

# PRODUCT MONOGRAPH

<sup>Pr</sup>**AURO-ABACAVIR/LAMIVUDINE**

Abacavir and Lamivudine Tablets

600 mg abacavir (as abacavir sulfate) and 300 mg lamivudine

Antiretroviral Agent

House Standard

**Auro Pharma Inc.**  
3700 Steeles Avenue West, Suite # 402  
Woodbridge, Ontario, L4L 8K8,  
Canada.

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**Pr AURO-ABACAVIR/LAMIVUDINE**

abacavir and lamivudine tablets 600 mg/ 300 mg  
(as abacavir sulfate)

Fixed-Dosed Combination

**PART I: HEALTH PROFESSIONAL INFORMATION**

**SUMMARY PRODUCT INFORMATION**

<b>Route of Administration</b>	<b>Dosage Form / Strength</b>	<b>All Nonmedicinal Ingredients</b>
oral	tablet/ 600 mg abacavir (as abacavir sulfate) and 300 mg lamivudine	Cellulose microcrystalline, Sodium Starch Glycolate, Magnesium Stearate, Opadry Orange (YS-1-13065-A).

For a complete listing see **DOSAGE FORMS, COMPOSITION AND PACKAGING** section of the Product Monograph.

**INDICATIONS AND CLINICAL USE**

AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) is indicated in antiretroviral combination therapy for the treatment of Human Immunodeficiency Virus (HIV) infection.

**Pediatrics (< 18 years of age)**

The safety and efficacy of AURO-ABACAVIR/LAMIVUDINE has been established in patients < 18 years of age and weighing at least 25 kg.

**Geriatrics (≥ 65 years of age)**

Clinical studies of abacavir sulfate/lamivudine did not include sufficient numbers of patients aged 65 and older to determine whether they respond differently from younger patients. In general, caution should be exercised in the administration and monitoring of AURO-ABACAVIR/LAMIVUDINE in elderly patients, reflecting the greater frequency of decreased hepatic, renal or cardiac function and of concomitant disease or other drug therapy.

**CONTRAINDICATIONS**

AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) is contraindicated in

- Patients who are hypersensitive to this drug or to any ingredient in the formulation or component of the container. For a complete listing, see the **DOSAGE FORMS, COMPOSITION AND PACKAGING** section of the product monograph.
- Patients who are positive for the HLA-B\*5701 allele and patients with a prior history of a hypersensitivity reaction (HSR) to abacavir, or products containing abacavir, regardless of HLA-B\*5701 status. Fatal HSRs have been associated with rechallenge of abacavir (see **WARNINGS AND PRECAUTIONS**).

- Patients with hepatic impairment, as AURO-ABACAVIR/LAMIVUDINE is a fixed-dose combination and the dosage of the individual components cannot be adjusted (see **DOSAGE AND ADMINISTRATION**).

## WARNINGS AND PRECAUTIONS

### Serious Warnings and Precautions

- **Fatal Hypersensitivity Reactions to Abacavir**

**All patients should be screened for the HLA-B\*5701 allele prior to initiating or re-initiating treatment with AURO-ABACAVIR/LAMIVUDINE.** Patients who carry the HLA-B\*5701 allele are at high risk for experiencing HSR to abacavir, a component of AURO-ABACAVIR/LAMIVUDINE although, HSR has occurred in patients who do not carry the HLA-B\*5701 allele. Serious and sometimes fatal HSRs have been associated with therapy with abacavir sulfate and other abacavir-containing products (see **WARNINGS AND PRECAUTIONS, Hypersensitivity Reactions**).

- **Lactic Acidosis and Severe Hepatomegaly with Steatosis**

Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogues alone or in combination, including abacavir sulfate/lamivudine and other antiretrovirals (see **WARNINGS AND PRECAUTIONS, Hepatic/Biliary/Pancreatic**).

- **Post-Treatment Exacerbations of Hepatitis B**

Severe acute exacerbations of hepatitis B have been reported in patients who are co-infected with hepatitis B virus (HBV) and human immunodeficiency virus (HIV-1) and have discontinued lamivudine, one component of abacavir sulfate/lamivudine. Hepatic function should be monitored closely with both clinical and laboratory follow-up for at least several months in patients who discontinue abacavir sulfate/lamivudine. If appropriate, initiation of anti-hepatitis B therapy may be warranted (see **WARNINGS AND PRECAUTIONS, Hepatic/Biliary/Pancreatic**).

### **General**

Patients prescribed AURO-ABACAVIR/LAMIVUDINE or any other antiretroviral therapy may still develop opportunistic infections and other complications of HIV infection. Therefore patients should remain under close clinical observation by physicians experienced in the treatment of these associated HIV diseases.

Patients should be advised that current antiretroviral therapy, including abacavir/lamivudine has not been proven to prevent the risk of transmission of HIV to others through sexual contact or blood contamination. Appropriate precautions should continue to be taken.

AURO-ABACAVIR/LAMIVUDINE is a fixed-dose combination of two nucleoside analogues, abacavir sulfate and lamivudine and should not be administered concomitantly with other products containing either abacavir or lamivudine (lamivudine, lamivudine and zidovudine, abacavir/lamivudine/zidovudine or abacavir sulfate or dolutegravir, abacavir, and lamivudine

tablets) or emtricitabine containing products (efavirenz/emtricitabine/tenofovir disoproxil fumarate, emtricitabine/rilpivirine/tenofovir disoproxil fumarate, emtricitabine, elvitegravir/cobicistat/emtricitabine/tenofovir disoproxil fumarate or emtricitabine/tenofovir disoproxil fumarate).

### **Hypersensitivity Reactions to Abacavir**

Abacavir is associated with a risk for HSR characterized by fever and/or rash with other symptoms indicating multi-organ involvement. HSR can be life-threatening, and in rare cases fatal, when not managed appropriately. The risk for abacavir HSR to occur is significantly increased for patients who test positive for the HLA-B\*5701 allele. However, abacavir HSRs have been reported at a lower frequency in patients who do not carry this allele.

### **Clinical Management of Abacavir HSRs**

**All patients should be screened for the HLA-B\*5701 allele prior to initiating or re-initiating treatment with AURO-ABACAVIR/LAMIVUDINE.**

**Do not use AURO-ABACAVIR/LAMIVUDINE in HLA-B\*5701-positive patients or in patients with a negative HLA-B\*5701 status who had a suspected abacavir HSR on a previous abacavir-containing regimen.**

HLA-B\*5701-negative patients may develop a HSR to abacavir; however, this occurs significantly less frequently than in HLA-B\*5701-positive patients. **Regardless of HLA-B\*5701 status, permanently discontinue AURO-ABACAVIR/LAMIVUDINE if HSR cannot be ruled out, even when other diagnoses are possible** (e.g., acute onset respiratory diseases such as pneumonia, bronchitis, pharyngitis, influenza; gastroenteritis; or reactions to other medications).

Restarting abacavir-containing products following a suspected abacavir HSR can result in a prompt return of symptoms within hours. This recurrence is usually more severe than on initial presentation, and may include life-threatening hypotension and death.

**NEVER restart AURO-ABACAVIR/LAMIVUDINE or any other abacavir-containing product in patients who have stopped therapy with AURO-ABACAVIR/LAMIVUDINE due to a HSR.**

When therapy with AURO-ABACAVIR/LAMIVUDINE has been discontinued for reasons other than symptoms of a HSR, and if reinitiation of AURO-ABACAVIR/LAMIVUDINE or any other abacavir-containing product is under consideration, carefully evaluate the reason for discontinuation of AURO-ABACAVIR/LAMIVUDINE to ensure that the patient did not have symptoms of a HSR.

If HSR cannot be ruled out, **DO NOT** reintroduce AURO-ABACAVIR/LAMIVUDINE or any other abacavir-containing product.

If symptoms consistent with abacavir HSR are not identified, reintroduction can be undertaken

with continued monitoring for symptoms of a HSR. Make patients aware that HSR can occur with reintroduction of AURO-ABACAVIR/LAMIVUDINE or any other abacavir-containing product. Reintroduction should be attempted only if the potential benefit outweighs the risk and if medical care can be readily accessed by the patient or others in case an adverse reaction occurs.

### **Clinical Description of Abacavir HSRs**

Abacavir HSR has been well characterised through clinical studies and during post marketing follow-up. Symptoms usually appeared within the first six weeks (median time to onset 11 days) of initiation of treatment with abacavir, **although these reactions may occur at any time during therapy**.

Almost all HSR to abacavir include fever and/or rash. Other signs and symptoms that have been observed as part of abacavir HSR may include, respiratory signs and symptoms (including, but not limited to pharyngitis, dyspnea or cough), and gastrointestinal symptoms (including, but not limited to, nausea, vomiting, diarrhea or abdominal pain). Importantly, such symptoms **may lead to misdiagnosis of HSR as respiratory disease (pneumonia, bronchitis, pharyngitis), or gastroenteritis**. Other frequently observed signs or symptoms of HSR may include, but are not limited to, generalized malaise, fatigue or achiness (see **ADVERSE DRUG REACTIONS, Description of Abacavir Hypersensitivity Adverse Reactions**). The symptoms related to this HSR worsen with continued therapy and **can be life-threatening**. These symptoms usually resolve upon discontinuation of the abacavir-containing product.

A warning card with information for the patient about this HSR is included as part of the AURO-ABACAVIR/LAMIVUDINE outer pack label (see a copy of this card on the last page of this Product Monograph).

### **Carcinogenesis and Mutagenesis**

Carcinogenicity studies with abacavir in mice and rats showed an increase in malignant tumours in the preputial gland of males and the clitoral gland of females of both species, and in the liver, urinary bladder, lymph nodes and subcutis of female rats. The majority of these tumours occurred at exposures equivalent to 24 to 33 times the expected systemic exposure in humans (see **TOXICOLOGY, Carcinogenicity and Mutagenicity**).

Abacavir was not mutagenic in a bacterial mutagenicity assay but induced chromosomal aberrations *in vitro* and was mutagenic in the absence of metabolic activation in an L5178Y mouse lymphoma assay. In an *in vivo* mouse bone marrow micronucleus assay, abacavir was clastogenic in males at exposures ~9X higher than those in humans at the therapeutic dose (see **TOXICOLOGY, Carcinogenicity and Mutagenicity**).

### **Cardiovascular**

In a published, prospective, observational, epidemiological study designed to investigate the rate of myocardial infarction in patients on combination antiretroviral therapy, the use of abacavir within the previous six months was correlated with an increased risk of myocardial infarction. In a sponsor-conducted pooled analysis of clinical trials, no excess risk of myocardial infarction was observed in abacavir-treated subjects as compared with control subjects. In totality, the

available data from observational cohorts and from controlled clinical trials are inconclusive.

As a precaution, the underlying risk of coronary heart disease should be considered when prescribing antiretroviral therapies, including abacavir, and action taken to minimize all modifiable risk factors (e.g. hypertension, hyperlipidemia, diabetes mellitus and smoking).

### **Endocrine and Metabolism**

#### **Serum lipids and blood glucose**

Serum lipid and blood glucose levels may increase during antiretroviral therapy. Disease control and life style changes may also be contributing factors. Consideration should be given to the measurement of serum lipids and blood glucose. Lipid disorders and blood glucose elevations should be managed as clinically appropriate.

#### **Hematologic**

Very rare occurrences of pure red cell aplasia have been reported with lamivudine use. Discontinuation of lamivudine has resulted in normalization of hematologic parameters in patients with suspected lamivudine induced pure red cell aplasia.

#### **Hepatic/Biliary/Pancreatic**

##### **Lactic Acidosis/Severe Hepatomegaly with Steatosis**

Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogues alone or in combination, including abacavir and lamivudine and other antiretrovirals. A majority of these cases have been in women.

Clinical features which may be indicative of the development of lactic acidosis include generalized weakness, anorexia and sudden unexplained weight loss, gastrointestinal symptoms and respiratory symptoms (dyspnea and tachypnea).

Obesity and prolonged nucleoside exposure may be risk factors. Caution should be exercised when administering abacavir sulfate/lamivudine or other nucleoside analogues, particularly to those with known risk factors for liver disease. However, cases have also been reported in patients with no known risk factors. Treatment with AURO-ABACAVIR/LAMIVUDINE should be suspended in any patient who develops clinical or laboratory findings suggestive of lactic acidosis with or without hepatitis, which may include hepatomegaly and steatosis even in the absence of marked transaminase elevations.

