

## **SUMMARY OF PRODUCT CHARACTERISTICS**

### **Lopinavir and Ritonavir USP Tablets**

Rx Only

#### **1. NAME OF THE FINISHED PHARMACEUTICAL PRODUCT**

Lopinavir 100 mg and Ritonavir 25 mg USP Tablets

Lopinavir 200 mg and Ritonavir 50 mg USP Tablets

#### **2. QUALITATIVE AND QUANTITATIVE COMPOSITION**

Each film coated Lopinavir 100 mg and Ritonavir 25 mg USP Tablet contains Lopinavir USP 100 mg and Ritonavir USP 25 mg.

Each film coated Lopinavir 200 mg and Ritonavir 50 mg USP Tablet contains Lopinavir USP 200 mg and Ritonavir USP 50 mg.

For excipients, see section 6.1.

#### **3. PHARMACEUTICAL FORM**

Lopinavir 100 mg and Ritonavir 25 mg USP Tablets are Light yellow Film-Coated capsule shaped tablets debossed with 'D91' on one side and plain on other side.

Lopinavir 200 mg and Ritonavir 50 mg USP Tablets are Light yellow Film-Coated Ovaloid tablets debossed with 'X' on one side and '28' on other side.

#### **4. CLINICAL PARTICULARS**

##### **4.1 Therapeutic Indications**

Lopinavir and Ritonavir Tablets is indicated for the treatment of HIV-1 infected adults and children in combination with other antiretroviral agents.

The choice of Lopinavir and Ritonavir Tablets to treat protease inhibitor-experienced HIV-1 infected patients should be based on individual viral resistance testing and treatment history of patients (see sections 4.4 and 5.1).

##### **4.2 Posology and method of administration**

Lopinavir and Ritonavir Tablets should be prescribed by physicians who are experienced in the treatment of HIV infection.

Lopinavir and Ritonavir Tablets must be swallowed whole and not chewed, broken or crushed.

The recommended dosage of Lopinavir and Ritonavir Tablets 200 mg/50 mg tablets for adults and children with a body weight of 35 kg or more (or with a body surface area

[BSA] greater than 1.4 m<sup>2</sup> ) is two 200/50 mg tablets twice daily (resulting in a total daily dose of 800/200 mg Lopinavir and Ritonavir).

The body surface area can be calculated with the following equation:

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

For children with a body weight of 25 kg to 35 kg the recommended dose is two 200/50 mg tablets in the morning and one 200/50 mg tablet in the evening (resulting in a total daily dose of 600/150mg Lopinavir and Ritonavir).

The doses should be taken approximately 12 hours apart.

Lopinavir and Ritonavir tablets may be taken with or without food.

The following table contains dosing guidelines for Lopinavir and Ritonavir tablets 100 mg/25 mg, in accordance with WHO guidelines.

| Body weight | Recommended number of 100/25 mg tablets               |         |
|-------------|---|---------|
|             | morning   | evening |
| 10-13.9 kg  | 2   | 1       |
| 14-19.9 kg  | 2   | 2       |
| 20-24.9 kg  | 3   | 2       |
| 25-35 kg    | 3   | 3       |
| > 35 kg     | Use adult formulation<br>(Lopinavir/Ritonavir 200/50) |         |

*Dose adjustments:*

In patients co-treated with nevirapine or efavirenz the Lopinavir and Ritonavir dose should be adjusted.

- In patients weighing <15 kg, the recommended dose is 12 mg Lopinavir/3 mg Ritonavir/kg BW given twice daily.
- For patients weighing >25 to 35 kg, to 11 mg Lopinavir /2.75 mg Ritonavir /kg BW twice daily.
- For patients weighing > 35 kg to 500 mg Lopinavir/125 mg Ritonavir (increase by 25%) twice daily (see section 4.5).

To enable these dose adjustments another Lopinavir and Ritonavir formulation has to be used in addition.

Children:

Lopinavir and Ritonavir tablets is not indicated for children weighing less than 25 kg as appropriate dose reductions for the weight of the child cannot be made.

Lopinavir and Ritonavir is not recommended for use in children weighing less than 10 kg due to insufficient data on safety and efficacy (see section 5.1).

Hepatic impairment: In HIV-infected patients with mild to moderate hepatic impairment, an approximate 30% increase in Lopinavir exposure has been observed but is not expected to be of clinical relevance (see section 5.2). As no data are available in patients with severe hepatic impairment, Lopinavir and Ritonavir Tablets must not be given to these patients (see section 4.3).

Renal impairment: No dose adjustment is necessary in patients with renal impairment. Caution is warranted when Lopinavir and Ritonavir Tablets is used in patients with severe renal impairment (see section 4.4).

#### **4.3 Contraindications:**

Hypersensitivity to the active substances or to any of the excipients.

Lopinavir and Ritonavir Tablets must not be administered to patients with severe hepatic impairment.

Lopinavir and Ritonavir Tablets must not be administered concurrently with agents with a narrow therapeutic window that are substrates of CYP3A4, such as amiodarone, bepedril, quinidine, propafenone, verapamil, pimozide, astemizole, terfenadine, cisapride, triazolam, oral midazolam, ergot derivatives, simvastatin and lovastatin (non-exhaustive list).

Inhibition of CYP3A4 by Ritonavir could result in elevated plasma concentrations of these agents, potentially causing serious or life-threatening reactions (see also sections 4.4 and 4.5).

Herbal preparations containing St John's wort (*Hypericum perforatum*) must not be used while taking Lopinavir and Ritonavir due to the risk of decreased plasma concentrations and reduced clinical effects of Lopinavir and Ritonavir (see section 4.5).

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

Patients with coexisting conditions

Hepatic impairment: Lopinavir and Ritonavir Tablets is contraindicated in patients with severe liver impairment (see section 4.3). Patients with chronic hepatitis B or C and treated with combination antiretroviral therapy are at an increased risk for severe and potentially fatal hepatic adverse reactions. In case of concomitant antiviral therapy for hepatitis B or C, please refer to the relevant product information for these medicinal products.

Patients with pre-existing liver dysfunction including chronic hepatitis have an increased frequency of liver function abnormalities during combination antiretroviral therapy and should be monitored according to standard practice. If there is evidence of worsening liver disease in such patients, interruption or discontinuation of treatment should be considered.

*Haemophilia:* there have been reports of increased bleeding, including spontaneous skin haematomas and haemarthrosis in patients with haemophilia type A and B treated with protease inhibitors. A causal relationship had been evoked, although the mechanism of action had not been elucidated. Haemophiliac patients should therefore be made aware of the possibility of increased bleeding.

Specific adverse reactions

*Lipid elevations:* Treatment with Lopinavir and Ritonavir has resulted in increases, sometimes marked, in the concentration of total cholesterol and triglycerides. Triglyceride and cholesterol testing is to be performed prior to initiating Lopinavir and Ritonavir therapy and at periodic intervals during therapy. Particular caution should be paid to patients with high values at baseline and with history of lipid disorders. Lipid disorders are to be managed as clinically appropriate.

*Pancreatitis:* Cases of pancreatitis have been reported in patients receiving Lopinavir and Ritonavir. Most of these cases patients have had a prior history of pancreatitis and/or concurrent therapy with other medicinal products associated with pancreatitis. Marked triglyceride elevation is a risk factor for development of pancreatitis. Patients with advanced HIV disease may be at risk of elevated triglycerides and pancreatitis. Pancreatitis should be considered if clinical symptoms (nausea, vomiting, abdominal pain) or abnormalities in laboratory values (such as increased serum lipase or amylase values)

suggestive of pancreatitis occur. Patients who exhibit these signs or symptoms should be evaluated and Lopinavir and Ritonavir Tablets therapy should be suspended if a diagnosis of pancreatitis is made (see section 4.8).

*Hyperglycaemia:* New onset diabetes mellitus, hyperglycaemia or exacerbation of existing diabetes mellitus has been reported in patients receiving protease inhibitors. In some of these cases hyperglycaemia was severe and also associated with ketoacidosis. Many patients had confounding medical conditions. A causal relation between Ritonavir-boosted Lopinavir and these events has not been established.

