, no dose adjustment is required. In subjects with severe renal insufficiency (n=6, Cl cr  $<$  20 mL/min/1.73 m<sup>2</sup>), the exposure of posaconazole was highly variable (96 % CV) compared to the exposure in the other renal groups ( $<$  40 % CV). As posaconazole is not significantly renally eliminated, an effect of severe renal insufficiency on the pharmacokinetics of posaconazole is not expected and no dose adjustment is recommended. However, due to the variability in exposure, patients with severe renal impairment should be monitored closely for breakthrough fungal infections. Posaconazole is not removed by haemodialysis.

### ***Hepatic insufficiency***

In a study with small number of subjects (n=12) who had hepatic impairment, there was an increase in exposure associated with prolongation of half-life (26.6, 35.3, and 46.1 hours for the mild, moderate and severe groups, respectively compared to 22.1 hours in subjects with normal hepatic function). An approximately 2-fold increase in steady-state AUC is estimated in patients with severe hepatic impairment. Due to the limited pharmacokinetic data in patients with hepatic impairment, posaconazole should be used with caution in patients with severe hepatic impairment since the prolonged half-life that may occur will lead to increased exposure.

### ***Electrocardiogram evaluation***

Multiple, time-matched ECGs collected over a 12 hour period were recorded at baseline and steady-state from 173 healthy male and female volunteers (18 to 85 years of age) administered posaconazole oral suspension 400 mg BID with a high-fat meal. In this pooled analysis, the mean QTc (Fridericia) interval change was -5 msec following administration of the recommended clinical dose. A decrease in the QTc (F) interval (- 3 msec) was also observed in a small number of subjects (n=16) administered placebo. The placebo-adjusted mean maximum QTc (F) interval change from baseline was  $<$  0 msec (- 8 msec). No healthy subject administered posaconazole had a QTc (F) interval of  $\geq$  500 msec or an increase  $\geq$  60 msec in their QTc (F) interval from baseline.

Posaconazole should be administered with caution to patients with potentially proarrhythmic conditions. Do not administer with drugs that are known to prolong the QTc interval and are metabolized through CYP3A4. Rigorous attempts to correct potassium, magnesium, and calcium should be made before starting posaconazole.

### **5.3. Preclinical safety data**

As observed with other azole antifungal agents, effects related to inhibition of steroid hormone synthesis were seen in repeated-dose toxicity studies with posaconazole. Adrenal suppressive

effects were observed in toxicity studies in rats and dogs at exposures equal to or greater than those obtained at therapeutic doses in humans.

Reproduction, peri- and postnatal development studies were conducted in rats. At exposures lower than those obtained at therapeutic doses in humans, posaconazole caused skeletal variations and malformations, dystocia, increased length of gestation, reduced mean litter size and postnatal viability. In rabbits, posaconazole was embryotoxic at exposures greater than those obtained at therapeutic doses. As observed with other azole antifungal agents, these effects on reproduction were considered related to a treatment-related effect on steroidogenesis.

Posaconazole was not genotoxic in *in vitro* and *in vivo* studies. Carcinogenicity studies did not reveal special hazards for humans.

## **6. PHARMACEUTICAL PARTICULARS**

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### **6.1. List of excipients**

Macrogolglycerol hydroxystearate, Sodium citrate (dihydrate), Citric acid monohydrate, Simethicone emulsion 30 %, Xanthan gum, Sodium benzoate, Glucose (liquid), Glycerol, Strawberry fresh flavour (artificial), Titanium dioxide.

### **6.2. Incompatibilities**

Not applicable.

### **6.3. Shelf life**

24 months for Unopened product. Use within 30 days of opening.

### **6.4. Special precautions for storage**

Store at or below 25°C.

### **6.5. Nature and contents of container**

DP-Posaconazole 105 mL is available in an amber glass bottle with a plastic child-resistant and tamper-evident cap. A measuring spoon is provided with each bottle pack.

### **6.6. Special precautions for disposal and other handling**

Any unused medicine or waste material should be disposed of in accordance with local requirements.

## **7. MEDICINE SCHEDULE**

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Prescription medicine

## 8. SPONSOR

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Douglas Pharmaceuticals Ltd  
P O Box 45 027  
Auckland 0651  
New Zealand  
Phone: (09) 835 0660

## 9. DATE OF FIRST APPROVAL

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8 October 2020

## 10. DATE OF REVISION OF THE TEXT

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26 September 2023

Summary table of changes

<b>Section Changed</b>	<b>Summary of new information</b>
4.2, 4.4, 5.1	Updated sections to correct safety and efficacy age statements regarding the paediatric population to be consistent with that in the approved indications
4.4	Added section concerning venetoclax toxicity
4.5	Added potential interaction with famotidine, flucloxacillin and venetoclax.
4.8	Added post-marketing experience
4.4, 4.9, 5.1	Editorial update