##### **Use With Interferon and Ribavirin Based Regimens**

*In vitro* studies have shown ribavirin can reduce the phosphorylation of pyrimidine nucleoside analogues such as lamivudine, a component of abacavir sulfate/lamivudine. Although no evidence of a pharmacokinetic or pharmacodynamic interaction (e.g. loss of HIV/HCV virologic suppression) was seen when ribavirin was coadministered with lamivudine in HIV/HCV coinfecting patients (see **DRUG INTERACTIONS**), hepatic decompensation (some fatal) has occurred in HIV/HCV coinfecting patients receiving combination antiretroviral therapy for HIV and interferon alfa with or without ribavirin. Patients receiving interferon alfa with or without ribavirin and AURO-ABACAVIR/LAMIVUDINE should be closely monitored for treatment

associated toxicities, especially hepatic decompensation. Discontinuation of AURO-ABACAVIR/LAMIVUDINE should be considered as medically appropriate. Dose reduction or discontinuation of interferon alfa, ribavirin, or both should also be considered if worsening clinical toxicities are observed, including hepatic decompensation.

### **Hepatic Impairment**

AURO-ABACAVIR/LAMIVUDINE is contraindicated in patients with hepatic impairment because AURO-ABACAVIR/LAMIVUDINE is a fixed-dose combination and the dosage of the individual components cannot be adjusted. If patients require a dose reduction due to hepatic impairment, separate preparations of abacavir and lamivudine should be administered (see **CONTRAINDICATIONS** and **DOSAGE AND ADMINISTRATION, Recommended Dose and Dosage Adjustment**).

### **Post-Treatment Exacerbations of Hepatitis B**

Clinical study and marketed use of lamivudine have shown that some patients with chronic hepatitis B virus (HBV) disease may experience clinical or laboratory evidence of recurrent hepatitis upon discontinuation of lamivudine, which may have more severe consequences in patients with decompensated liver disease. If AURO-ABACAVIR/LAMIVUDINE is discontinued in patients coinfecting with HBV, periodic monitoring of both liver function tests and markers of HBV replication should be considered.

### **Patients with HBV and/or HCV Co-infection**

The safety and efficacy of abacavir sulfate/lamivudine have not been established in subjects co-infected with Hepatitis B and/or Hepatitis C virus.

### **Pancreatitis**

Pancreatitis has been observed in some patients receiving nucleoside analogues, including abacavir and lamivudine. However it is not clear whether these cases were due to drug treatment or to the underlying HIV disease. Pancreatitis must be considered whenever a patient develops abdominal pain, nausea, vomiting or elevated biochemical markers. Discontinue use of AURO-ABACAVIR/LAMIVUDINE until diagnosis of pancreatitis is excluded (see **ADVERSE EVENTS, Post-Market Adverse Drug Reactions**).

### **Immune**

#### **Immune Reconstitution Inflammatory Syndrome**

During the initial phase of treatment, patients responding to antiretroviral therapy may develop an inflammatory response to indolent or residual opportunistic infections (such as MAC, CMV, PCP and TB), which may necessitate further evaluation and treatment.

Autoimmune disorders (such as Graves' disease, polymyositis and Guillain-Barre syndrome) have also been reported to occur in the setting of immune reconstitution, however, the time to onset is more variable, and can occur many months after initiation of treatment and sometimes can be an atypical presentation.

#### **Renal Impairment**

AURO-ABACAVIR/LAMIVUDINE is not recommended for use in patients with a creatinine clearance < 50 mL/min as AURO-ABACAVIR/LAMIVUDINE is a fixed-dose combination and



the dosage of the individual components cannot be adjusted. If patients require a dose reduction due to renal impairment, separate preparations of abacavir and lamivudine should be administered (see **DOSAGE AND ADMINISTRATION, Recommended Dose and Dosage Adjustment**, and **ACTION AND CLINICAL PHARMACOLOGY, Pharmacokinetics**).

### **Special Populations**

#### **Pregnant Women**

Abacavir sulfate/lamivudine has not been studied in pregnant women. Therefore, AURO-ABACAVIR/LAMIVUDINE should not be used in pregnant women unless the potential benefits outweigh the potential risk to the fetus.

There have been reports of developmental delay, seizures and other neurological disease. However, a causal relationship between these events and NRTI exposure *in utero* or peri-partum has not been established. Findings of developmental toxicity were also observed in animal toxicology studies (see **TOXICOLOGY**).

There have also been reports of mild, transient elevations in serum lactate levels, which may be due to mitochondrial dysfunction, in neonates and infants exposed *in utero* or peri-partum to nucleoside reverse transcriptase inhibitors (NRTIs). The clinical relevance of transient elevations in serum lactate is unknown.

**Antiretroviral Pregnancy Registry:** To monitor maternal-fetal outcomes of pregnant women exposed to ART (antiretroviral therapy), including abacavir sulfate/lamivudine, an Antiretroviral Pregnancy Registry has been established. Healthcare providers are encouraged to register patients:

<http://www.apregistry.com>  
Telephone: (800) 258-4263  
Fax: (800) 800-1052

To date, the Antiretroviral Pregnancy Registry has received reports of over 2,000 exposures to abacavir during pregnancy resulting in live birth. These consist of over 800 exposures during the first trimester, over 1,100 exposures during the second/third trimester and included 27 and 32 birth defects respectively. The prevalence (95% CI) of defects in the first trimester was 3.1% (2.0, 4.4%) and in the second/third trimester, 2.7% (1.9, 3.9%). Among pregnant women in the reference population, the background rate of birth defects is 2.7%. There appears to be no association between abacavir and overall birth defects observed in the Antiretroviral Pregnancy Registry.

The Antiretroviral Pregnancy Registry has received reports of over 11,000 exposures to lamivudine during pregnancy resulting in live birth. These consist of over 4,200 exposures during the first trimester, over 6,900 exposures during the second/third trimester and included 135 and 198 birth defects respectively. The prevalence (95% CI) of defects in the first trimester was 3.2% (2.6, 3.7%) and in the second/third trimester, 2.8% (2.4, 3.2%). Among pregnant women in the reference population, the background rate of birth defects is 2.7%. The Antiretroviral Pregnancy Registry does not show an increased risk of major birth defects for lamivudine compared to the background rate.

## **Nursing Women**

**HIV-1 infected mothers should not breast-feed their infants to avoid risking postnatal transmission of HIV.** Lamivudine is excreted in human milk at similar concentrations to those found in serum. Abacavir is also secreted in human breast milk at similar concentrations as plasma levels. Because of both the potential for HIV transmission and the potential for serious adverse reactions in nursing infants, **mothers should be instructed not to breast-feed if they are receiving AURO-ABACAVIR/LAMIVUDINE.**

## **Pediatrics (< 18 years of age)**

AURO-ABACAVIR/LAMIVUDINE is not recommended for treatment of patients < 18 years of age weighing less than 25 kg as the necessary dose adjustment cannot be made.

## **Geriatrics (≥ 65 years of age)**

Clinical studies of abacavir sulfate/lamivudine did not include sufficient numbers of patients aged 65 and older to determine whether they respond differently from younger patients. In general, caution should be exercised in the administration and monitoring of AURO-ABACAVIR/LAMIVUDINE in elderly patients, reflecting the greater frequency of decreased hepatic, renal or cardiac function and of concomitant disease or other drug therapy.

## **ADVERSE REACTIONS**

### **Adverse Drug Reaction Overview**

The following adverse reactions are discussed in greater detail in other sections of the labelling:

- Serious and sometimes fatal hypersensitivity reaction (see **WARNINGS AND PRECAUTIONS, Hypersensitivity Reactions to Abacavir**)
- Lactic acidosis and severe hepatomegaly (see **WARNINGS AND PRECAUTIONS, Lactic Acidosis and Severe Hepatomegaly with Steatosis**)
- Post-treatment exacerbations of hepatitis (see **WARNINGS AND PRECAUTIONS, Post-Treatment Exacerbations of Hepatitis B**)
- Hepatic decompensation in patients co-infected with HIV-1 and Hepatitis C (see **WARNINGS AND PRECAUTIONS, Use With Interferon and Ribavirin Based Regimens**)
- Myocardial infarction (see **WARNINGS AND PRECAUTIONS, Cardiovascular**)
- Serum lipids and blood glucose (see **WARNINGS AND PRECAUTIONS, Endocrine and Metabolism**)
- Immune reconstitution inflammatory syndrome (see **WARNINGS AND PRECAUTIONS, Immune**)

### **Clinical Trial Adverse Drug Reactions**

*Because clinical trials are conducted under very specific conditions the adverse reaction rates observed in the clinical trials may not reflect the rates observed in practice and should not be compared to the rates in the clinical trials of another drug. Adverse drug reaction information*

from clinical trials is useful for identifying drug-related adverse events and for approximating rates.

### Therapy-Naïve Adults

Treatment-emergent clinical adverse reactions (rated by the investigator as moderate or severe) with a  $\geq 5\%$  frequency during therapy with abacavir 600 mg once daily or abacavir 300 mg twice daily, both in combination with lamivudine 300 mg once daily and efavirenz 600 mg once daily, are listed in Table 1.

**Table 1 Treatment-emergent Adverse Reactions of at Least Moderate Intensity (Grades 2-4) and  $\geq 5\%$  Frequency in Treatment-Naïve Adults (CNA30021) Through 48 Weeks of Treatment**

Adverse Event	Abacavir 600 mg q.d. plus Lamivudine plus Efavirenz (n = 384)	Abacavir 300 mg b.i.d. plus Lamivudine plus Efavirenz (n = 386)
<b>Drug hypersensitivity<sup>a</sup></b>	9%	7%
Insomnia	7%	9%
Depression/Depressed mood	7%	7%
Headache/Migraine	5%	5%
Fatigue/Malaise	5%	8%
Dizziness/Vertigo	5%	5%
Nausea	5%	6%
Diarrhea <sup>a</sup>	5%	6%
Rash	5%	5%
Pyrexia	5%	3%
Abnormal dreams	4%	5%
Anxiety	3%	5%

<sup>a</sup>Subjects receiving abacavir 600 mg once daily, experienced a significantly higher incidence of severe drug hypersensitivity reactions and severe diarrhea compared with subjects who received abacavir 300 mg twice daily. Five percent (5%) of subjects receiving abacavir 600 mg once daily had severe drug hypersensitivity reactions compared with 2% of subjects receiving abacavir 300 mg twice daily. Two percent (2%) of subjects receiving abacavir 600 mg once daily had severe diarrhea while none of the subjects receiving abacavir 300 mg twice daily had this event.

Other adverse reactions observed in clinical studies include neutropenia, anemia, thrombocytopenia, anorexia, hyperlactatemia, lactic acidosis, vomiting, pancreatitis, erythema multiforme, upper abdominal pain, transient rise in liver enzymes (AST, ALT, GGT), Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN).

### Pediatric Patients

The safety of once daily compared with twice daily dosing of abacavir and lamivudine was assessed in the ARROW study (COL105677). No additional safety issues were identified in pediatric patients (n=669) receiving abacavir and lamivudine either once (n=336) or twice daily dosing compared to adults. Within this population, 104 pediatric patients weighing at least 25 kg received abacavir and lamivudine once daily as abacavir sulfate/lamivudine. One event of Grade 4 hepatitis in the once daily cohort was considered as uncertain causality by

the investigator and all other Grade 3 or 4 adverse events were considered not related by the investigator.

### **Post-Market Adverse Drug Reactions**

In addition to the adverse events included from clinical trial data, the following adverse events listed below have been identified during post-approval use of abacavir and lamivudine, and/or abacavir sulfate/lamivudine.

These events have been chosen for inclusion due to either their seriousness, frequency of reporting, potential causal connection to abacavir and lamivudine, or a combination of these factors. Because these reactions are reported voluntarily from a population of unknown size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

#### Abacavir

Endocrine/Metabolic: lactic acidosis (see **WARNINGS AND PRECAUTIONS, Hepatic/Biliary/Pancreatic**), hepatic steatosis

Digestive: pancreatitis

Immune System: Immune Reconstitution Inflammatory Syndrome (see **WARNINGS AND PRECAUTIONS, Immune**)

Skin: rash, **erythema multiforme**, **Stevens-Johnson syndrome (SJS)** and **toxic epidermal necrolysis (TEN)** (primarily in combination with medications known to be associated with SJS and TEN, respectively). Because of the overlap of the clinical signs and symptoms between hypersensitivity to abacavir, SJS and TEN and the possibility of multiple drug sensitivities in some patients, abacavir should be discontinued and not restarted in such cases.