*Fat redistribution and metabolic disorders:* Combination antiretroviral therapy has been associated with redistribution of body fat (lipodystrophy) in HIV-infected patients. The long-term consequences of these events are currently unknown. Knowledge about the mechanism is incomplete. A connection between protease inhibitors (PIs) and visceral lipomatosis, and between certain nucleoside reverse transcriptase inhibitors (NRTIs), mainly stavudine and zidovudine, and lipoatrophy, seems likely given available evidence. A higher risk of lipodystrophy has been associated with individual factors such as older age, and with drug related factors such as longer duration of antiretroviral treatment and associated metabolic disturbances. Clinical examination should include evaluation for physical signs of fat redistribution. Consideration should be given to measurement of fasting serum lipids and blood glucose. Lipid disorders should be managed as clinically appropriate (see section 4.8).

*Immune Reactivation Syndrome:* In HIV-infected patients with pre-existing severe immune deficiency, typically in the first few weeks or months after initiation of combination ART, an inflammatory reaction to asymptomatic or residual opportunistic pathogens (e.g. CMV retinitis, mycobacterial infections, Pneumocystis pneumonia) may arise and cause serious clinical conditions or aggravation of symptoms. Treatment should be instituted when necessary.

*Osteonecrosis:* Although the etiology is considered to be multifactorial (including corticosteroid use, alcohol consumption, severe immunosuppression, higher body mass index), cases of osteonecrosis have been reported, particularly in patients with advanced HIV-disease and/or long-term exposure to combination antiretroviral therapy. So far, this

disease has been reported mainly in adults. Patients should be advised to seek medical advice if they experience joint aches and pain, joint stiffness or difficulty in movement.

*PR interval prolongation:* Lopinavir and Ritonavir has been shown to cause modest asymptomatic prolongation of the PR interval in some healthy adult subjects. Rarely, 2nd or 3rd degree atrioventricular block in patients with underlying structural heart disease and pre-existing conduction system abnormalities or in patients receiving drugs known to prolong the PR interval (such as verapamil or atazanavir) have been reported in patients receiving Lopinavir and Ritonavir.

Lopinavir and Ritonavir Tablets should be used with caution in such patients (see sections 4.8, 5.1 and 5.3).

#### Warnings on specific interactions with other medicinal products

Lopinavir and Ritonavir Tablets contains Ritonavir, which is a very potent inhibitor of the P450 isoform CYP3A. Lopinavir and Ritonavir Tablets 200 mg/50 mg is likely to increase plasma concentrations of medicinal products that are primarily metabolised by CYP3A. These increases of plasma concentrations of co-administered medicinal products could increase or prolong their therapeutic effect and adverse events (see sections 4.3 and 4.5).

*Rifampicin:* Co-administration of Lopinavir and Ritonavir Tablets with rifampicin is not recommended.

Rifampicin in combination with Lopinavir and Ritonavir Tablets causes large decreases in Lopinavir concentrations which may in turn significantly decrease the therapeutic effect of Lopinavir. Adequate exposure to Lopinavir and Ritonavir may be achieved when a higher dose of Lopinavir and Ritonavir Tablets is used but this is associated with a higher risk of liver and gastrointestinal toxicity.

*HMG-CoA reductase inhibitors:* Simvastatin and lovastatin are highly dependent on CYP3A for metabolism; thus concomitant use of Lopinavir and Ritonavir Tablets and simvastatin or lovastatin is not recommended due to an increased risk of myopathy including rhabdomyolysis.

Caution must also be exercised and reduced doses should be considered if Lopinavir and Ritonavir tablets is used concurrently with rosuvastatin or with atorvastatin, which

are metabolised to a lesser extent by CYP3A4. If treatment with a HMG-CoA reductase inhibitor is indicated, pravastatin or fluvastatin is recommended (see section 4.5).

*QT-interval prolonging agents:* Particular caution must be used when prescribing Lopinavir and Ritonavir tablets and medicinal products known to induce QT interval prolongation.

Lopinavir and Ritonavir tablets could increase concentrations of the co-administered medicinal products and this may result in an increase of their associated cardiac adverse events (see also section 4.3 and 4.5).

*Sedative agents:* Lopinavir and Ritonavir tablets should not be used concomitantly with strongly sedative drugs metabolized by CYP3A, as this may result in excessive effects. Such drugs include, among others, fentanyl, meperidine, propoxyphene, diazepam, alprazolam, triazolam and midazolam. Morphine and oxazepam are not metabolized by CYP3A; however, due to induction of glucuronidation, an increased dose of these drugs may be necessary when co-treating with Lopinavir and Ritonavir tablets.

*Hormonal contraceptives:* In case of co-administration of Lopinavir and Ritonavir tablets 200 mg/50 mg with contraceptives containing ethinyl oestradiol, irrespective of the formulation (e.g. oral or patch), additional barrier or non-hormonal methods of contraception are to be used. The decreased systemic exposure to the estrogen component may not only impact the contraceptive efficacy but also lead to alterations in the uterine bleeding profile.

*Glucocorticoids:* Concomitant use of Lopinavir and Ritonavir tablets and fluticasone or other glucocorticoids that are metabolised by CYP3A4 is not recommended unless the potential benefit of treatment outweighs the risk of systemic corticosteroid effects, including Cushing's syndrome and adrenal suppression (see section 4.5).

*Other*

Treatment with Lopinavir and Ritonavir tablets has not been shown to eliminate the risk of transmission of HIV infection by sexual contact or by blood transfer. Patients should continue to use appropriate precautions to prevent transmission of HIV.

People taking Lopinavir and Ritonavir tablets may still develop infections or other illnesses associated with HIV disease and AIDS.

#### **4.5 Interaction with other medicinal products and other forms of interaction:**

Lopinavir and Ritonavir tablets contains Lopinavir and Ritonavir, both of which are inhibitors of the P450 isoform CYP3A *in vitro*. Co-administration of Lopinavir and Ritonavir tablets and medicinal products primarily metabolised by CYP3A may result in increased plasma concentrations of the other medicinal product, which could increase or prolong its therapeutic and adverse reactions (see section 4.3). Lopinavir and Ritonavir Tablets 200 mg/50 mg does not inhibit CYP2D6, CYP2C9, CYP2C19, CYP2E1, CYP2B6 or CYP1A2 at clinically relevant concentrations.

Lopinavir and Ritonavir has been shown *in vivo* to induce its own metabolism and to increase the biotransformation of some medicinal products metabolised by cytochrome P450 enzymes and by glucuronidation. This may result in lowered plasma concentrations and potential decrease of efficacy of co-administered medicinal products. Medicinal products that are contraindicated specifically due to the expected magnitude of interaction and potential for serious adverse events are listed in section 4.3.

All interaction studies, when not stated otherwise, were performed using Lopinavir and Ritonavir capsules (Kaletra®) at the dose of 400/100 mg b.i.d.

The following list of drug interactions with Lopinavir and Ritonavir Tablets is not exhaustive, but is a selection of interactions of putative importance.



| Medicinal products by therapeutic areas                            | Interaction  | Recommendations concerning co-administration  |
|--|--|---|
| <b>ANTI-INFECTIVES</b>   |  |   |
| <i>Antiretrovirals</i>   |  |   |
| Stavudine  | Not studied, but no interaction expected   | No dose adjustment necessary.   |
| Lamivudine   | Not studied, but no interaction expected   | No dose adjustment necessary.   |
| Emtricitabine  | Not studied, but no interaction expected   | No dose adjustment necessary.   |
| Zidovudine   | No clinically relevant interaction expected  | No dose adjustment necessary.   |
| Abacavir (600 mg q.d.)   | Abacavir AUC ↓ 30%   | No dose adjustment recommended.   |
| Tenofovir (300 mg q.d.)  | Tenofovir AUC ↑ 30%  | No dose adjustment recommended. Renal function should be monitored.   |
| Efavirenz (600 mg q.d./ Lopinavir/Ritonavir tablets 400/100 b.i.d) | Lopinavir AUC ↓ 30-40%   | In adults, a 25% dose increase of Lopinavir/Ritonavir is recommended. For dosing in children when co-administering efavirenz, see   |
| Nevirapine (200 mg b.i.d)  | Lopinavir AUC ↓ 27%,<br>C <sub>min</sub> ↓ 51% compared to historical data   | In adults, a 25% dose increase of Lopinavir/Ritonavir is recommended. For dosing in children when coadministering nevirapine, see   |
| Etravirine (1600 mg b.i.d.)  | Lopinavir AUC ↓ 20%<br>Etravirine AUC ↑ 17%  | No dose adjustment necessary.   |
| Raltegravir (400 mg b.i.d)   | Lopinavir AUC ↔<br>Raltegravir AUC ↓ 30%   | No dose adjustment necessary.   |
| Maraviroc (300 mg b.i.d)   | Maraviroc AUC ↑ 3.95-fold  | In adults, it is recommended that the maraviroc dose be reduced by 50% when co-treating with Lopinavir/Ritonavir.   |
| Enfuvirtide  | Not studied, but no interaction expected.  | No dose adjustment necessary.   |
| Atazanavir (300mg q.d.)  | Atazanavir AUC unchanged,<br>C <sub>min</sub> ↑ 45%<br>(Compared to atazanavir/Ritonavir 300/100 mg q.d.)<br>Lopinavir AUC unaltered | The benefit of co-administering two protease inhibitors (excepting Ritonavir as a pharmacokinetic boosting agent) has not been demonstrated. Furthermore, appropriate doses of HIV protease inhibitors in combination with Lopinavir/Ritonavir with respect to safety and efficacy have not been established. Therefore, generally co-administration of Lopinavir/Ritonavir with other PIs is not recommended. If concomitant administration of Lopinavir/Ritonavir tablets 200 mg/ 50 mg with PIs is considered necessary, this requires close monitoring. |
| Darunavir/Ritonavir (1200/100 mg q.d.)                             | Darunavir AUC ↓ 41%,<br>C <sub>min</sub> ↓ 45% compared to darunavir/Ritonavir 600/100 mg b.i.d.)<br>Lopinavir AUC unaltered.        |   |
| Fosamprenavir/Ritonavir (700/100 b.i.d.)                           | Amprenavir AUC ↓ 63%<br>C <sub>min</sub> ↓ 65%<br>Lopinavir AUC ↑ 37%<br>C <sub>min</sub> ↑ 52%                                      |   |

| Medicinal products by therapeutic areas                                | Interaction   | Recommendations concerning co-administration  |
|--|---|---|
| Indinavir (600mg q.d.)   | Indinavir<br>AUC unaltered,<br>C <sub>min</sub> ↑ 3.5-fold<br>(compared to indinavir<br>800 mg t.i.d.).<br>Lopinavir<br>AUC unaltered.              |   |
| Nelfinavir (1000 mg b.i.d.)  | Lopinavir<br>AUC ↓ 27%,<br>C <sub>min</sub> ↓ 38%<br>Nelfinavir<br>AUC ↑ 7%<br>C <sub>min</sub> ↑ 86%<br>(compared to nelfinavir<br>1250 mg b.i.d.) |   |
| Saquinavir (800 mg b.i.d.)   | Saquinavir<br>AUC ↑ 30%<br>(compared to saquina-<br>vir/Ritonavir 1000/100<br>mg b.i.d.)  |   |
| Tipranavir/Ritonavir (500/200 mg b.i.d)                                | Lopinavir<br>AUC ↓ 47%,<br>C <sub>min</sub> ↓ 70%   |   |
| <b><i>Anti-Mycobacterial</i></b>                                       |   |   |
| Rifampicin (600 mg q.d.; Lopinavir/Ritonavir<br>SGC 400/100 mg b.i.d.) | Lopinavir<br>AUC ↓ 75%,<br>C <sub>min</sub> ↓ 99%   | The co-administration of<br>Lopinavir/Ritonavir tablets 200 mg/<br>50 mg and rifampicin is not<br>recommended (see section 4.4).<br>Rifabutin is the preferable rifamycin<br>in this situation (see below).<br>In adults, if co-administration is<br>judged unavoidable, a dose<br>adjustment of Lopinavir/Ritonavir to<br>400/400 mg twice daily has allowed<br>compensating for the CYP3A4-<br>inducing effect of rifampicin. Also in<br>children, dosing Lopinavir and<br>Ritonavir at a 1:1 dose ratio has been<br>evaluated.. The Ritonavir dose should<br>be titrated upward only after<br>rifampicin has been initiated. Patients<br>should be carefully monitored for<br>side effects and therapeutic efficacy. |
| Rifampicin (600 mg; Lopinavir/Ritonavir<br>SGC 800/200 b.i.d.)         | Lopinavir<br>AUC unchanged,<br>C <sub>min</sub> ↓ 54%<br>compared to Lopinavir/<br>Ritonavir 400/100 mg<br>without rifampicin.                      |   |
| Rifampicin (600 mg q.d.; Lopinavir/Ritonavir<br>SGC 400/400 mg b.i.d.) | Lopinavir<br>AUC unchanged,<br>C <sub>min</sub> ↓ 10%,<br>compared to Lopinavir/<br>Ritonavir 400/100 mg<br>without rifampicin                      |   |
| Rifabutin (150 mg q.d.)  | Rifabutin<br>AUC ↑ 3-fold;<br>25-O-deacetyl-rifabutin<br>(active metabolite)<br>AUC ↑ 47.5-fold,<br>compared with rifabutin<br>300 mg q.d.          | In adults rifabutin dose should be<br>reduced by 75%; i.e. to 150 mg every<br>other day, or 150 mg thrice weekly,<br>and safety should be closely<br>monitored. No studies on rifabutin<br>dosing when co-treating with<br>Lopinavir/Ritonavir in children are<br>available.  |
| <b><i>Other anti-infectives</i></b>                                    |   |   |

| Medicinal products by therapeutic areas                               | Interaction  | Recommendations concerning co-administration  |
|---|--|---|
| Clarithromycin (500 mg b.i.d., together with Ritonavir 200 mg t.i.d.) | Clarithromycin AUC ↑ 77%;<br>14-OH-clarithromycin (active metabolite) AUC ↓ 100% | Clarithromycin doses greater than 1g/day* should not be co-administered with Lopinavir/Ritonavir tablets 200 mg/50 mg. For patients with renal impairment, a clarithromycin dose reduction should be considered (for further details see Summary of Product Characteristics of clarithromycin-containing products).       |
| Erythromycin  | No interaction data available. Erythromycin levels may increase                  | Co-administer with caution and monitor for adverse effects.   |
| Fusidic acid  | No interaction data available. Exposure to fusidic acid is expected to increase. | Co-administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and systemically administered fusidic acid should be avoided as this may result in hepatotoxicity.  |
| Voriconazole (200 mg b.i.d., together with Ritonavir 100 mg b.i.d)    | Voriconazole AUC ↓ 39%   | Coadministration of Lopinavir/Ritonavir tablets 200 mg/50 mg and voriconazole should be avoided due to the risk of therapeutic failure secondary to low voriconazole exposure. If deemed necessary, the therapeutic effect of voriconazole should be carefully monitored, and plasma concentration measured, if feasible. |
| Itraconazole  |  | Itraconazole exposure may increase. Doses > 200 mg/d are not recommended.*  |
| Ketoconazole  |  | Ketoconazole exposure may increase. Doses > 200 mg/d are not recommended.*  |
| Fluconazole   |  | No interaction expected.  |
| Sulfamethoxazole/trimethoprim   |  | No interaction expected.  |
| Atovaquone  |  | Atovaquone exposure may decrease. The therapeutic effect should be carefully monitored.   |
| Artemisinin derivatives   |  | No data are available. However artemisinin derivatives are metabolized into active metabolites by CYP3A. The putative interaction effects are unclear. If co-administered, monitor efficacy and safety of artemisinins  |
| Halofantrine  |  | Halofantrine prolongs the QT interval and is metabolized by CYP3A. Co-administration with Lopinavir/Ritonavir tablets 200 mg/50 mg is contraindicated (see section 4.3).  |
| Lumefantrine (480 mg b.i.d.)  | Lumefantrine AUC ↑ 193%  | Lumefantrine and Lopinavir/Ritonavir tablets 200 mg/50 mg should be co-administered with caution.   |