#### Lamivudine

Body as a whole: anaphylaxis, weakness

Hematological: pure red cell aplasia

Hemic and Lymphatic: anemia, lymphadenopathy, splenomegaly

Endocrine/Metabolic: lactic acidosis (see **WARNINGS AND PRECAUTIONS, Hepatic/Biliary/Pancreatic**), hyperlactatemia, hepatic steatosis, hyperglycemia

Nervous: paresthesia, peripheral neuropathy

Digestive: rises in serum amylase, pancreatitis, stomatitis

Immune System: Immune Reconstitution Inflammatory Syndrome (see **WARNINGS AND PRECAUTIONS, Immune**)

Skin: alopecia, pruritus, urticaria

Musculoskeletal: muscle disorders including rarely rhabdomyolysis, arthralgia

## **Description of Abacavir Hypersensitivity Adverse Reactions**

### **Hypersensitivity**

The signs and symptoms of abacavir hypersensitivity reaction are listed below. These have been identified either from clinical studies or post marketing surveillance. Those reported in at least 10% of patients with a hypersensitivity reaction are in **bold** text.

As described in Warnings and Precautions, almost all patients developing hypersensitivity reactions will have fever and/or rash (usually maculopapular or urticarial) as part of the syndrome, however, reactions have occurred without rash or fever. Other key symptoms include gastrointestinal, respiratory or constitutional symptoms such as lethargy and malaise.

Skin:	<b>Rash</b> (usually maculopapular or urticarial)
Gastrointestinal tract:	<b>Nausea, vomiting, diarrhoea, abdominal pain</b> , mouth ulceration
Respiratory tract:	<b>Dyspnoea, cough</b> , sore throat, adult respiratory distress syndrome, respiratory failure
Miscellaneous:	<b>Fever, fatigue, malaise</b> , oedema, lymphadenopathy, hypotension, conjunctivitis, anaphylaxis
Neurological/Psychiatry:	<b>Headache</b> , paraesthesia
Hematological:	Lymphopenia
Liver/pancreas:	<b>Elevated liver function tests</b> , hepatic failure
Musculoskeletal:	<b>Myalgia</b> , rarely myolysis, arthralgia, elevated creatine phosphokinase
Urology:	Elevated creatinine, renal failure

Restarting abacavir following an abacavir HSR results in a prompt return of symptoms within hours. This recurrence of the HSR is usually more severe than on initial presentation, and may include life-threatening hypotension and death. Reactions have also occurred infrequently after restarting abacavir in patients who had only one of the key symptoms of hypersensitivity (see above) prior to stopping abacavir; and on very rare occasions have also been seen in patients who have restarted therapy with no preceding symptoms of a HSR (i.e., patients previously considered to be abacavir tolerant).

For details of clinical management in the event of a suspected abacavir HSR (see **WARNINGS AND PRECAUTIONS, Clinical Management of Abacavir HSRs**).

## **DRUG INTERACTIONS**

### **Overview**

As AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) contains abacavir and lamivudine, any interactions that have been identified with these agents individually may occur with AURO-ABACAVIR/LAMIVUDINE. Clinical studies have shown that there are no clinically significant interactions between abacavir and lamivudine. Abacavir and lamivudine are

not significantly metabolized by cytochrome P<sub>450</sub> enzymes (such as CYP 3A4, CYP 2C9 or CYP 2D6) nor do they inhibit or induce this enzyme system. Therefore, there is little potential for interactions with antiretroviral protease inhibitors, non-nucleosides and other medicinal products metabolized by major P<sub>450</sub> enzymes.

The likelihood of metabolic interactions with lamivudine is low due to limited metabolism and plasma protein binding, and almost complete renal clearance. Lamivudine is predominantly eliminated by active organic cationic secretion. The possibility of interactions with other medicinal products administered concurrently should be considered, particularly when the main route of elimination is renal.

#### **Effect of Abacavir on the Pharmacokinetics of Other Agents**

*In vitro*, abacavir demonstrates no or weak inhibition of the drug transporters organic anion transporter 1B1 (OATP1B1), OATP1B3, breast cancer resistant protein (BCRP) or P-glycoprotein (Pgp) and minimal inhibition of organic cation transporter 1 (OCT1), OCT2 and multidrug and toxin extrusion protein 2-K (MATE2-K). Abacavir is therefore not expected to affect the plasma concentrations of drugs that are substrates of these drug transporters.

Abacavir is an inhibitor of MATE1 *in vitro*, however abacavir has low potential to affect the plasma concentrations of MATE1 substrates at therapeutic drug exposures (up to 600 mg).

#### **Effect of Other Agents on the Pharmacokinetics of Abacavir**

*In vitro*, abacavir is not a substrate of OATP1B1, OATP1B3, OCT1, OCT2, OAT1, MATE1, MATE2-K, Multidrug resistance-associated protein 2 (MRP2) or MRP4, therefore drugs that modulate these transporters are not expected to affect abacavir plasma concentrations.

Although abacavir is a substrate of BCRP and Pgp *in vitro*, clinical studies demonstrate no clinically significant changes in abacavir pharmacokinetics when co-administered with lopinavir/ritonavir (Pgp and BCRP inhibitors).

#### **Effect of Lamivudine on the Pharmacokinetics of Other Agents**

*In vitro*, lamivudine demonstrates no or weak inhibition of the drug transporters OATP1B1, OATP1B3, BCRP or Pgp, MATE1, MATE2-K or OCT3. Lamivudine is therefore not expected to affect the plasma concentrations of drugs that are substrates of these drug transporters.

Lamivudine is an inhibitor of OCT1 and OCT2 *in vitro* with IC<sub>50</sub> values of 17 and 33 µM, respectively, however lamivudine has low potential to affect the plasma concentrations of OCT1 and OCT2 substrates at therapeutic drug exposures (up to 300 mg).

#### **Effect of Other Agents on the Pharmacokinetics of Lamivudine**

Lamivudine is a substrate of MATE1, MATE2-K and OCT2 *in vitro*. Trimethoprim (an inhibitor of these drug transporters) has been shown to increase lamivudine plasma concentrations, however this interaction is not considered clinically significant as no dose adjustment of lamivudine is needed.

Lamivudine is a substrate of the hepatic uptake transporter OCT1. As hepatic elimination plays a minor role in the clearance of lamivudine, drug interactions due to inhibition of OCT1 are unlikely to be of clinical significance.

Lamivudine is a substrate of Pgp and BCRP, however due to its high bioavailability it is unlikely that these transporters play a significant role in the absorption of lamivudine. Therefore co-administration of drugs that are inhibitors of these efflux transporters is unlikely to affect the disposition and elimination of lamivudine.

### **Drug-Drug Interactions**

No drug interaction studies have been conducted with abacavir sulfate/lamivudine. The drugs listed in the following table are based on either drug interaction case reports or studies, or potential interactions due to the expected magnitude and seriousness of the interaction (i.e. those identified as contraindicated).

**Table 2      Established or Potential Drug-Drug Interactions**

<b>Abacavir Drug Interactions</b>		
<b>Proper name</b>	<b>Effect</b>	<b>Clinical comment</b>
Ethanol	In men, the metabolism of abacavir sulfate is altered by concomitant ethanol resulting in an increase in AUC of abacavir of about 41%.	The clinical significance of this is unknown. In men, abacavir sulfate has no effect on the metabolism of ethanol. This interaction has not been studied in women.
Methadone	In a pharmacokinetic study, coadministration of 600 mg abacavir twice daily with methadone showed a 35% reduction in abacavir $C_{max}$ and a one hour delay in $t_{max}$ , but AUC was unchanged.	The changes in abacavir pharmacokinetics are not considered clinically relevant. In this study, abacavir increased the mean methadone systemic clearance by 22%. This change is not considered clinically relevant for the majority of patients, however occasionally methadone dose retitration may be required.
Retinoids		Retinoid compounds, such as isotretinoin, are eliminated via alcohol dehydrogenase. Interaction with abacavir is possible but has not been studied.

### Lamivudine Drug Interactions

Proper name	Effect	Clinical comment
Ribavirin	<i>In vitro</i> data indicate ribavirin reduces phosphorylation of lamivudine, stavudine, and Zidovudine.	No pharmacokinetic (e.g. plasma concentrations or intracellular triphosphorylated active metabolite concentrations) or pharmacodynamic (e.g. loss of HIV/HCV virologic suppression) interaction was observed when ribavirin and lamivudine (n = 18), stavudine (n = 10), or zidovudine (n = 6) were coadministered as part of a multi drug regimen to HIV/HCV coinfecting patients (see <b>WARNINGS AND PRECAUTIONS, Hepatic/Biliary/Pancreatic</b> ).
Sorbitol	Coadministration of sorbitol solution (3.2 g, 10.2 g, 13.4 g) with a single 300 mg dose of lamivudine oral solution resulted in dose dependent decreases of 14%, 32%, and 36% in lamivudine exposure ( $AUC_{\infty}$ ) and 28%, 52%, and 55% in the $C_{max}$ of lamivudine in adults.	When possible, avoid chronic coadministration of sorbitol-containing medicines with lamivudine. Consider more frequent monitoring of HIV-1 viral load when chronic coadministration cannot be avoided.
Trimethoprim	Administration of trimethoprim/sulphamethoxazole 160 mg/800 mg (co-trimoxazole) causes a 40% increase in lamivudine exposure because of the trimethoprim component.	Unless the patient has renal impairment, no dosage adjustment of lamivudine is necessary (see <b>DOSAGE AND ADMINISTRATION</b> ). Lamivudine has no effect on the pharmacokinetics of trimethoprim or sulphamethoxazole. The effect of coadministration of lamivudine with higher doses of co-trimoxazole used for the treatment of <i>Pneumocystis jiroveci</i> pneumonia (often referred to as PCP) and toxoplasmosis has not been studied.
Emtricitabine	Lamivudine may inhibit the intracellular phosphorylation of emtricitabine when the two medicinal products are used concurrently. Additionally, the mechanism of viral resistance for both lamivudine and emtricitabine is mediated via mutation of the same viral reverse transcriptase gene (M184V) and therefore the therapeutic efficacy of these drugs in combination therapy may be limited.	AURO-ABACAVIR/LAMIVUDINE is not recommended for use in combination with emtricitabine oremtricitabine-containing fixed-dose combinations.

### Drug-Food Interactions

Interactions with food have not been established.



### **Drug-Herb Interactions**

Interactions with herbs have not been established.

### **Drug-Laboratory Test Interactions**

Interactions with laboratory tests have not been established.

## **DOSAGE AND ADMINISTRATION**

### **Dosing Considerations**

AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) can be taken with or without food.

Before prescribing AURO-ABACAVIR/LAMIVUDINE tablets, pediatric patients should be assessed for the ability to swallow tablets.

### **Recommended Dose and Dosage Adjustment**

- Because AURO-ABACAVIR/LAMIVUDINE is a fixed dose tablet it should not be prescribed for patients requiring dosage adjustments, such as: patients who weigh less than 25 kg
- patients with renal impairment (creatinine clearance < 50 mL/min)
- patients with mild hepatic impairment
- patients experiencing dose-limiting adverse events

Separate preparations of abacavir or lamivudine should be administered in cases where discontinuation or dose adjustment is indicated.

### **Adults and children weighing at least 25 kg**

The recommended dose of AURO-ABACAVIR/LAMIVUDINE is one tablet once daily.

### **Pediatric patients (weighing less than 25 kg)**

AURO-ABACAVIR/LAMIVUDINE is not recommended for treatment of children weighing less than 25 kg as the necessary dose adjustment cannot be made.

### **Geriatrics (≥ 65 years of age)**

There are limited data available on the use of abacavir and lamivudine in patients aged 65 years and older. However, there is no evidence that elderly patients would differ in their response from adult patients less than 65 years of age. When treating elderly patients, consideration needs to be given to the greater frequency of decreased hepatic, renal and cardiac function, concomitant medicinal products or disease.

### **Missed Dose**

It is important to take AURO-ABACAVIR/LAMIVUDINE as prescribed to ensure the patient gets maximum benefit. If the patient forgets to take a dose, they should take it as soon as they remember, and then continue as before. Patients must not take more than one tablet to make up for forgotten individual doses.

## OVERDOSAGE

For management of a suspected drug overdose, please contact your regional Poison Control Centre immediately.

If overdosage occurs, the patient should be monitored, and standard supportive treatment applied as required.

Administration of activated charcoal may also be used to aid in the removal of unabsorbed active substance. General supportive measures are recommended.

It is not known whether abacavir can be removed by peritoneal dialysis or hemodialysis.

Since lamivudine is dialysable, continuous haemodialysis could be used in the treatment of overdose, although this has not been studied.