| Medicinal products by therapeutic areas              | Interaction   | Recommendations concerning co-administration  |
|--|---|---|
| Quinine (600 mg single dose, Ritonavir 200 mg b.i.d) | Quinine AUC and Cmax ↑ 4-fold (Pharmacokinetic interaction between Ritonavir and quinine. | Since quinine may prolong the QT-interval, co-administration should be avoided unless the benefit is considered to outweigh the risk. |
| Sulfadoxine/pyrimethamine                            | Not studied, but no interaction expected.   | No dose adjustment necessary.   |
| Doxycycline  | Not studied, but no interaction expected.   | No dose adjustment necessary.   |
| Chloroquine  | Chloroquine levels may increase due to CYP3A inhibition.                                  | Co-administer with caution and monitor for chloroquine toxicity.  |
| Mefloquine   | Not studied, but no interaction expected.   | No dose adjustment necessary.   |

| <b><i>ANALGESICS</i></b>                              |  |  |
|---|--|--|
| Buprenorphine (16 mg q.d.)                            | Buprenorphine and norbuprenorphine AUC ↔   | No dose adjustment necessary.  |
| Methadone (5 mg single dose)                          | Methadone AUC ↓ 53%  | Monitor for methadone withdrawal symptoms, and increase methadone dose if necessary.   |
| Morphine  | Morphine levels may be decreased due to induction of glucuronidation.  | Dose increase may be necessary to maintain therapeutic effect.   |
| Fentanyl, Propoxiphene                                |  | Lopinavir/Ritonavir tablets 200 mg/ 50 mg co-administration is likely to result in increased plasma concentrations of fentanyl and propoxiphene, and is therefore contraindicated (see section 4.3).   |
| Meperidine  |  | The concomitant use of Lopinavir/Ritonavir tablets 200 mg/ 50 mg and meperidine is contraindicated due to increases in concentrations of the metabolite normeperidine which may increase the risk of CNS side effects (e.g. seizures).                 |
| <b><i>ANTIARRHYTHMICS</i></b>                         |  |  |
| Amiodarone<br>Bepridil<br>Quinidine<br>Propafenone    |  | Co-administration with Lopinavir/Ritonavir tablets 200 mg/ 50 mg is likely to result in increased plasma concentrations of amiodarone, bepridil, encainide, flecainide, propafenone and quinidine, and is therefore contraindicated (see section 4.3). |
| Digoxin (0.4 mg SD + Ritonavir 200 mg b.i.d.)         | Digoxin AUC: ↑ 22%. Ritonavir may increase digoxin levels due to modification of P-glycoprotein mediated digoxin efflux. | Careful monitoring of digoxin levels is recommended when digoxin is administered concomitantly with Lopinavir/Ritonavir tablets 200 mg/ 50 mg.   |
| <b><i>ANTIASTHMATIC</i></b>                           |  |  |
| Theophylline  |  | An increased dose of theophylline may be required due to induction of CYP1A2. Monitor clinical efficacy and theophylline plasma concentration if possible.   |
| <b><i>ANTICANCERAGENTS</i></b>                        |  |  |
| Ifosfamide<br>Vincristine<br>Vinblastine<br>Etoposide | Serum concentrations of ifosfamide, vincristine, vinblastine and etoposide may be increased due to CYP3A inhibition.     | This may result in an increase in the incidence and severity of adverse events. These agents and Lopinavir/Ritonavir tablets 200 mg/ 50 mg should be co-administered with caution.   |

| <b><i>ANTICOAGULANT</i></b>                            |   |   |
|--|---|---|
| Warfarin   |   | S-warfarin levels may be decreased leading to reduced anticoagulation due to induction of CYP1A2 and CYP2C9 by Ritonavir. However, in some patients with aberrant metabolism, warfarin effect may increase. Dose alterations of warfarin may be necessary, and INR should be monitored closely. |
| <b><i>ANTICONVULSANTS</i></b>                          |   |   |
| Carbamazepine  | Co-administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and carbamazepine could lead to a two-way interaction, with increased plasma levels of carbamazepine (due to CYP3A inhibition) and decreased levels of Lopinavir (due to hepatic enzyme | Coadministration should be avoided. If deemed necessary, monitor clinical efficacy and safety, and plasma concentrations of carbamazepine and Lopinavir if possible.  |
| Phenytoin  | Co-administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and phenytoin may lead to a two-way interaction, with decreased levels of both phenytoin and Lopinavir.   | Co-administration should be avoided. If deemed necessary, monitor clinical efficacy, and plasma concentrations of phenytoin and Lopinavir if possible.  |
| Lamotrigine (100 mg b.i.d)                             | Lamotrigine<br>AUC ↓ 50%  | Monitor efficacy and, if possible, lamotrigine plasma concentration. A dose increase of lamotrigine may be necessary.   |
| Phenobarbital  |   | Coadministration should be avoided, as decreased levels of Lopinavir may result due to hepatic enzyme induction by phenobarbital. If coadministration is deemed necessary, monitor efficacy and, if possible, plasma levels of Lopinavir.   |
| Valproic acid  | Probably no clinically relevant interaction   | Monitor efficacy and safety. Probably no dose adjustment will be necessary.   |
| <b><i>ANTIDEPRESSANTS</i></b>                          |   |   |
| Trazodone (50 mg single dose; Ritonavir 200 mg b.i.d.) | Trazodone<br>AUC ↑ 2.4-fold   | If trazodone is co-administered with Lopinavir/Ritonavir tablets 200 mg/50 mg, the combination should be used with caution, initiating trazodone at the lowest dosage and monitoring for clinical response and tolerability.  |

|  |                                |   |
|--|--------------------------------|---|
| <b>ANTIPSYCHOTICS</b>                  |                                |   |
| Pimozide                               |                                | Co-administration of Lopinavir/Ritonavir tablets 200 mg/ 50 mg and pimozide is contraindicated, as inhibition of CYP3A may increase the plasma concentration of pimozide (see section 4.3).   |
| Clozapine                              |                                | Co-administer with caution, as Lopinavir/Ritonavir tablets 200 mg/ 50 mg may increase plasma levels of clozapine.   |
| <b>ANTI-HISTAMINES</b>                 |                                |   |
| Astemizole<br>Terfenadine              |                                | Co-administration with Lopinavir/Ritonavir tablets 200 mg/ 50 mg is likely to result in increased plasma concentrations of astemizole and terfenadine, and is therefore contraindicated (see section 4.3).  |
| <b>CALCIUM CHANNEL BLOCKERS</b>        |                                |   |
| Verapamil                              |                                | Co-administration of Lopinavir/Ritonavir tablets 200 mg/ 50 mg and verapamil is contraindicated, as increased verapamil plasma levels could cause AV-block (see section 4.3).   |
| Diltiazem                              |                                | Lopinavir/Ritonavir tablets 200 mg/ 50 mg and diltiazem should not be co-administered, as increased diltiazem plasma levels could cause AV-block.   |
| Amlodipine<br>Felodipine<br>Nifedipine |                                | Co-administer with caution. Careful monitoring of adverse effects is recommended when co-administering Lopinavir/Ritonavir tablets 200 mg/ 50 mg and amlodipine, felodipine, nifedipine or other dihydropyridine calcium channel blockers, since CYP3A blockade by Lopinavir/Ritonavir tablets 200 mg/ 50 mg may cause higher plasma levels of these drugs. |
| <b>HMG-CoA REDUCTASE INHIBITORS</b>    |                                |   |
| Simvastatin<br>Lovastatin              |                                | Co-administration of Lopinavir/Ritonavir tablets 200 mg/ 50 mg is contraindicated, as this is likely to lead to increased plasma levels of simvastatin or lovastatin and, thus, to a greater risk of rhabdomyolysis (see section 4.3).  |
| Atorvastatin (20 mg q.d.)              | Atorvastatin<br>AUC ↑ 5.9-fold | If co-administered, the lowest possible initial dose of atorvastatin should be used, and the patient should be closely monitored for efficacy and safety (see section 4.4.).  |