Limited data are available on the consequences of ingestion of acute overdoses in humans. No fatalities occurred, and the patients recovered.

Single doses up to 1,200 mg and daily doses up to 1,800 mg of abacavir sulfate have been administered to patients in clinical studies. No unexpected adverse reactions were reported. The effects of higher doses are not known. No specific signs or symptoms have been identified following such overdose.

## ACTION AND CLINICAL PHARMACOLOGY

### **Mechanism of Action**

AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) is a fixed dose combination of two nucleoside analogues (abacavir and lamivudine). Abacavir is a carbocyclic synthetic nucleoside analogue of deoxyguanosine-5'-triphosphate and lamivudine is also a synthetic nucleoside analogue, an (-) enantiomer of a dideoxy analogue of cytidine. Both abacavir and lamivudine are metabolized sequentially by intracellular kinases to their respective triphosphate (TP), which are the active moieties (carbovir triphosphate (CBV-TP) for abacavir; and lamivudine triphosphate (L-TP) for lamivudine). Abacavir and lamivudine are nucleoside reverse transcriptase inhibitors (NRTIs), and are potent, selective inhibitors of HIV-1 and HIV-2 replication *in vitro*. *In vitro* L-TP has an intracellular half life of approximately 10.5 to 15.5 hours. L-TP and CBV-TP are substrates for and competitive inhibitors of HIV reverse transcriptase (RT). Inhibition of RT is via viral DNA chain termination after nucleoside analogue incorporation. CBV-TP and L-TP show significantly less affinity for host cell DNA polymerases and are weak inhibitors of mammalian  $\alpha$ ,  $\beta$  and  $\gamma$ -DNA polymerases.

In a study of 20 HIV-infected patients receiving abacavir 300 mg twice daily, with only one 300 mg dose taken prior to the 24 hours sampling period, the geometric mean terminal carbovir-TP intracellular half-life at steady-state was 20.6 hours, compared to the geometric mean abacavir plasma half-life in this study of 2.6 hours.

The steady state pharmacokinetic properties of abacavir 600 mg once daily was compared to

abacavir 300 mg twice daily in a crossover study in 27 HIV-infected patients. Intracellular carbovir triphosphate exposures in peripheral blood mononuclear cells were higher for abacavir 600 mg once daily with respect to  $AUC_{24,ss}$  (32 %, higher),  $C_{max 24,ss}$  (99% higher) and trough values (18% higher), compared to the 300 mg twice daily regimen.

For patients receiving lamivudine 300 mg once daily, the terminal intracellular half-life of lamivudine-TP was prolonged to 16 to 19 hours, compared to the plasma lamivudine half-life of 5 to 7 hours.

The steady state pharmacokinetic properties of lamivudine 300 mg once daily for 7 days compared to lamivudine 150 mg twice daily for 7 days were assessed in a crossover study in 60 healthy volunteers. Intracellular lamivudine triphosphate exposures in peripheral blood mononuclear cells were similar with respect to  $AUC_{24,ss}$  and  $C_{max 24,ss}$ ; however, trough values were lower compared to the 150 mg twice daily regimen. Inter subject variability was greater for intracellular lamivudine triphosphate concentrations versus lamivudine plasma trough concentrations. These data support the use of lamivudine 300 mg and abacavir 600 mg once daily for the treatment of HIV-infected patients. Additionally, the efficacy and safety of this combination given once daily has been demonstrated in a pivotal clinical study (see **CLINICAL TRIALS**).

### **Pharmacokinetics**

**Absorption:** Abacavir and lamivudine are rapidly and well absorbed following oral administration. The absolute bioavailability of oral abacavir and lamivudine in adults is 83 and 80-85% respectively. The mean time to maximal serum concentrations ( $t_{max}$ ) is about 1.5 and 1.0 hours for abacavir and lamivudine respectively. Following a single oral dose of 600 mg of abacavir, the mean  $C_{max}$  is 4.26  $\mu\text{g/mL}$  and the mean  $AUC_{\infty}$  is 11.95  $\mu\text{g.h/mL}$ . Following multiple dose oral administration of lamivudine 300 mg once daily for seven days the mean steady state  $C_{max}$  is 2.04  $\mu\text{g/mL}$  and the mean  $AUC_{24}$  is 8.87  $\mu\text{g.h/mL}$ .

**Effect of Food on Absorption:** In the fasted state there was no significant difference in the extent of absorption, as measured by the area under the plasma concentration-time curve (AUC) and maximal peak concentration ( $C_{max}$ ), of each component. There was also no clinically significant food effect observed between administration of abacavir sulfate/lamivudine in the fasted or fed state. These results indicate that abacavir sulfate/lamivudine can be taken with or without food.

**Distribution:** Intravenous studies with abacavir and lamivudine showed that the mean apparent volume of distribution is 0.8 and 1.3 L/kg respectively. Plasma protein binding studies *in vitro* indicate that abacavir binds only low to moderately (~ 49%) to human plasma proteins at therapeutic concentrations. Lamivudine exhibits linear pharmacokinetics over the therapeutic dose range and displays low plasma protein binding (< 36%). This indicates a low likelihood for interactions with other medicinal products through plasma protein binding displacement.

Data show that abacavir and lamivudine penetrate the central nervous system (CNS) and reach the cerebrospinal fluid (CSF). Studies with abacavir demonstrate a CSF to plasma AUC ratio of between 30 to 44%. The observed values of the peak concentrations are 9 fold greater than the  $IC_{50}$  of abacavir of 0.08  $\mu\text{g/mL}$  or 0.26  $\mu\text{M}$  when abacavir is given at 600 mg twice daily. The mean ratio of CSF/serum lamivudine concentrations 2-4 hours after oral administration was

approximately 12%. The true extent of CNS penetration of lamivudine and its relationship with any clinical efficacy is unknown.

**Metabolism:** Abacavir is primarily metabolized by the liver with less than 2% of the administered dose being renally excreted as unchanged compound. The primary pathways of metabolism in humans are by alcohol dehydrogenase and by glucuronidation to produce the 5'-carboxylic acid and 5'-glucuronide which account for about 66% of the administered dose. These metabolites are excreted in the urine.

Metabolism of lamivudine is a minor route of elimination. Lamivudine is predominately cleared unchanged by renal excretion. The likelihood of metabolic interactions with lamivudine is low due to the small extent of hepatic metabolism (< 10%).

**Elimination:** The mean half life of abacavir is about 1.5 hours. Following multiple oral doses of abacavir 300 mg twice a day, there is no significant accumulation of abacavir. Elimination of abacavir is via hepatic metabolism with subsequent excretion of metabolites primarily in the urine. The metabolites and unchanged abacavir account for about 83% of the administered abacavir dose in the urine. The remainder is eliminated in the feces.

The observed lamivudine half life of elimination is 5 to 7 hours. The mean systemic clearance of lamivudine is approximately 0.32 L/h/kg, predominantly by renal clearance (> 70%) via the organic cationic transport system.

## **Special Populations and Conditions**

### **Pediatric Patients**

Abacavir is rapidly and well absorbed from oral solution and tablet formulations when administered to children. Plasma abacavir exposure has been shown to be the same for both formulations when administered at the same dose. Children receiving abacavir oral solution according to the recommended dosage regimen achieve plasma abacavir exposure similar to adults. Children receiving abacavir oral tablets according to the recommended dosage regimen achieve higher plasma abacavir exposure than children receiving oral solution because higher mg/kg doses are administered with the tablet formulation. Pediatric pharmacokinetic studies have demonstrated that once daily dosing provides equivalent  $AUC_{0-24}$  to twice daily dosing of the same total daily dose for both oral solution and tablet formulations.

The absolute bioavailability of lamivudine (approximately 58 to 66%) was lower and more variable in pediatric patients under 12 years of age. In children, administration of tablets delivered higher plasma lamivudine  $AUC_{\infty}$  and  $C_{max}$  than oral solution. Children receiving lamivudine oral solution according to the recommended dosage regimen achieve plasma lamivudine exposure within the range of values observed in adults. Children receiving lamivudine oral tablets according to the recommended dosage regimen achieve higher plasma lamivudine exposure than children receiving oral solution because higher mg/kg doses are administered with the tablet formulation and the tablet formulation has higher bioavailability (see **DOSAGE AND ADMINISTRATION**). Pediatric pharmacokinetic studies with both oral solution and tablet formulations have demonstrated that once daily dosing provides equivalent  $AUC_{0-24}$  to twice daily dosing of the same total daily dose.

**Patients with impaired hepatic function:** Pharmacokinetic data has been obtained for abacavir and lamivudine alone. Abacavir is metabolised primarily by the liver. The pharmacokinetics of abacavir have been studied in patients with mild hepatic impairment (Child-Pugh score 5-6) who had confirmed cirrhosis.

The results showed that there was a mean increase of 1.89 fold in the abacavir AUC, and 1.58 fold in the half life of abacavir. The AUCs of the metabolites were not modified by the liver disease. However, the rates of formation and elimination of these were decreased. Dosage reduction of abacavir is likely to be required in patients with mild hepatic impairment. The separate preparation of abacavir should therefore be used to treat these patients. The pharmacokinetics of abacavir have not been studied in patients with moderate or severe hepatic impairment. Plasma concentrations of abacavir are expected to be variable and substantially increased in these patients. Abacavir sulfate/lamivudine is therefore contraindicated in patients with hepatic impairment.

Data obtained in patients with moderate to severe hepatic impairment show that lamivudine pharmacokinetics are not significantly affected by hepatic dysfunction.

**Patients with Impaired Renal Function:** Pharmacokinetic data have been obtained for abacavir and lamivudine alone. Abacavir is primarily metabolized by the liver, with approximately 2% of abacavir excreted unchanged in the urine. The pharmacokinetics of abacavir in patients with end stage renal disease is similar to patients with normal renal function. Studies with lamivudine show that plasma concentrations (AUC) are increased in patients with renal dysfunction due to decreased clearance. Dose reduction is required for patients with creatinine clearance of < 50 mL/min; therefore the separate preparation of lamivudine (lamivudine) should be used to treat these patients.

## STORAGE AND STABILITY

### Stability and Storage Recommendations

Store at room temperature (15°C to 30°C).

## DOSAGE FORMS, COMPOSITION AND PACKAGING

Each tablet contains 702.78 mg of abacavir sulfate equivalent to 600 mg of abacavir and 300 mg of lamivudine.

Dosage form	Tablets
Strength	600 mg/300 mg
Description	Orange colored, modified capsule shaped, film-coated tablets debossed with “H” on one side and “27” on other side.
Composition	Cellulose microcrystalline, Sodium Starch Glycolate, Magnesium stearate, Opadry Orange (YS-1-13065-A).
Packaging	Blister pack of 30 (3 x 10) tablets and HDPE bottles of 30, 60 and 90

tablets.
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## PART II: SCIENTIFIC INFORMATION

### PHARMACEUTICAL INFORMATION

#### Drug Substance

Proper name: abacavir sulfate

Chemical name: Bis[[*(1S,4R)*-4-[2-amino-6-(cyclopropylamino)-9*H*purin-9-yl]cyclopent-2-enyl]methanol] sulfate

**OR**

*(1S,4R)*-4-[2-AMINO-6-(CYCLOPROPYLAMINO)-9*H*-PURIN-9-YL]-2-CYCLOPENTENE-1-METHANOL SULFATE

(2:1)

**OR**

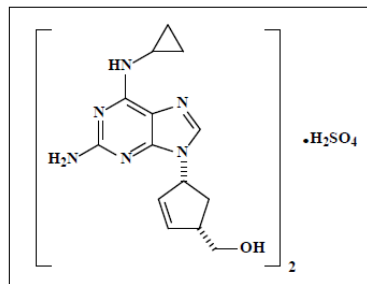
*(-)-Cis*-4-[2-AMINO-6-(CYCLOPROPYLAMINO)-9*H*-PURIN-9-YL]-2-CYCLOPENTENE-1-METHANOL SULFATE

(2:1)

Molecular formula:  $(C_{14}H_{18}N_6O)_2 \cdot H_2SO_4$

Molecular mass: 670.76 g/mol

Structural formula:



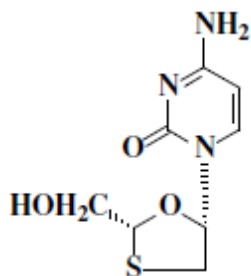
Physicochemical Properties:

Description: White or almost white powder.

Solubility: Soluble in water, practically insoluble in ethanol (96 percent) and in methylene chloride

## Drug Substance

Proper name:	lamivudine
Chemical name:	4-Amino-1-[(2R, 5S)-2-(hydroxymethyl)-1,3-oxathiolan-5-yl] pyrimidin-2(1H)-one
Molecular formula:	C <sub>8</sub> H <sub>11</sub> N <sub>3</sub> O <sub>3</sub> S
Molecular mass:	229.3 g/mol
Structural formula:	



### Physicochemical properties:

Description:	White or almost white powder
Solubility:	Soluble in water, sparingly soluble in methanol, slightly soluble in ethanol (96%).

## CLINICAL TRIALS

### Comparative Bioavailability Studies

A double-blind, randomized, two-treatment, two-sequence, two-period, crossover, single-dose comparative oral bioequivalence study of AURO-ABACAVIR/LAMIVUDINE Tablets 600 mg/300 mg [Test; Aurobindo Pharma Limited, India manufactured for Auro Pharma Inc. (Canada)] versus KIVEXA<sup>®</sup> (abacavir and lamivudine) Tablets 600 mg/300 mg [Reference; ViiV Healthcare ULC, Canada] was conducted in 36 healthy, adult male, human subjects under fasting conditions. A summary of the bioavailability data of 34 subjects who completed the study is presented in the following table:

**Summary Table of the Comparative Bio-availability Data (Abacavir)**

<b>Abacavir Sulfate</b> <b>(1 x 600/300 mg Abacavir Sulfate/Lamivudine)</b> <b>From measured data</b>				
<b>Geometric Mean</b> <b>Arithmetic Mean (CV %)</b>				
<b>Parameter</b>	<b>Test*</b>	<b>Reference†</b>	<b>% Ratio of Geometric Means</b>	<b>90% Confidence Interval</b>
<b>AUC<sub>0→t</sub></b> <b>(hr.ng/mL)</b>	17088.4 17397.6 (19.6)	16645.9 17072.6 (23.9)	102.7	99.1 – 106.4
<b>AUC<sub>0→∞</sub></b> <b>(hr.ng/mL)</b>	17378.3 17680.9 (19.3)	16933.2 17356.7 (23.6)	102.6	99.1 – 106.3
<b>C<sub>max</sub></b> <b>(ng/mL)</b>	5734.6 5979.3 (32.09)	5578.6 5820.8 (33.6)	102.8	95.2 – 111.0
<b>T<sub>max</sub>§ (hr)</b>	1.0 (0.3-2.5)	1.5 (0.5-3.0)		
<b>T<sub>1/2</sub>§ (hr)</b>	1.7 (21.7)	1.7 (23.5)		

\*AURO-ABACAVIR/LAMIVUDINE (Abacavir sulfate and Lamivudine) Tablets 600 mg/300 mg, by Auro Pharma Inc.

† KIVEXA<sup>®</sup> (Abacavir sulfate and Lamivudine) Tablets 600 mg/300 mg, of ViiV Healthcare ULC, Canada were purchased from Canada.

§ Expressed as the median (range) only.

§ Expressed as arithmetic mean (% CV) only.



**Summary Table of the Comparative Bio-availability Data (Lamivudine)**

<p align="center"><b>Lamivudine</b>  <b>(1 x 600/300 mg Abacavir Sulfate/Lamivudine)</b>  <b>From measured data</b></p> <p align="center"><b>Geometric Mean</b>  <b>Arithmetic Mean (CV %)</b></p>				
<b>Parameter</b>	<b>Test*</b>	<b>Reference†</b>	<b>% Ratio of Geometric Means</b>	<b>90% Confidence Interval</b>
<b>AUC<sub>0→t</sub> (hr.ng/mL)</b>	12234.2 12783.2 (31.3)	12570.2 12957.8 (26.4)	97.3	91.5 – 103.5
<b>AUC<sub>0→∞</sub> (hr.ng/mL)</b>	12622.8 13163.3 (30.7)	12966.4 13340.2 (25.6)	97.4	91.7 – 103.3
<b>C<sub>max</sub> (ng/mL)</b>	2268.6 2361.4 (29.2)	2365.2 2499.0 (34.9)	95.9	89.8 – 102.5
<b>T<sub>max</sub>‡ (hr)</b>	2.0 (1.0-3.0)	2.3 (0.8-4.0)		
<b>T<sub>1/2</sub>§ (hr)</b>	4.2 (33.3)	4.2 (37.5)		

\*AURO-ABACAVIR/LAMIVUDINE (Abacavir sulfate and Lamivudine) Tablets 600 mg/300 mg, by Auro Pharma Inc.

† KIVEXA® (Abacavir sulfate and Lamivudine) Tablets 600 mg/300 mg, of ViiV Healthcare ULC, Canada were purchased from Canada.

‡ Expressed as the median (range) only.

§ Expressed as arithmetic mean (% CV) only.

Abacavir and lamivudine have been used as components of antiretroviral combination therapy in naïve and experienced patients. Combination therapy has included other antiretroviral agents of the same class or different classes, such as PIs and NNRTIs. Abacavir and lamivudine from (abacavir sulfate/lamivudine) tablets have been shown to be bioequivalent to abacavir and lamivudine when given separately (see **DETAILED PHARMACOLOGY, Pharmacokinetics**). The clinical efficacy of antiretroviral combination therapy containing abacavir plus lamivudine, administered once or twice daily, has been confirmed in the study below.

**Therapy-Naïve Adults**

A once daily regimen of abacavir and lamivudine was investigated in a multi centre, double blind, controlled study (CNA30021) of 770 HIV infected, therapy naïve adults. They were randomized to receive either abacavir 600 mg once daily or 300 mg twice daily, both in combination with lamivudine 300 mg once daily and efavirenz 600 mg once daily. Patients were stratified at baseline based on plasma HIV-1 RNA ≤ 100,000 copies/mL or > 100,000 copies/mL. The duration of double blind treatment was at least 48 weeks. The results are summarized in Table 3.

**Table 3 Virological Response Based on Plasma HIV-1 RNA Less Than 50 copies/mL at Week 48 ITT – Exposed Population (Protocol CNA30021)**

<b>Populations</b>	<b>abacavir once/day + lamivudine + EFV (N = 384)</b>	<b>abacavir twice/day + lamivudine + EFV (N= 386)</b>
<b>Sub-group by baseline RNA</b>		
≤ 100,000 copies/mL	141/217 (65%)	145/217 (67%)
> 100,000 copies/mL	112/167 (67%)	116/169 (69%)
<b>Total Population</b>	253/384 (66%)	261/386 (68%)

The abacavir once daily group was demonstrated to be non inferior when compared to the twice daily group in the overall and baseline viral load subgroups.

### **Pediatrics**

ARROW (COL105677) was a 5-year, randomized, multi centre trial which evaluated multiple aspects of clinical management of HIV-1 infection in pediatric patients. HIV-1 infected, treatment-naïve subjects aged 3 months to 17 years were enrolled and treated with first-line regimen containing lamivudine and abacavir, dosed twice daily according to World Health Organization recommendations. After 36 weeks on treatment, subjects were given the option to participate in Randomization 3 of the ARROW trial, comparing the safety and efficacy of once daily with twice daily dosing of lamivudine and abacavir, in combination with a third antiretroviral drug for an additional 96 weeks. Subjects randomized to receive once daily dosing (n = 336) and who weighed at least 25 kg received abacavir 600 mg and lamivudine 300 mg, as either the single entities or as abacavir sulfate/lamivudine. During the treatment period, 104 subjects took abacavir sulfate/lamivudine for a median duration of 596 days.

Of the 1206 original subjects enrolled in the study, 669 participated in Randomization 3. Virologic suppression was not a requirement for participation: at baseline (following a minimum of 36 weeks of twice daily treatment), 76% of subjects in the twice daily cohort were virologically suppressed, compared with 71% of subjects in the once daily cohort.

The proportion of subjects with HIV-1 RNA of less than 80 copies per mL through 96 weeks is shown in Table 4. The differences between virologic responses in the two treatment arms were comparable across baseline characteristics for gender and age.

**Table 4 Virologic response by HIV-1 RNA Copies Through 96 Weeks (Randomization of abacavir plus lamivudine Once Daily or Twice Daily Dosing - Snapshot Analysis)**

	Twice Daily Dosing n = 333 N (%)	Once Daily Dosing n= 336 N (%)
Week 0 (After ≥36 Weeks on Treatment)		
Virological Response (<80 copies/mL)	250 (75)	237 (71)
Risk difference	-4.5% (95% CI -11.3% to +2.2%)	
Week 48		
Virological Response (<80 copies/mL)	242 (73)	233 (69)
Risk difference	-3.3% (95% CI -10.2% to +3.5%)	
Week 96		
Virological Response (<80 copies/mL)	232 (70)	226 (67)
Risk difference	-2.4% (95% CI -9.4% to +4.6%)	

The abacavir plus lamivudine once daily dosing group demonstrated non-inferiority to the twice daily group according to the pre-specified non-inferiority margin of -12%, for the primary endpoint of <80 c/mL at Week 48 and including Week 96 (the secondary endpoint) all other thresholds tested (<200c/mL, <400c/mL, <1000c/mL). Virologic outcomes between treatment arms were comparable across baseline characteristics (gender, age, or viral load at randomization).

## MICROBIOLOGY

### In Vitro Activity

#### Abacavir

The *in vitro* anti-HIV-1 activity of abacavir was evaluated against a T-cell tropic laboratory strain HIV-1 IIIB in lymphoblastic cell lines, a monocyte/macrophage tropic laboratory strain HIV-1 BaL in primary monocytes/macrophages and clinical isolates in peripheral blood mononuclear cells. The concentration of drug necessary to inhibit viral replication by 50 percent (IC<sub>50</sub>) ranged from 3.7 to 5.8 μM against HIV-1 IIIB, and was 0.26 ± 0.18 μM (1 μM = 0.28 μg/mL) against eight clinical isolates. The IC<sub>50</sub> of abacavir against HIV-1 BaL varied from 0.07 to 1.0 μM. The antiviral activity of abacavir in cell culture was not antagonized when combined with the nucleoside reverse transcriptase inhibitors (NRTIs) didanosine, emtricitabine, lamivudine, stavudine, tenofovir, zalcitabine or zidovudine, the non-nucleoside reverse transcriptase inhibitor (NNRTI) nevirapine, or the protease inhibitor (PI) amprenavir.

#### Lamivudine

The antiviral activity of lamivudine has been studied in combination with other antiretroviral compounds using HIV-1 infected MT-4 cells as the test system. No antagonistic effects were seen *in vitro* with lamivudine and other antiretrovirals (tested agents: abacavir, didanosine, nevirapine, zalcitabine, and zidovudine).

## **Abacavir and Lamivudine**

The antiviral activity of an equimolar mixture of abacavir and lamivudine in cell culture was not antagonized when combined with the nucleoside reverse transcriptase inhibitors (NRTIs) didanosine, emtricitabine, lamivudine, stavudine, tenofovir, zalcitabine or zidovudine, the non-nucleoside reverse transcriptase inhibitors (NNRTIs) nevirapine, delavirdine or efavirenz, or the protease inhibitors (PIs) amprenavir, indinavir, ritonavir, lopinavir, nelfinavir or saquinavir.

## **Drug Resistance**

### **Abacavir**

Abacavir resistant isolates of HIV-1 have been selected *in vitro* and are associated with specific genotypic changes in the RT codon region (codons M184V, K65R, L74V and Y115F). Viral resistance to abacavir develops relatively slowly *in vitro* and *in vivo*, requiring multiple mutations to reach an eight fold increase in IC<sub>50</sub> over wild type virus, which may be a clinically relevant level. The mutations selected by *in vitro* passage have also been observed among isolates obtained from patients participating in clinical trials, with L74V and M184V being the most common. Combination therapy with abacavir sulfate and zidovudine delays the emergence of mutations associated with resistance to abacavir sulfate compared with monotherapy with abacavir sulfate.

### **Lamivudine**

In nonclinical studies, lamivudine resistant isolates of HIV have been selected *in vitro*. A known mechanism of lamivudine resistance is the change in the 184 amino acid of RT from methionine to either isoleucine or valine. *In vitro* studies indicate that zidovudine resistant viral isolates can become sensitive to zidovudine when they acquire the 184 mutation. The clinical relevance of such findings remains, however, not well defined.