|  |  |   |
|--|--|---|
| Rosuvastatin (20 mg q.d.)                              | Rosuvastatin<br>AUC ↑ 2.1-fold   | If co-administered, the lowest possible initial dose of rosuvastatin should be used, and the patient should be closely monitored for efficacy and safety (see section 4.4).                           |
| Pravastatin (20 mg q.d.)                               | Pravastatin<br>AUC ↑ 33%   | No dose adjustment necessary.   |
| Fluvastatin  | No clinically relevant interaction expected  | No dose adjustment necessary.   |
| <b>IMMUNOSUPPRESSANTS</b>                              |  |   |
| Cyclosporine A   | Following initiation of Ritonavir-boosted PI treatment, a dose reduction of cyclosporine A to 5-20% of prior dose was needed to maintain cyclosporine A levels within therapeutic range. | Co-administer only, if therapeutic drug monitoring of cyclosporine is available. Reduce cyclosporine dose and monitor plasma concentrations closely.  |
| Tacrolimus   | The tacrolimus dose, needed to maintain therapeutic concentrations, have often been < 2% when co-administered with a boosted PI, compared to when tacrolimus was given without a PI.     | Co-administer only if therapeutic drug monitoring of tacrolimus is available. Reduce tacrolimus dose and monitor plasma concentrations closely.   |
| <b>HORMONAL CONTRACEPTIVES</b>                         |  |   |
| Ethinylestradiol 0.035 mg<br>Norethindrone 1 mg        | Ethinylestradiol<br>AUC ↓ 42%<br>Norethindrone<br>AUC ↓ 17%  | Due to reductions in ethinyl oestradiol concentrations, contraceptive efficacy may be impaired. (Additional) barrier or other non-hormonal methods of contraception should be used (see section 4.4). |
| <b>PDE5 INHIBITORS</b>                                 |  |   |
| Sildenafil (100 mg SD, Ritonavir 500 mg b.i.d.)        | Sildenafil<br>AUC ↑ 11-fold  | Co-administer with caution. Sildenafil doses should not exceed 25 mg in 48 hours.*  |
| Tadalafil (20 mg SD; Ritonavir 200 mg b.i.d.)          | Tadalafil<br>AUC ↑ 124%  | Co-administer with caution. Tadalafil doses should not exceed 10 mg every 72 hours.*  |
| Vardenafil (5 mg single dose; Ritonavir 600 mg b.i.d.) | Vardenafil<br>AUC ↑ 49-fold  | Co-administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and vardenafil is contraindicated (see section 4.3).  |
| <b>SEDATIVES/HYPNOTICS</b>                             |  |   |
| Triazolam (0.125 mg SD; Ritonavir 200 mg, 4 doses)     | Triazolam<br>AUC ↑ > 20-fold<br>(no steady state)  | Lopinavir/Ritonavir tablets 200 mg/50 mg co-administration is likely to result in increased plasma concentrations of triazolam, and is therefore contraindicated (see section 4.3).                   |



|  |  |  |
|--|--|--|
| Clorazepate<br>Diazepam<br>Estazolam<br>Flurazepam                               |  | Lopinavir/Ritonavir tablets 200 mg/50 mg co-administration is likely to result in increased plasma concentrations of clorazepate, diazepam, estazolam and flurazepam, through inhibition of CYP3A, and is therefore contraindicated (see section 4.3).   |
| Midazolam  | Midazolam<br>AUC(oral) ↑ 13-fold<br>AUC (parenteral)<br>↑ 4-fold   | Co-administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and oral midazolam is contraindicated (see section 4.3). If Lopinavir/Ritonavir tablets 200 mg/50 mg is co-administered with parenteral midazolam, it should be done in an intensive care unit or similar setting which ensures close clinical monitoring and appropriate medical management in case of respiratory depression and/or prolonged sedation. A reduced dose should be considered, especially if more than a single dose of midazolam is administered. |
| Alprazolam   | Alprazolam metabolism was inhibited following the introduction of Ritonavir. After Ritonavir use for 10 days, no inhibitory effect was observed. | Caution is warranted during the first several days when alprazolam is co-administered with Lopinavir/Ritonavir tablets 200 mg/50 mg, before induction of alprazolam metabolism develops.   |
| Oxazepam   | Due to induction of glucuronidation, oxazepam clearance may be increased   | Monitor oxazepam efficacy and increase dose if necessary.  |
| <b>STEROIDS</b>  |  |  |
| Fluticasone propionate aqueous nasal spray (0.2 mg q.d; Ritonavir 100 mg b.i.d.) | Fluticasone<br>AUC ↑ 350-fold  | Concomitant administration of Lopinavir/Ritonavir tablets 200 mg/50 mg and fluticasone or other inhaled corticosteroids (e.g. budesonide, mometasone) that are substrates of CYP3A is not recommended unless the potential benefit of treatment outweighs the risk of systemic corticosteroid effects (see section 4.4.). The use of a corticosteroid which is not a substrate of CYP3A (e.g. beclomethasone) should be preferred.   |
| Prednisolone (20 mg SD; Ritonavir 200 mg b.i.d.)                                 | Prednisolone<br>AUC ↑ 30%  | Monitor for corticosteroid efficacy and side effects and dose adjust if necessary.   |
| <b>MISCELLANEOUS</b>   |  |  |
| Alfuzosin  | Lopinavir/Ritonavir tablets 200 mg/50 mg is likely to increase plasma concentrations of alfuzosin.   | The combination should be avoided.   |

|   |  |  |
|---|--|--|
| Dihydroergotamine<br>Ergonovine<br>Ergotamine<br>Methylergovine |  | Co-administration of ergot derivatives and Lopinavir/Ritonavir tablets 200 mg/50 mg is contraindicated, as this is likely to lead to increased plasma levels of the ergot derivatives (see section 4.3). |
| Cisapride   |  | Co-administration of cisapride and Lopinavir/Ritonavir tablets 200 mg/50 mg is contraindicated, as this is likely to lead to increased plasma levels of cisapride (see section 4.3).                     |
| St John's Wort  |  | Serum levels of Lopinavir may decrease due to concomitant use of the herbal preparation St John's Wort. Co-administration is contraindicated (see section 4.3).  |

\* These doses refer to treatment in adult patients. The interaction concerns, however, should be considered of relevance also when treating paediatric patients.

#### 4.6 Pregnancy and lactation

**Pregnancy:** Studies in animals have shown reproductive toxicity (see section 5.3). The potential risk for humans is unknown, but available data do not support a teratogenic potential in humans.

Lopinavir and Ritonavir Tablets should only be used in pregnancy if the benefit clearly outweighs the risk.

**Lactation:** Studies in rats revealed that Lopinavir is excreted in the milk. It is not known whether this medicinal product is excreted in human milk. It is recommended that HIV-infected mothers should not breast-feed in order to avoid the transmission of HIV. Only under specific circumstances the benefits of breast-feeding might be considered to outweigh the risks. The most recent official treatment guidelines (e.g. those issued by WHO) should be consulted before advising patients on this matter.

#### 4.7 Effects on ability to drive and use machines:

No studies on the effects on the ability to drive and use machines have been performed. Nevertheless, the clinical status of the patient and the adverse reaction profile of {product name} should be borne in mind when considering the patient's ability to drive or operate machinery.

#### 4.8 Undesirable effects:

The most common adverse reaction associated with Lopinavir therapy is diarrhoea and was generally of mild to moderate severity. Also, dyslipidaemia, including hypertriglyceridaemia and hypercholesterolaemia are common, and may require drug treatment or discontinuation of Lopinavir and Ritonavir tablets 200 mg/50 mg.

It is important to note that cases of pancreatitis have been reported in patients receiving Ritonavir- boosted Lopinavir. Furthermore, rare increases in the PR interval have been reported during therapy with Ritonavir-boosted Lopinavir.