For isolates collected in clinical studies, phenotypic resistance data showed that resistance to lamivudine monotherapy developed within 12 weeks. Evidence in isolates from antiretroviral-naïve patients suggests that the combination of lamivudine and zidovudine delays the emergence of mutations conferring resistance to zidovudine. Combination therapy with lamivudine plus zidovudine did not prevent phenotypic resistance to lamivudine. However, phenotypic resistance to lamivudine did not limit the antiretroviral activity of combination therapy with lamivudine plus zidovudine. In antiretroviral therapy-naïve patients, phenotypic resistance to lamivudine emerged more slowly on combination therapy than on lamivudine monotherapy. In the zidovudine experienced patients on lamivudine plus zidovudine, no consistent pattern of changes in phenotypic resistance to lamivudine or zidovudine was observed.

### **Cross-resistance**

Cross resistance between abacavir or lamivudine and antiretrovirals from other classes (e.g. protease inhibitors (PI) or non-nucleoside reverse transcriptase inhibitors (NNRTIs)), is unlikely. Reduced susceptibility to abacavir has been demonstrated in clinical isolates of patients with uncontrolled viral replication, who have been pre-treated with and are resistant to other nucleoside inhibitors.

Clinical isolates with three or more mutations associated with NRTIs are unlikely to be susceptible to abacavir. Cross resistance conferred by the M184V RT is limited within the

nucleoside inhibitor class of antiretroviral agents. Zidovudine, stavudine, abacavir and tenofovir maintain their antiretroviral activities against lamivudine-resistant HIV-1 harbouring only the M184V mutation.

*In vitro* isolates resistant to abacavir might also show reduced sensitivity to lamivudine, zalcitabine, tenofovir, emtricitabine and/or didanosine, but remain sensitive to zidovudine and stavudine.

### **Observed During Clinical Trial**

A once daily regimen of abacavir and lamivudine was investigated in a multi centre, double blind, controlled study (CNA30021) of 770 HIV-infected, therapy naïve adults. They were randomized to receive either abacavir 600 mg once daily or 300 mg twice daily, both in combination with lamivudine 300 mg once daily and efavirenz 600 mg once daily. Patients were stratified at baseline based on plasma HIV-1 RNA  $\leq$  100,000 copies/mL or  $>$  100,000 copies/mL. The duration of double blind treatment was at least 48 weeks.

Genotypic analysis was attempted for all subjects with virologic failure (confirmed HIV RNA  $>$  50 copies/mL). There was a low overall incidence of virologic failure in both the once and twice daily treatment groups (10 and 8% respectively). Additionally, for technical reasons, genotyping was restricted to samples with plasma HIV-1 RNA  $>$  500 copies/mL. These factors resulted in a small sample size. Therefore, no firm conclusions could be drawn regarding differences in treatment emergent mutations between the two treatment groups. Reverse transcriptase amino acid residue 184 was consistently the most frequent position for NRTI resistance associated mutations (M184V or M184I). The second most frequent mutation was L74V. Mutations Y115F and K65R were uncommon.

### **Cytotoxicity**

The results of cytotoxicity studies in various assays have shown little cytotoxic action with lamivudine. Cytotoxicity of lamivudine was compared with that of zidovudine, zalcitabine, and didanosine in four T-lymphoblastoid cell lines; one monocyte/macrophage-like cell line; one B-lymphoblastoid cell line; and peripheral blood lymphocytes (PBLs) using both cell proliferation (CP) and [<sup>3</sup>H]-thymidine uptake (Td) assays. In the CP assay, lamivudine was the least toxic of the four compounds. [<sup>3</sup>H]-thymidine uptake results demonstrated a similar trend to those from the CP assays. Lamivudine had no cytotoxic effect when incubated for 10 days with phytohemagglutinin (PHA)-activated human lymphocytes or human macrophages.

The cytotoxicity of combinations of lamivudine with zidovudine, zalcitabine, or didanosine was evaluated in PHA-activated PBLs and CEM cells by measuring cellular uptake of [<sup>3</sup>H]-thymidine. Lamivudine greatly reduced the cytotoxicity of zalcitabine, slightly reduced the cytotoxicity of zidovudine in some cases, and did not alter the cytotoxicity of didanosine.

In myelotoxicity studies *in vitro*, lamivudine demonstrated no toxic effects against erythroid, granulocyte-macrophage, pluripotent, or stromal progenitor cells from healthy human donors. Lamivudine was not toxic to human hematopoietic supportive stroma, nonadherent hematopoietic cells, or stromal fibroblasts and produced minimal changes in cytokine (GM-CSF) production from mitogen stimulated bone marrow stromal cells. Lamivudine was less toxic than zidovudine, zalcitabine, ara-C, 3FT, and stavudine in these studies. In another study, lamivudine was not toxic to activated human T-cells.

## **TOXICOLOGY**

With the exception of a negative *in vivo* rat micronucleus test, there are no data available on the effects of the combination of abacavir and lamivudine in animals.

### **Acute Toxicity**

Acute toxicity studies with abacavir and lamivudine have been performed in the mouse and rat.

#### **Abacavir**

Single oral or intravenous dose acute toxicity studies in the mouse and rat revealed no significant effects. The maximum non-lethal oral dose of abacavir in the mouse and rat was at least 100 and 115 fold greater, respectively, than the maximum intended therapeutic dose in humans of 300 mg b.i.d. (12 mg(base)/kg/day for a 50 kg person).

#### **Lamivudine**

The acute oral administration of very high doses of lamivudine (two doses of 2,000 mg/kg) in mice was associated with transient increases in sexual activity in males and general activity in males and females. There were no deaths and no evidence of target organ toxicity. Therefore the maximum non-lethal oral dose of lamivudine in mice is greater than two doses of 2,000 mg/kg.

The acute intravenous administration of lamivudine at 2,000 mg/kg was well tolerated by both mice and rats and was not associated with any target organ toxicity. A number of non-specific clinical signs were observed which were more severe in rats but were all of relatively short duration.

### **Long-term toxicity**

#### **Abacavir**

Repeated oral administration of abacavir succinate to mice at 330 mg/kg/day for up to 6 months, and to monkeys at 300 mg/kg/day for up to 52 weeks, or abacavir sulfate to rats at 530 mg/kg/day for up to 3 months, resulted in few changes which were mostly reversible.

The only consistent findings in rodents and monkeys were changes in the liver. Increases in liver weights seemed to be dose related in the monkey. Slight increases in serum alanine aminotransferase and triglycerides were also observed in monkeys.

Microscopically, slight centrilobular hepatocellular hypertrophy was seen in these animal species. In high dose monkeys, slightly swollen mitochondria, a decrease in the amount of rough endoplasmic reticulum and an increase in the number of lysosomes were observed using electron microscopy. Occasional individual cell necrosis, pigment deposits in centrilobular hepatocyte and Kupffer cells were seen in mice and rats. Additional changes observed in toxicity studies included slight alterations in cholesterol, albumin and/or total protein in mice and/or rats and transient reductions in hematology parameters in monkeys. Clinical observations of toxicity (including emesis, hunched posture, hypoactivity, decreased appetite, and abnormal feces) occurred in monkeys administered high doses of abacavir daily for 12 months.

## **Lamivudine**

In repeat dose toxicity studies, lamivudine was very well tolerated in the rat at oral doses up to 2,000 mg/kg b.i.d. for 6 months. Treatment related effects were restricted to minor hematological (mainly red cell parameters), clinical chemistry and urinalysis changes, and the mucosal hyperplasia of the cecum (in the 6 month study). The no (toxicologically important) effect level was 450 mg/kg b.i.d.

In the dog, oral doses of lamivudine 1,500 mg/kg b.i.d. in males and 1,000 mg/kg b.i.d. in females for a period of 12 months were well tolerated. Treatment related changes included reductions in red cell counts at all dose levels, associated with increased MCV and MCH, and reductions in total leucocyte, neutrophil and lymphocyte counts in high-dose animals, but with no effect on bone marrow cytology. Deaths were seen in females dosed with 1,500 mg/kg b.i.d. in a 3 month study but not in a 12 month study, using a dose of 1,000 mg/kg b.i.d.

When administered orally for one month, at a dose of 1,000 mg/kg b.i.d., lamivudine demonstrated low hematotoxic potential in the mouse, and did not significantly enhance the hematotoxicity of zidovudine or interferon  $\alpha$ .

## **Carcinogenicity and Mutagenicity**

Neither abacavir nor lamivudine was mutagenic in bacterial tests, but like many nucleoside analogues they show activity in the *in vitro* mammalian tests such as the mouse lymphoma assay. This is consistent with the known activity of other nucleoside analogues.

Abacavir induced chromosomal aberrations both in the presence and absence of metabolic activation in an *in vitro* cytogenetic study in human lymphocytes. Abacavir was mutagenic in the absence of metabolic activation, although it was not mutagenic in the presence of metabolic activation in an L5178Y mouse lymphoma assay. At systemic exposures approximately nine times higher than those in humans at the therapeutic dose, abacavir was clastogenic in males and not clastogenic in females in an *in vivo* mouse bone marrow micronucleus assay.

Abacavir was not mutagenic in bacterial mutagenicity assays in the presence and absence of metabolic activation.

## **Abacavir and Lamivudine in Combination**

The results of an *in vivo* rat micronucleus test with abacavir and lamivudine in combination were negative. For each compound at the maximum dose (2000 mg/kg) mean systemic exposures were  $C_{\max}$ : 75 and 28  $\mu\text{g/mL}$  and AUC: 1185 and 377  $\mu\text{g.h/mL}$  for abacavir and lamivudine, respectively.

## **Abacavir**

Carcinogenicity studies with orally administered abacavir in mice and rats showed an increase in the incidence of malignant and non-malignant tumours. Malignant tumours occurred in the preputial gland of males and the clitoral gland of females of both species, and in the liver, urinary bladder, lymph nodes and the subcutis of female rats.

The majority of these tumours occurred at the highest abacavir dose of 330 mg/kg/day in mice

and 600 mg/kg/day in rats. These dose levels were equivalent to 24 to 33 times the expected systemic exposure in humans. The exception was the preputial gland tumour which occurred at a dose of 110 mg/kg. This is equivalent to six times the expected human systemic exposure. There is no structural counterpart for this gland in humans.

Reductions in survival and body weight in rats at 600 mg/kg/day resulted in the early discontinuation of dosing in Weeks 84 (males) and 100 (females). Survival in mice was also reduced at 330 mg/kg/day, resulting in the early discontinuation of dosing of males in Week 98.

While the carcinogenic potential in humans is unknown, these data suggest that a carcinogenic risk to humans is outweighed by the potential clinical benefit.

Mild myocardial degeneration in the heart of mice and rats was observed following administration of abacavir for two years. The systemic exposures were equivalent to 7 to 24 times the expected systemic exposure in humans. The clinical relevance of this finding has not been determined.

In an *in vitro* cytogenetic study performed in human lymphocytes, abacavir induced chromosomal aberrations following exposure at 2,800 and 3,200 µg/mL for 3 hours in the presence of metabolic activation and after exposure at 100 and 125 µg/mL for 50.3 hours in the absence of metabolic activation. The abacavir concentrations at which evidence of genotoxicity was seen *in vitro* were at least 33 times higher than the expected maximum human blood level.

In an *in vivo* mouse bone marrow micronucleus test, there was a small (2.3 fold) increase in the number of micronucleated polychromatic erythrocytes in males at 1,000 mg/kg. No significant increase was seen in bone marrow harvested from females. Findings in the micronucleus test were seen at systemic exposures (in terms of AUC) approximately nine times higher than exposure in humans at the therapeutic dose, and  $C_{max}$  values approximately 14 times higher than the maximum concentration in humans at the therapeutic dose.

No evidence of mutagenicity (with or without metabolic activation) was observed in bacterial mutagenicity assays at concentrations up to approximately 5,000 µg/plate. In a mutagenicity assay conducted in L5178Y mouse lymphoma cells, abacavir was weakly mutagenic following exposure at 250 µg/mL for 24 hours in the absence of metabolic activation. Abacavir was not mutagenic to L5178Y mouse lymphoma cells in a 3 hour exposure in the presence or absence of metabolic activation.

### **Lamivudine**

Traditional 24 month carcinogenicity studies using lamivudine have been conducted in mice and rats at exposures up to 10 times (mice) and 58 times (rats) those observed in humans at recommended therapeutic doses. The following results should be noted. In mice, there appeared to be an increased incidence of histiocytic sarcoma in female mice treated with 180 mg/kg/day (6 of 60 mice) and 2,000 mg/kg/day (5 of 60 mice) when compared to control mice (two control groups with 1 of 60 and 2 of 60 mice). There did not appear to be an increased incidence in histiocytic sarcoma in female mice treated with 600 mg/kg/day (3 of 60 mice). It should be noted that the control incidence of this type of tumour in this strain of mice can be as high as 10%, similar to that found in the 180 and 2,000 mg/kg/day groups. In rats, there appeared to be an



increased incidence of endometrial epithelial tumours in female rats treated with 3,000 mg/kg/day (5 of 55 rats) when compared to control rats (two control groups, each with 2 of 55 rats). There did not appear to be an increased incidence for endometrial tumours in rats treated with 1,000 mg/kg/day (2 of 55 rats) or 300 mg/kg/day (1 of 55 rats). It should be noted that there did not appear to be an increased incidence of any proliferative, non-neoplastic, epithelial lesions in treated female rats when compared to control rats, and the incidence of adenocarcinoma (5/55 or 9%) was only slightly higher than recorded controls at the laboratory where the study was conducted (4/50 or 8%). The statistical significance of the findings in mice and rats varied with the statistical analysis conducted, and therefore, the statistical and hence, the clinical significance of these findings are uncertain. However, based on the similarity to historical control data, it was concluded that the results of long term carcinogenicity studies in mice and rats for lamivudine did not seem to show a carcinogenic potential relevant for humans.

Lamivudine was not active in a microbial mutagenicity screen or an *in vitro* cell transformation assay, but showed weak *in vitro* mutagenic activity in a cytogenetic assay using cultured human lymphocytes and in the mouse lymphoma assay. However, lamivudine showed no evidence of *in vivo* genotoxic activity in the rat at oral doses of up to 2,000 mg/kg (approximately 65 times the recommended human dose based on body surface area comparisons).

### **Reproduction and Teratology**

In reproductive toxicity studies in animals, abacavir and lamivudine were shown to cross the placenta. Fertility studies in the rat have shown that abacavir and lamivudine had no effect on male or female fertility.

#### **Abacavir**

Abacavir had no adverse effects on the mating performance or fertility of male and female rats at doses of up to 500 mg/kg/day.

Reproduction studies were performed in rats and rabbits at orally administered doses up to 1,000 mg/kg/day and 700 mg/kg/day, respectively. These doses in rats and rabbits achieved approximately 35 and 8.5 times, respectively, the exposure associated with the recommended human dose. In the rat, development toxicity (depressed fetal body weight and reduced crown-rump length) and increased incidences of fetal anasarca and skeletal malformations were observed at the highest dose assessed. Studies in pregnant rats showed that abacavir is transferred to the fetus through the placenta. In a fertility study, evidence of toxicity to the developing embryo and fetuses (increased resorptions, decreased fetal body weights) occurred only at 500 mg/kg/day, a dose that was toxic to the parental generation. The offspring of female rats treated with abacavir at 500 mg/kg (beginning at embryo implantation and ending at weaning) showed increased incidence of stillbirth and lower body weights throughout life.

This dose in rats achieved approximately 33 times the exposure with the usual human dose. In the rabbit, there was no evidence of drug related developmental toxicity and no increases in fetal malformations, at doses up to 700 mg/kg (8.5 times the human exposure at the recommended dose, based on AUC).

## **Lamivudine**

A range of studies have been performed to assess the effects of repeated oral administration of lamivudine upon mammalian reproduction and development.

In a rat fertility study, except for a few minor changes in high dose (2,000 mg/kg b.i.d.) animals, the overall reproductive performance of the F<sub>0</sub> and F<sub>1</sub> generation animals, and the development of the F<sub>1</sub> and F<sub>2</sub> generation, was unaffected by treatment with lamivudine.

Lamivudine was not teratogenic in the rat or rabbit, at doses up to 2,000 mg/kg b.i.d. and 500 mg/kg b.i.d., respectively. In the rabbit a slight increase in the incidence of pre-implantation loss at doses 20 mg/kg b.i.d. and above indicates a possible early embryolethal effect. There was no such effect in the rat. These marginal effects occurred at relatively low doses, which produced plasma levels comparable to those achieved in patients.

In a peri-/post-natal/juvenile toxicity study in rats, some histological inflammatory changes at the ano-rectal junction and slight diffuse epithelial hyperplasia of the cecum were observed in dams and pups at the high-dose level. An increased incidence of urination upon handling was also seen in some offspring receiving 450 or 2,000 mg/kg. In addition, a reduction in testes weight was observed in juvenile males at 2,000 mg/kg which was associated with slight to moderate dilatation of the seminiferous tubules.

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**PART III: CONSUMER INFORMATION**

**Pr AURO-ABACAVIR/LAMIVUDINE**

**Abacavir and Lamivudine Tablets**

**600 mg abacavir (as abacavir sulfate) and 300 mg lamivudine**

**Antiretroviral Agent  
House Standard**

This leaflet is part III of a three-part "Product Monograph" published for AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) approved for sale in Canada and is designed specifically for Consumers. Please read this leaflet carefully before you start to take your medicine. You may need to read this leaflet again during your treatment. This leaflet is a summary and will not tell you everything about AURO-ABACAVIR/LAMIVUDINE. Contact your doctor or pharmacist if you have any questions about the drug.

**ABOUT THIS MEDICATION**

**What the medication is used for:**

The Human Immunodeficiency Virus (HIV) is a retrovirus (a type of virus). Infection with HIV damages the immune system and can lead to Acquired Immune Deficiency Syndrome (AIDS) and other related illnesses.

AURO-ABACAVIR/LAMIVUDINE belongs to a group of antiretroviral medicines called nucleoside analogue reverse transcriptase inhibitors (NRTIs), and is used in combination with other antiretrovirals to treat Human Immunodeficiency Virus (HIV) infection.

**What it does:**

AURO-ABACAVIR/LAMIVUDINE does not cure HIV, but helps to prevent further damage to the immune system by slowing down production of new viruses. You must be sure to be seen regularly by your health care provider.

AURO-ABACAVIR/LAMIVUDINE also increases the CD4 cell count in your blood. CD4 cells are a type of white blood cells that are important in helping your body fight infection.

**When it should not be used:**

AURO-ABACAVIR/LAMIVUDINE should not be taken if:

- you previously had an allergic reaction (hypersensitivity) to the active ingredient abacavir, which is also included in medicines called abacavir sulfate, Abacavir/lamivudine/zidovudine and dolutegravir, abacavir, and lamivudine tablets (see **What the important nonmedicinal ingredients are**).
- you previously had an allergic reaction to the active ingredient lamivudine which is included in medicines called lamivudine, lamivudine and zidovudine or Abacavir/lamivudine/zidovudine or any of the other ingredients found in AURO-ABACAVIR/LAMIVUDINE (see **What the important nonmedicinal ingredients are**).
- you have the HLA-B\* 5701 gene variation
- you have liver disease.

**What the medicinal ingredient is:**

AURO-ABACAVIR/LAMIVUDINE is a treatment that contains a fixed dose combination of two active ingredients that are currently available as separate medicines: abacavir sulfate and lamivudine. Each AURO-ABACAVIR/LAMIVUDINE tablet contains 702.78 mg of abacavir sulfate equivalent to 600 mg of abacavir and 300 mg of lamivudine

**What the important nonmedicinal ingredients are:**

Each AURO-ABACAVIR/LAMIVUDINE tablet contains the following nonmedicinal ingredients: Cellulose microcrystalline, Sodium Starch Glycolate, Magnesium Stearate, Opadry Orange (YS-1-13065-A).

**What dosage forms it comes in:**

AURO-ABACAVIR/LAMIVUDINE tablets are Orange colored, modified capsule shaped, film-coated tablets debossed with "H" on one side and "27" on other side, containing 702.78 mg of abacavir sulfate equivalent to 600 mg of abacavir and 300 mg lamivudine. Available in 3 x 10 tablet blister packs (total 30 tablets per pack) and HDPE 30's, 60's and 90's count.

**WARNINGS AND PRECAUTIONS**

**Hypersensitivity Reaction**

You should be screened for the HLA-B\*5701 gene variation prior to starting or re-starting treatment with AURO-ABACAVIR/LAMIVUDINE. Patients who have the HLA-B\*5701 gene variation have a high risk of developing a hypersensitivity reaction (serious allergic reaction) to abacavir, which is in the drug AURO-ABACAVIR/LAMIVUDINE. This hypersensitivity reaction **can be life threatening** if you continue to take AURO-ABACAVIR/LAMIVUDINE (see **Important Information on Hypersensitivity Reactions**). **Build-up of acid in your blood (lactic acidosis)**

**IMPORTANT: PLEASE READ**

**and swollen and fatty liver:**

Lactic acidosis (too much acid in the blood) and swollen and fatty liver (hepatomegaly with steatosis), including fatal cases, have been reported using nucleoside analogues alone or in combination. If you suffer symptoms (See Serious Side Effects Table), contact your doctor.

If you have a hepatitis B infection, you should not stop taking AURO-ABACAVIR/LAMIVUDINE without instructions from your doctor as your hepatitis may worsen or reoccur. Your doctor will monitor your conditions for several months after stopping treatment with AURO-ABACAVIR/LAMIVUDINE.

**Important Information on Hypersensitivity Reactions**

If you get two or more of the following groups of symptoms while taking AURO-ABACAVIR/LAMIVUDINE contact your doctor immediately to find out if you should stop taking AURO-ABACAVIR/LAMIVUDINE:

	SYMPTOM(S)
Group 1	Fever
Group 2	Rash
Group 3	Nausea, vomiting, diarrhea, or abdominal (stomach area) pain
Group 4	Generally ill feeling, extreme tiredness or achiness
Group 5	Shortness of breath, cough or sore throat

**A list of these symptoms is on the Warning Card provided by your pharmacist. You should carry this Warning Card with you at all times. If you notice these symptoms while taking AURO-ABACAVIR/LAMIVUDINE, call your doctor immediately. Your doctor may advise you to stop taking AURO-ABACAVIR/LAMIVUDINE.**

**If you stop AURO-ABACAVIR/LAMIVUDINE because of a serious allergic reaction, never take AURO-ABACAVIR/LAMIVUDINE or any other medicine containing abacavir (such as abacavir sulfate, Abacavir/lamivudine/zidovudine or dolutegravir, abacavir, and lamivudine tablets) again, regardless of whether you have the HLA-B\*5701 gene variation or not. Within hours you may experience a life threatening lowering of your blood pressure or death. If you stop AURO-ABACAVIR/LAMIVUDINE for any other reason, even for a few days, and you are not allergic to AURO-ABACAVIR/LAMIVUDINE, talk with your doctor before taking it again. Taking AURO-**

ABACAVIR/LAMIVUDINE again may cause a serious allergic or life-threatening reaction, even if you never had an allergic reaction to it before.

**If your healthcare provider tells you that you can take AURO-ABACAVIR/LAMIVUDINE, again, start taking it when you are around medical help or people who can call a doctor if you need one.**

Occasionally, reactions have developed in people who start taking abacavir again, and had only one symptom on the Warning Card before they stopped taking it.

If you are hypersensitive to AURO-ABACAVIR/LAMIVUDINE, return all your unused AURO-ABACAVIR/LAMIVUDINE tablets for safe disposal. Ask your doctor or pharmacist for advice.

**Before you use AURO-ABACAVIR/LAMIVUDINE, talk to your doctor or pharmacist:**

- About all your medicines and medical conditions
- If you have kidney or liver disease (including hepatitis B or C)
- If you are taking interferon or ribavirin
- If you have had previous use of any NRTI class medicine
- If you have been tested and know whether or not you have a gene variation called HLA-B\*5701
- If you are pregnant, or planning to become pregnant, breastfeeding or planning to breastfeed
- About all the medicines you are taking including vitamins, herbal supplements and nonprescription drugs

**Other special warnings**

Your blood sugar levels (glucose) or levels of fats (lipids) in your blood may increase with HIV treatment. Your doctor may order blood tests for you.

The class of medicines to which AURO-ABACAVIR/LAMIVUDINE belongs (NRTIs) can cause a condition called lactic acidosis (excess of lactic acid in your blood), together with an enlarged liver. Symptoms of lactic acidosis include feeling of weakness, loss of appetite, sudden unexplained weight loss, upset stomach and difficulty breathing or rapid breathing. This rare but serious side effect occurs more often in women. If you have liver disease you may also be more at risk of getting this condition. While you are being treated with AURO-ABACAVIR/LAMIVUDINE your doctor will monitor you closely for any signs that you may be developing lactic acidosis.

If you have hepatitis B infection, you should not stop AURO-ABACAVIR/LAMIVUDINE without



## IMPORTANT: PLEASE READ

instructions from your doctor, as you may have recurrence of your hepatitis. This may occur due to you suddenly stopping the active ingredient lamivudine in AURO-ABACAVIR/LAMIVUDINE.