The following adverse reactions of moderate to severe intensity with possible or probable relationship to Lopinavir/Ritonavir have been reported. The adverse reactions are displayed by system organ class. Within each frequency grouping, undesirable effects are presented in order of decreasing seriousness: very common ( $\geq 1/10$ ), common ( $\geq 1/100$  to  $< 1/10$ ), uncommon ( $\geq 1/1000$  to  $< 1/100$ ) and rare ( $\geq 1/10,000$  to  $< 1/1,000$ ).

| <b>Undesirable effects in clinical studies in adult patients</b> |                            |   |
|--|----------------------------|---|
| <b>System Organ Class</b>  | <b>Frequency</b>           | <b>Adverse reaction</b>   |
| Investigations   | Very common (Grade 3 or 4) | Blood triglycerides increased, blood cholesterol increased, glutamyltransferase increased   |
|  | Common (Grade 3 or 4)      | Blood glucose increased, blood amylase increased, aspartate aminotransferase increased, alanine aminotransferase increased, liver function tests abnormal   |
|  | Uncommon                   | Glucose tolerance decreased, blood bilirubin increased, creatinine renal clearance decreased, lipase increased, weight increased, weight decreased, hormone level abnormal, laboratory test abnormal  |
|  | Rare                       | Blood alkaline phosphatase increased  |
| Cardiac disorders  | Uncommon                   | Myocardial infarction <sup>1</sup> , palpitations   |
|  | Rare                       | Atrioventricular block  |
| Blood and lymphatic system disorders                             | Uncommon                   | Anaemia, leucopenia, lymphadenopathy  |
|  | Rare                       | Splenomegaly  |
| Nervous system disorders   | Common                     | Headache, paraesthesia  |
|  | Uncommon                   | Extrapyramidal disorder, migraine, facial palsy, encephalopathy, dizziness, amnesia, coordination abnormal, hypertonia, neuropathy, neuropathy peripheral, somnolence, tremor, ageusia, dysgeusia, dyskinesia   |
| Eye disorders  | Uncommon                   | Visual disturbance  |
| Ear and labyrinth disorders                                      | Uncommon                   | Tinnitus  |
|  | Rare                       | Vertigo, hyperacusis  |
| Respiratory, thoracic and mediastinal disorders                  | Uncommon                   | Pulmonary oedema, dyspnoea, cough   |
| Gastrointestinal disorders                                       | Very common                | Diarrhoea   |
|  | Common                     | Nausea, vomiting, abdominal pain, abnormal faeces, dyspepsia, flatulence, gastrointestinal disorder   |
|  | Uncommon                   | Haemorrhagic colitis, pancreatitis <sup>2</sup> , enterocolitis, oesophagitis, constipation, faecal incontinence, abdominal distension, gastrooesophageal reflux disease, dry mouth, dysphagia, eructation, gastritis, mouth ulcerations, stomatitis, periodontitis |
|  | Rare                       | Haemorrhoids  |
| Renal and urinary disorders                                      | Uncommon                   | Nephrolithiasis, nephritis, albuminuria, hypercalcaemia, urine abnormality  |

|  |          |  |
|--|----------|--|
| Skin and subcutaneous tissue disorders                                   | Common   | Rash, lipodystrophy acquired, acne   |
|  | Uncommon | Alopecia, eczema, dermatitis exfoliative, rash maculopapular, dermatitis allergic, dry skin, nail disorder, pruritis, seborrhoea, skin discoloration, skin ulcer, hyperhidrosis, skin striae |
|  | Rare     | Idiopathic capillaritis  |
| Musculoskeletal and connective tissue disorders                          | Uncommon | Arthralgia, osteoarthritis, myalgia, back pain, arthropathy  |
| Endocrine disorders  | Uncommon | Cushing syndrome, hypothyroidism, hypogonadism male,   |
| Metabolism and nutrition disorders                                       | Uncommon | Diabetes mellitus, dehydration, lactic acidosis, oedema, increased appetite, obesity, anorexia, hyperglycaemia, hypocholesteraemia, lipomatosis, hyperuricaemia, hypovitaminosis             |
|  | Rare     | Hypophosphataemia, decreased appetite  |
| Infections and infestations  | Uncommon | Gastroenteritis, otitis media, bronchitis, sinusitis, sialadenitis, furunculosis, bacterial infection, viral infection, pharyngitis, influenza, rhinitis                                     |
|  | Rare     | Cellulitis, folliculitis, perineal abscess   |
| Neoplasms benign, malignant and unspecified (including cysts and polyps) | Uncommon | Benign neoplasm of skin  |
| Vascular disorders   | Uncommon | Hypertension, thrombophlebitis, deep vein thrombosis, vasculitis, varicose vein, angiopathy  |
| General disorders and administration site conditions                     | Common   | Asthenia, pain   |
|  | Uncommon | Chest pain, chest pain substernal, chills, pyrexia, malaise, oedema peripheral, face oedema, drug interaction, cyst  |
| Immune system disorders  | Uncommon | Drug hypersensitivity  |
|  | Rare     | Immune reconstitution syndrome   |
| Hepatobiliary disorders  | Uncommon | Hepatitis, cholecystitis, hepatic steatosis, hepatomegaly, liver tenderness  |
| Reproductive system and breast disorders                                 | Uncommon | Amenorrhoea, menorrhagia, ejaculation disorder, erectile dysfunction, breast enlargement, gynaecomastia  |
| Psychiatric disorders  | Common   | Insomnia   |
|  | Uncommon | Agitation, anxiety, confusional state, depression, affect lability, abnormal dreams, decreased libido, nervousness, abnormal thinking  |

<sup>1</sup> This event had a fatal outcome.

<sup>2</sup> See section 4.4: pancreatitis and lipids

### *Paediatric patients*

In children 2 years of age and older, the nature of the safety profile is similar to that seen in adults.

| <b>Undesirable effects in clinical studies in paediatric patients</b> |                       |  |
|---|-----------------------|--|
| Infections and infestations   | Common                | Viral infection  |
| Nervous system disorders  | Common                | Taste perversion   |
| Gastrointestinal disorders  | Common                | Constipation, vomiting, pancreatitis*  |
| Hepatobiliary disorders   | Common                | Hepatomegaly   |
| Skin and subcutaneous tissue disorders                                | Common                | Rash, dry skin   |
| General disorders and administration site conditions                  | Common                | Fever  |
| Investigations  | Common (Grade 3 or 4) | Increased activated partial thromboplastin time, decreased haemoglobin, decreased platelets, increased sodium, increased potassium, increased calcium, increased bilirubin, increased ALT, increased AST, increased total cholesterol, increased amylase, increased uric acid, decreased sodium, decreased potassium, decreased calcium, decreased neutrophils |

\*see section 4.4: pancreatitis and lipids

#### **4.9 Overdose**

To date, there is limited human experience of acute overdose with Lopinavir and Ritonavir.

The adverse clinical signs observed in dogs included salivation, emesis and diarrhoea/abnormal stool. The signs of toxicity observed in mice, rats or dogs included decreased activity, ataxia, emaciation, dehydration and tremors.

There is no specific antidote for overdose with Lopinavir/Ritonavir tablets. Treatment of overdose with Lopinavir and Ritonavir tablets is to consist of general supportive measures including monitoring of vital signs and observation of the clinical status of the patient. If indicated, elimination of unabsorbed active substance is to be achieved by emesis or gastric lavage. Administration of activated charcoal may also be used to aid in removal of unabsorbed active substance. Since Lopinavir and Ritonavir are highly protein bound, dialysis is unlikely to be beneficial in significant removal of the active substance.

## **5. PHARMACOLOGICAL PROPERTIES**

### **5.1 Pharmacodynamic properties**

Pharmaco-therapeutic group: protease inhibitor, ATC code: J05AE06

*Mechanism of action:* Lopinavir provides the antiviral activity of Lopinavir/Ritonavir tablets. Lopinavir is an inhibitor of the HIV-1 and HIV-2 proteases. Inhibition of HIV protease prevents cleavage of the *gag-pol* polyprotein resulting in the production of immature, non-infectious virus.

*Antiviral activity in vitro:* The in vitro antiviral activity of Lopinavir against laboratory and clinical HIV strains was evaluated in acutely infected lymphoblastic cell lines and peripheral blood lymphocytes, respectively. In the absence of human serum, the mean IC<sub>50</sub> of Lopinavir against five different HIV-1 laboratory strains was 19 nM. In the absence and presence of 50% human serum, the mean IC<sub>50</sub> of Lopinavir against HIV-1<sub>IIIIB</sub> in MT4 cells was 17 nM and 102 nM, respectively. In the absence of human serum, the mean IC<sub>50</sub> of Lopinavir was 6.5 nM against several HIV-1 clinical isolates. Lopinavir also has in vitro activity against HIV-2, with median IC<sub>50</sub> values similar to those seen for HIV-1.