Some HIV medicines including abacavir may increase your risk of heart attack. If you have heart problems, smoke or suffer from diseases that increase your risk of heart disease such as high blood pressure and diabetes, tell your doctor. Do not stop taking your medication unless you are advised to do so by your doctor.

You may continue to develop other infections and other illnesses associated with HIV disease. You should therefore keep in regular contact with your doctor while taking AURO-ABACAVIR/LAMIVUDINE.

AURO-ABACAVIR/LAMIVUDINE helps to control your condition but is not a cure for HIV infection. You will need to take it every day. Unless you suspect you are having an allergic reaction with AURO-ABACAVIR/LAMIVUDINE, do not stop taking your medicine without first talking to your doctor.

Treatment with AURO-ABACAVIR/LAMIVUDINE has not been shown to reduce the risk of passing HIV infection on to others by sexual contact or by blood transfer. You should continue to use appropriate precautions to prevent this.

### Use of this medicine during pregnancy and breastfeeding:

If you are pregnant, or planning to become pregnant soon, you must inform your doctor before taking any medicine. The safe use of abacavir and lamivudine in pregnancy has not been established. Your doctor will decide whether you should continue to be treated with AURO-ABACAVIR/LAMIVUDINE if you are pregnant. If you take AURO-ABACAVIR/LAMIVUDINE while you are pregnant, talk to your doctor about how you can be included in the Antiretroviral Pregnancy Registry.

Babies and infants exposed to Nucleoside Reverse Transcriptase Inhibitors (NRTIs) during pregnancy or labour show minor temporary increases in blood levels of lactate. The clinical importance of these temporary increases is unknown.

These findings do not affect current recommendations to use antiretroviral therapy in pregnant women to prevent transmission of HIV to their babies. There have been very rare reports of disease that affect the neonatal (babies) nervous system such as delayed development and seizures. The long term effects of abacavir and lamivudine are not known.

It is recommended that HIV infected women do not breastfeed their infants under any circumstances in order to avoid transmission of HIV from mother to child. Both of the active substances in AURO-ABACAVIR/LAMIVUDINE are likely to be found in breast milk.

You are recommended **not** to breastfeed your baby while taking AURO-ABACAVIR/LAMIVUDINE.

**Remember: This medicine is for you. Never give it to someone else. It may harm them even if their symptoms are the same as yours.**

## INTERACTIONS WITH THIS MEDICATION

AURO-ABACAVIR/LAMIVUDINE should not be taken with:

- lamivudine
- lamivudine and zidovudine
- abacavir sulfate
- Abacavir/lamivudine/zidovudine
- emtricitabine/tenofovir disoproxil fumarate
- emtricitabine/rilpivirine/tenofovir disoproxil fumarate
- efavirenz/emtricitabine/Tenofovir disoproxil fumarate
- emtricitabine
- elvitegravir/cobicistat/emtricitabine/tenofovir disoproxil fumarate
- dolutegravir, abacavir, and lamivudine tablets

Some of these medicines are already in AURO-ABACAVIR/LAMIVUDINE.

It is important that you tell your doctor or pharmacist about all the medicines listed below or any that you are taking or have recently taken, including those you have bought yourself:

- Sorbitol-containing medicines (usually liquids) used regularly
- Methadone
- Retinoids
- Trimethoprim sulphamethoxazole (co-trimoxazole), an antibiotic used to treat *Pneumocystis jiroveci* pneumonia (often referred to as PCP) or toxoplasmosis
- Interferon and/or ribavirin

If you are taking methadone, your doctor may need to adjust your methadone dose, as abacavir increases the rate at which methadone leaves your body. This is unlikely to affect most methadone users.

## IMPORTANT: PLEASE READ

In men, alcohol does increase the amount of abacavir in your blood. However, the meaning of this is unknown. This interaction has not been studied in women.

### PROPER USE OF THIS MEDICATION

#### Usual dose:

Take AURO-ABACAVIR/LAMIVUDINE **exactly as your doctor has advised you, and try not to miss any doses.** The usual dose in adults and children who weigh at least 25 kg is one tablet once a day. Your doctor will determine if the child is able to swallow the tablet. Swallow the tablet whole with water. AURO-ABACAVIR/LAMIVUDINE can be taken with or without food. AURO-ABACAVIR/LAMIVUDINE is a set (fixed) dose combination of abacavir sulfate and lamivudine, and therefore cannot be dose reduced. Therefore, AURO-ABACAVIR/LAMIVUDINE cannot be used if you have kidney or liver problems or if you weigh less than 25 kg because you cannot change the dose. If you are unsure about how to take it, ask your doctor or pharmacist.

#### Overdose:

If you think you have taken too much AURO-ABACAVIR/LAMIVUDINE, contact a health care practitioner, hospital emergency department or regional Poison Control Centre immediately, even if there are no symptoms.

#### Missed Dose:

It is important to take this medicine as prescribed to ensure you get maximum benefit. If you forget to take a dose, take it as soon as you remember, and then continue as before. Do not take a double dose to make up for forgotten individual doses.

#### If you stopped taking AURO-ABACAVIR/LAMIVUDINE:

If you stop taking AURO-ABACAVIR/LAMIVUDINE because of side effects or illness, you must contact your doctor before restarting to make sure that symptoms of a hypersensitivity reaction have not been missed. In some cases your doctor will ask you to restart AURO-ABACAVIR/LAMIVUDINE under direct medical supervision or in a place where you will be able to get ready access to medical care if needed.

### SIDE EFFECTS AND WHAT TO DO ABOUT THEM

Like all medicines, AURO-ABACAVIR/LAMIVUDINE can have side effects. When treating HIV infection, it is not

always possible to tell whether some of the undesirable effects that occur are caused by AURO-ABACAVIR/LAMIVUDINE, by other medicines you are taking at the same time or by the HIV infection. For this reason it is very important that you inform your doctor about any changes in your health.

**A hypersensitivity reaction (serious allergic reaction) has been reported in patients who have been treated with abacavir. This is described in the Warnings and Precautions section on Hypersensitivity Reaction in the beginning of this leaflet. It is important that you read and understand the information about this serious reaction.**

AURO-ABACAVIR/LAMIVUDINE contains both abacavir sulfate and lamivudine. The most common side effects for this combination are nausea, vomiting, diarrhea, upper abdominal pain, headache, high temperature (fever), lethargy (unusual lack of energy), fatigue, trouble sleeping, depression/depressed mood, loss of appetite, hair loss, joint and muscle pain, abacavir hypersensitivity (serious allergic reaction) and skin rash (without any other illness). **If these symptoms persist or become bothersome, contact your doctor.**

Other side effects (very rare) include serious skin reactions and severe anemia.

Changes in your immune system (Immune Reconstitution Inflammatory Syndrome) can happen when you start taking HIV medicines. Your immune system may get stronger and begin to fight infections that have been hidden in your body for a long time, or you could develop an autoimmune disease in which your immune system reacts against your own body (e.g. Grave's disease (which affects the thyroid gland), Guillain-Barre syndrome (which affects the nervous system) or polymyositis (which affects the muscles) and it may develop at any time, sometimes months later after the start of HIV therapy). Sometimes symptoms can be severe, so if you develop high temperature (fever), joint or muscle pain, redness, rash, swelling, or fatigue or any new symptoms contact your doctor straight away.

Inflammation of the pancreas (pancreatitis) has been observed in patients treated with abacavir and lamivudine, although it was not clear whether this was due to the medicine or the HIV infection itself (See **Side Serious Side Effects** table). If your doctor detects clinical signs, symptoms or lab tests suggestive of pancreatitis, they will stop treatment with AURO-ABACAVIR/LAMIVUDINE immediately.

**IMPORTANT: PLEASE READ**

Always tell your doctor or pharmacist if any of the side effects mentioned becomes severe or troublesome, or if you notice any other side effects not listed in this leaflet.

<b>SERIOUS SIDE EFFECTS HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM</b>			
Symptom / effect	Talk to your healthcare professional		Stop taking drug and get immediate medical help
	Only if severe	In all cases	
<b>Common</b>	<u>Hypersensitivity to abacavir:</u> Serious allergic reaction and 2 or more of the following symptoms: fever, skin rash, nausea, vomiting, diarrhea, abdominal pain, severe tiredness, achiness, general ill-feeling, sore throat, shortness of breath.		X
<b>Uncommon</b>	Blood problems and symptoms such as anemia (lowered red blood cell count – resulting in fatigue, breathlessness), low white blood cell count (neutropenia – increasing chance of infection), reduced platelets (blood cells important for blood clotting – could increase chance of bruising) and increases in enzymes produced by the liver.		X
<b>Rare</b>	Pancreatitis (inflammation of the pancreas) and symptoms such as nausea, vomiting and abdominal pain.		X

<b>SERIOUS SIDE EFFECTS HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM</b>			
Symptom / effect	Talk to your healthcare professional		Stop taking drug and get immediate medical help
	Only if severe	In all cases	
Lactic acidosis (high level of acid in the blood): Weight loss, fatigue, malaise abdominal pain, shortness of breath, severe hepatomegaly (swollen and enlarged liver) with symptoms of liver problems such as nausea, vomiting, abdominal pain, weakness and diarrhea.		X	

*This is not a complete list of side effects. For any unexpected effects while taking AURO-ABACAVIR/LAMIVUDINE, contact your doctor or pharmacist.*

**HOW TO STORE IT**

Store at room temperature (15°C to 30°C).

Do not use AURO-ABACAVIR/LAMIVUDINE after the expiry date which is stated on the label or carton after EXP. Keep out of the reach and sight of children.

**Reporting Side Effects**

You can report any suspected side effects associated with the use of health products to Health Canada by:

- Visiting the Web page on Adverse Reaction Reporting (<https://www.canada.ca/en/health-canada/services/drugs-health-products/medeffect-canada.html>) for information on how to report online, by mail or by fax; or
- Calling toll-free at 1-866-234-2345.

*NOTE: Contact your health professional if you need information about how to manage your side effects. The Canada Vigilance Program does not provide medical advice.*

**MORE INFORMATION**

If you want more information about AURO-ABACAVIR/LAMIVUDINE:

- Talk to your healthcare professional
- Find the full product monograph that is prepared for healthcare professionals and includes this Patient Medication Information by visiting the Health Canada website (<https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/drug-product-database.html>); the manufacturer's website [www.auropharma.ca](http://www.auropharma.ca), or by calling 1-855-648-6681.

This leaflet was prepared by

**Auro Pharma Inc.**

3700 Steeles Avenue West, Suite # 402  
Woodbridge, Ontario, L4L 8K8,  
Canada.

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**IMPORTANT: PLEASE READ**

**INFORMATION FOR PRESCRIBERS:**

A copy of the warning card included with the AURO-ABACAVIR/LAMIVUDINE carton is shown below.

**WARNING CARD**

**AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) Tablets**

Patients taking AURO-ABACAVIR/LAMIVUDINE (abacavir sulfate/lamivudine) may develop a hypersensitivity reaction (a serious allergic reaction) which can be life threatening if you continue to take AURO-ABACAVIR/LAMIVUDINE.

**If you notice two or more of the following sets of symptoms while taking AURO-ABACAVIR/LAMIVUDINE, contact your doctor immediately to find out if you should stop taking AURO-ABACAVIR/LAMIVUDINE:**

	<b>SYMPTOM(S)</b>
<b>Group 1</b>	<b>Fever</b>
<b>Group 2</b>	<b>Rash</b>
<b>Group 3</b>	<b>Nausea, vomiting, diarrhea, or abdominal (stomach area) pain</b>
<b>Group 4</b>	<b>Generally ill feeling, extreme tiredness or achiness</b>
<b>Group 5</b>	<b>Shortness of breath, cough or sore throat</b>

If you have already had this reaction to AURO-ABACAVIR/LAMIVUDINE, **never take any medicine containing abacavir, such as abacavir sulfate/ lamivudine/zidovudine, abacavir sulfate or dolutegravir/ abacavir/lamivudine again. If you take any medicine containing abacavir, such as AURO-ABACAVIR/LAMIVUDINE, abacavir sulfate/ lamivudine/zidovudine, abacavir sulfate or dolutegravir/ abacavir/lamivudine again, within hours you may experience a life threatening lowering of your blood pressure or death.**

**Carry this card with you at all times.**

You should return all of your unused AURO-ABACAVIR/LAMIVUDINE to your doctor or pharmacist for proper disposal.