*Antiviral activity according to genotypic/phenotypic resistance:* De novo resistance in treatment-naïve patients with prior wild-type virus failing therapy with Ritonavir-boosted Lopinavir in combination with NRTI is rare, provided that the patient is regularly monitored for viral load (e.g. 2-4 times annually after attaining undetectable HIV-RNA). For instance, in the pivotal phase three trial of Ritonavir-boosted Lopinavir (Kaletra®), 0/51 patients failing therapy had emergent protease inhibitor resistance mutations. Lack of resistance to Lopinavir was confirmed by phenotypic analysis. Also, the level of resistance to the backbone therapy has been lower in previously treatment-naïve patients failing on Ritonavir-boosted Lopinavir therapy, when compared with regimens not including a Ritonavir-boosted PI.

In patients who have previously failed protease inhibitor therapy, incremental resistance may occur upon virological failure. Mutations V82A, I54V and M46I have emerged most frequently. Mutations L33F, I50V, V32I and I47V/A have also occurred.

The in vitro antiviral activity of Lopinavir against 112 clinical isolates taken from patients failing therapy with one or more protease inhibitors was assessed. Within this panel, the following mutations in the HIV protease were associated with reduced in vitro susceptibility to Lopinavir: L10F/I/R/V, K20M/R, L24I, M46I/L, F53L,

I54L/T/V, L63P, A71I/L/T/V, V82A/F/T, I84V and L90M. The median EC<sub>50</sub> of Lopinavir against isolates with 0-3, 4-5, 6-7 and 8-10 mutations at the above amino acids was 0.8, 2.7, 13.5 and 44-fold higher than the EC<sub>50</sub> against wild-type HIV, respectively. In addition to the mutations described above, mutations V32I and I47A have been observed in rebound isolates with reduced Lopinavir susceptibility from protease inhibitor-experienced patients receiving Ritonavir-boosted Lopinavir therapy.

In studies of PI-experienced, NNRTI-naïve patients receiving therapy including Ritonavir-boosted Lopinavir, efavirenz and NRTIs, plasma HIV-RNA <400 copies was observed at 48 weeks in 93% (25/27), 73% (11/15) and 25% (2/8) of patients with <10-fold, 10 to 40-fold and >40-fold reduced susceptibility to Lopinavir at baseline. In another study with a dataset from several clinical trials and cohorts, the changes in drug susceptibility associated with a 20% and 80% loss of predicted wild-type drug effect for Lopinavir were 9.7 and 56-fold, respectively.

Clinically relevant resistance to Lopinavir requires the accumulation of resistance mutations in the HIV-protease. Several genotypic resistance algorithms have been proposed for the quantification of the degree of phenotypic resistance to Lopinavir, and for predicting the clinical response to Lopinavir in protease inhibitor pretreated patients. One of these, the Lopinavir-ATU score, includes mutations at the following codons of the protease: 10, 20, 24, 33, 36, 47, 48, 54, 82 and 84.

With increasing resistance to Lopinavir, resistance to other protease inhibitors will also increase to a varying degree, depending on the pattern of resistance mutations. Viruses with clinically relevant resistance to Lopinavir are often susceptible to darunavir or tipranavir (please refer to the SPCs of darunavir or tipranavir-containing products for more information on genotypic predictors of response).

**Table 1 Clinical cut-off values for reduced activity of Ritonavir-boosted Lopinavir by baseline genotype/phenotype**

|   |                              |                           |                   |
|---|------------------------------|---------------------------|-------------------|
| LPV-ATU score <sup>1</sup><br>(no of mutations)             | Activity not affected<br>0-2 | Decreased activity<br>3-5 | Resistance<br>≥ 6 |
| Clinical cut off<br>Phenotype (fold<br>change) <sup>2</sup> | <10                          | 10-60                     | >60               |

1: Codons 10, 20, 24, 33, 36, 47, 48, 54, 82 and 84



2: These are approximate values; see text above. Assay: Antivirogram; Virco.

*Clinical efficacy:* Ritonavir-boosted Lopinavir has been extensively studied in treatment-naïve and treatment-experienced patients. In various studies in treatment-naïve patients, the combination of Ritonavir-boosted Lopinavir and 2 NRTI have yielded response rates (i.e. plasma viral load > 400 or > 50 copies/ml) in the ITT population in the range of 70-80% at 48 weeks. In treatment-experienced patients the response rate is varying depending on the activity of the background regimen and the sensitivity of the virus to Lopinavir (see above).

#### *Paediatric Use*

M98-940 is an open-label study of a liquid formulation of Lopinavir/Ritonavir in 100 antiretroviral naïve (44%) and experienced (56%) paediatric patients. All patients were non-nucleoside reverse transcriptase inhibitor naïve. Patients were randomised to either 230 mg Lopinavir/57.5 mg Ritonavir per m<sup>2</sup> or 300 mg Lopinavir/75 mg Ritonavir per m<sup>2</sup>. Naïve patients also received nucleoside reverse transcriptase inhibitors. Experienced patients received nevirapine plus up to two nucleoside reverse transcriptase inhibitors. Safety, efficacy and pharmacokinetic profiles of the two dose regimens were assessed after 3 weeks of therapy in each patient. Subsequently, all patients were continued on the 300/75 mg per m<sup>2</sup> dose. Patients had a mean age of 5 years (range 6 months to 12 years) with 14 patients less than 2 years old and 6 patients one year or less. Mean baseline CD4 cell count was 838 cells/ mm<sup>3</sup> and mean baseline plasma HIV-1 RNA was 4.7 log<sub>10</sub> copies/ml. Through 48 weeks of therapy, the proportion of patients with HIV RNA < 400 copies/ml was 84% for antiretroviral naïve patients and 75% for antiretroviral experienced patients and the mean increases from baseline in CD4 cell count were 404 cells/ mm<sup>3</sup> and 284 cells/ mm<sup>3</sup> respectively.

*Effects on the electrocardiogram:* QTcF interval was evaluated in a randomised, placebo and active (moxifloxacin 400 mg once daily) controlled crossover study in 39 healthy adults, with 10 measurements over 12 hours on Day 3. The maximum mean (95% upper confidence bound) differences in QTcF from placebo were 3.6 (6.3) and 13.1(15.8) for 400/100 mg twice daily and supratherapeutic 800/200 mg twice daily Ritonavir-boosted Lopinavir, respectively. The two regimens resulted in exposures on Day 3 that were approximately 1.5 and 3-fold higher than those observed with recommended once daily or twice daily LPV/r doses at steady state. No subject

experienced an increase in QTcF of  $\geq 60$  msec from baseline or a QTcF interval exceeding the potentially clinically relevant threshold of 500 msec.

Modest prolongation of the PR interval was also noted in subjects receiving Lopinavir/Ritonavir in the same study on Day 3. The mean changes from baseline in PR interval ranged from 11.6 ms to 24.4 ms in the 12 hour interval post dose. Maximum PR interval was 286 msec and no second or third degree heart block was observed (see section 4.4).

## **5.2 Pharmacokinetic Properties**

Lopinavir is almost completely metabolised by CYP3A. Ritonavir inhibits the metabolism of Lopinavir, thereby increasing the plasma levels of Lopinavir. Across studies, administration of Ritonavir-boosted Lopinavir 400/100 mg twice daily yields mean steady-state Lopinavir plasma concentrations 15 to 20-fold higher than those of Ritonavir in HIV-infected patients. The plasma levels of Ritonavir are less than 7% of those obtained after the Ritonavir dose of 600 mg twice daily. The in vitro antiviral EC<sub>50</sub> of Lopinavir is approximately 10-fold lower than that of Ritonavir. Therefore, the antiviral activity of Lopinavir and Ritonavir tablets 200 mg/50 mg is due to Lopinavir.

### Absorption

The absolute bioavailability of Lopinavir co-formulated with Ritonavir in humans has not been established. The bioavailability of Lopinavir and Ritonavir in Lopinavir and Ritonavir Tablets 200 mg/ 50 mg has been studied under fasting conditions.

No pharmacokinetic data are available for Lopinavir/Ritonavir tablets 100 mg/25 mg. A bioequivalence study was conducted with a fixed dose combination product containing 200 mg Lopinavir and 50 mg Ritonavir, which is qualitatively and with respect to the ratio of active and other ingredients essentially the same as Lopinavir and Ritonavir Tablets 100 mg/25 mg.

Following single dose Lopinavir and Ritonavir Tablets 200 mg/50 mg administration in healthy volunteers, the mean ( $\pm$  SD) Lopinavir C<sub>max</sub> value was  $3.9 \pm 1.9$   $\mu\text{g/ml}$ , the corresponding value for AUC was  $33.9 \pm 20.2$   $\mu\text{g.h/ml}$  and for t<sub>max</sub> it was  $3.5 \pm 1.2$  hours.

The mean ( $\pm$  SD) Ritonavir C<sub>max</sub> value was  $0.18 \pm 0.10$   $\mu\text{g/ml}$ , the corresponding value for AUC was  $1.49 \pm 0.85$   $\mu\text{g.h/ml}$  and for t<sub>max</sub> it was  $3.7 \pm 1.0$  hours.

### Distribution

At steady state, Lopinavir is approximately 98 – 99% bound to serum proteins. Lopinavir binds to both alpha-1-acid glycoprotein (AAG) and albumin; however, it has a higher affinity for AAG. Lopinavir has been detected in cerebrospinal fluid at concentrations exceeding the IC<sub>50</sub> of wild-type virus and has been shown to reduce HIV-RNA in cerebrospinal fluid.

### Biotransformation

In vitro experiments indicate that Lopinavir primarily undergoes oxidative metabolism. Lopinavir is extensively metabolised by the hepatic cytochrome P450 system, almost exclusively by isozyme CYP3A. Ritonavir is a potent CYP3A inhibitor, which inhibits the metabolism of Lopinavir and therefore increases plasma levels of Lopinavir. At least 13 metabolites of Lopinavir have been identified, two of which are active; however, these are present at very low levels. Ritonavir has been shown to induce metabolic enzymes, resulting in the induction of its own metabolism, and the induction of Lopinavir metabolism. Pre-dose Lopinavir concentrations decline with time during multiple dosing, stabilising after 10 days to 2 weeks.

### Elimination

After administering radio-labelled Lopinavir with Ritonavir, approximately 10% and 83% of an administered dose was accounted for in urine and faeces, respectively. After multiple dosing, less than 3% of the Lopinavir dose is excreted unchanged in the urine. The effective (peak to trough) half-life of Lopinavir over a 12 hour dosing interval averaged 5-6 hours, and the apparent oral clearance (CL/F) of Lopinavir is 6-7 l/h.

### Special populations

Paediatrics: There are limited pharmacokinetic data in children below 2 years of age. The pharmacokinetics of a Lopinavir and Ritonavir oral solution 300/75 mg/m<sup>2</sup> twice daily and 230/57.5 mg/m<sup>2</sup> twice daily have been studied in a total of 53 paediatric patients, ranging in age from 6 months to 12 years. The 230/57.5 mg/m<sup>2</sup> twice daily regimen without nevirapine and the 300/75 mg/m<sup>2</sup> twice daily regimen with nevirapine provided Lopinavir plasma concentrations similar to those obtained in adult patients receiving the 400/100 mg twice daily regimen without nevirapine. Lopinavir and Ritonavir once daily has not been evaluated in paediatric patients.

*Gender, race and age:* Lopinavir and Ritonavir pharmacokinetics have not been studied in the elderly. No age, gender or race related effect has been observed in adult patients.

*Renal insufficiency:* Ritonavir-boosted Lopinavir pharmacokinetics have not been studied in patients with renal insufficiency; however, since the renal clearance of Lopinavir is negligible, a decrease in total body clearance is not expected in patients with renal insufficiency.

*Hepatic insufficiency:* The steady state pharmacokinetic parameters of Lopinavir in HIV-infected patients with mild-to-moderate hepatic impairment were compared with those of HIV-infected patients with normal hepatic function in a multiple dose study with Lopinavir and Ritonavir 400/100 mg twice daily. A limited increase in total Lopinavir concentrations of approximately 30% has been observed, and is not expected to be of clinical relevance.

### **5.3 Preclinical safety data**

Repeat-dose toxicity studies in rodent and dogs identified major target organs including the liver, kidney, thyroid, spleen and circulating red blood cells. Hepatic changes indicated cellular swelling with focal degeneration. The exposures eliciting these changes were comparable to or below human clinical exposure. Mild renal tubular degeneration was confined to mice exposed to at least twice the recommended human exposure; the kidney was unaffected in rats and dogs. Reduced serum thyroxine levels led to an increased release of TSH with resultant follicular cell hypertrophy in the thyroid glands of rats. These changes were reversible with withdrawal of the active substance and were absent in mice and dogs. Coombs-negative anisocytosis and poikilocytosis were observed in rats, but not in mice or dogs. Enlarged spleens with histiocytosis were seen in rats but not other species. Serum Cholesterol was elevated in rodents but not dogs, while triglycerides were elevated only in mice.

During in vitro studies, cloned human cardiac potassium channels (hERG) were inhibited by 30% at the highest concentrations of Lopinavir and Ritonavir tested, corresponding to a Lopinavir exposure 15-fold the free peak plasma levels achieved in humans at the maximum recommended therapeutic dose. In contrast, similar concentrations of Lopinavir and Ritonavir demonstrated no repolarisation delay in the canine cardiac Purkinje fibres. Lower concentrations of Lopinavir and Ritonavir did not produce significant potassium (hERG) current blockade. Tissue distribution studies conducted in the rat did not suggest significant cardiac retention of the active substance; 72-hour AUC

in heart was approximately 50% of measured plasma AUC. Therefore, it is reasonable to expect that cardiac Lopinavir levels would not be significantly higher than plasma levels. In dogs, prominent U waves on the electrocardiogram have been observed associated with prolonged PR interval and bradycardia. These effects have been assumed to be caused by electrolyte disturbance. The clinical relevance of these preclinical data is unknown, however, the potential cardiac effects of this product in humans cannot be ruled out (see also sections 4.4 and 4.8).

In rats, embryofoetotoxicity (pregnancy loss, decreased foetal viability, decreased foetal body weights, increased frequency of skeletal variations) and postnatal developmental toxicity (decreased survival of pups) was observed at maternally toxic dosages. The systemic exposure to Lopinavir and Ritonavir at the maternal and developmental toxic dosages was lower than the intended therapeutic exposure in humans.

Long-term carcinogenicity studies of Lopinavir and Ritonavir in mice revealed a non-genotoxic, mitogenic induction of liver tumours, generally considered to have little relevance to human risk.

Carcinogenicity studies in rats revealed no tumourigenic findings. Lopinavir and Ritonavir was not found to be mutagenic or clastogenic in a battery of in vitro and in vivo assays including the Ames bacterial reverse mutation assay, the mouse lymphoma assay, the mouse micronucleus test and chromosomal aberration assays in human lymphocytes.

## **6. PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

*Tablet core:*

Copovidone, Sorbiton monolaurate, Colloidal silicon dioxide, Poloxamer 188, Sodium stearyl fumarate.

*Film-coating:*

Hypromellose, Polyethylene glycol 400, Polysorbate 80, Titanium dioxide, Ferric oxide yellow.

### **6.2 Incompatibilities**

Not applicable.

### **6.3 Shelf-life**

Please refer outer carton for expiry date.

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

Do not store above 30°C. Store in the original package.  
Keep out of reach and sight of children.

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

Lopinavir 100 mg and Ritonavir 25 mg USP Tablets  
HDPE container containing 60 tablets  
Lopinavir 200 mg and Ritonavir 50 mg USP Tablets  
HDPE container containing 120 tablets

#### **6.6 Instructions for use and handling**

No special requirements

#### **7. MARKETING AUTHORIZATION HOLDER:**



M/s Aurobindo Pharma Ltd  
Plot No.: 2, Maitrivihar,  
Ameerpet, Hyderabad-500 038  
Telangana State  
India.

#### **8. DATE OF PREPARATION OF THE TEXT: May 2020**

**200/ 50 mg: NDC 65862-333-08**

**100/25 mg: NDC 65862-376-60**

**POM**

**Lopinavir 200 mg Ritonavir 50 mg USP Tablets**

**Botswana Reg. No.: BOT1202083 S2**

**NAFDAC Reg. No.: A4-3852**

**Tanzania Reg. No.: TZ11H180**

**Zambia Reg. No.: 127/075**

**Lopinavir 100 mg Ritonavir 25 mg USP Tablets**

**Botswana Reg. No.: BOT1402377 S2**

**NAFDAC Reg. No.: A4-6567**

**Tanzania Reg. No.: TZ15H0006**