

HIGHLIGHTS OF PRESCRIBING INFORMATION

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

Lamivudine and zidovudine Tablets 30 mg/60 mg

Initial U.S. Approval:

WARNING: RISK OF HEMATOLOGIC TOXICITY, MYOPATHY, LACTIC ACIDOSIS, EXACERBATIONS OF HEPATITIS B IN CO-INFECTED PATIENTS

See full prescribing information for complete boxed warning.

- Hematologic toxicity including neutropenia and anemia have been associated with the use of zidovudine, one of the components of lamivudine and zidovudine (5.1)
- Symptomatic myopathy associated with prolonged use of zidovudine. (5.2)
- Lactic acidosis and hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogues including zidovudine. Suspend treatment if clinical or laboratory findings suggestive of lactic acidosis or pronounced hepatotoxicity occur. (5.3)
- 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, a component of lamivudine and zidovudine. Monitor hepatic function closely in these patients and, if appropriate, initiate anti-hepatitis B treatment. (5.4)

INDICATIONS AND USAGE

Lamivudine and zidovudine, a combination of two nucleoside analogue reverse transcriptase inhibitors, is indicated in combination with other antiretroviral agents for the treatment of HIV-1 infection. (1)

DOSAGE AND ADMINISTRATION

- Pediatrics: Dosage should be based on body weight. 2.1
- Lamivudine and zidovudine, a fixed-dose product, should not be prescribed for pediatric patients weighing less than 5 kg or patients requiring dosage adjustment, such as those with renal or hepatic impairment, or patients experiencing dose-limiting adverse reactions. (2.2)

DOSAGE FORMS AND STRENGTHS

Tablets: Scored 30 mg lamivudine and 60 mg zidovudine (3)

CONTRAINDICATIONS

Lamivudine and zidovudine Tablets are contraindicated in patients with previously demonstrated clinically significant hypersensitivity (e.g., anaphylaxis, Stevens-Johnson syndrome). (4)

WARNINGS AND PRECAUTIONS

Hematologic toxicity/bone marrow suppression including neutropenia and anemia have been associated with the use of zidovudine, one of the components of lamivudine and zidovudine. (5.1)

- Symptomatic myopathy is associated with prolonged use of zidovudine. (5.2)
- Lactic acidosis and hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogues including zidovudine. Suspend treatment if clinical or laboratory findings suggestive of lactic acidosis or pronounced hepatotoxicity occur. (5.3)
- 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, a component of lamivudine and zidovudine. Monitor hepatic function closely in these patients and, if appropriate, initiate anti-hepatitis B treatment. (5.4)
- Do not co-administer Lamivudine and zidovudine with other lamivudine or zidovudine-containing products or emtricitabine-containing products. (5.5)
- Hepatic decompensation, some fatal, has occurred in HIV-1/HCV co-infected patients receiving combination antiretroviral therapy and interferon alfa with/without ribavirin. Discontinue lamivudine and zidovudine as medically appropriate and consider dose reduction or discontinuation of interferon alfa, ribavirin, or both. (5.6)
- Exacerbation of anemia has been reported in HIV-1/HCV co-infected patients receiving ribavirin and zidovudine. Co-administration of ribavirin and zidovudine is not advised. (5.6)
- Pancreatitis: Use with caution in pediatric patients with a history of pancreatitis or other significant risk factors for pancreatitis. Discontinue treatment as clinically appropriate. (5.7)
- Immune reconstitution syndrome (5.8) and redistribution/accumulation of body fat (5.9) have been reported in patients treated with combination antiretroviral therapy.

ADVERSE REACTIONS

- The most commonly reported adverse reactions (incidence greater than or equal to 15%) in adult and pediatric HIV-1 clinical studies of combination lamivudine and zidovudine were headache, nausea, malaise and fatigue, nasal signs and symptoms, diarrhea, fever, and cough. (6.1)

To report SUSPECTED ADVERSE REACTIONS, contact Matrix Laboratories at 1-877-446-3679 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS

- Concomitant use with the following drugs should be avoided: stavudine (7.1), zalcitabine (7.1), doxorubicin (7.2).
- Bone marrow suppressive/cytotoxic agents: May increase the hematologic toxicity of zidovudine. (7.3)

See 17 for PATIENT COUNSELING INFORMATION.

Revised: January 2011

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FULL PRESCRIBING INFORMATION

WARNING: RISK OF HEMATOLOGIC TOXICITY, MYOPATHY, LACTIC ACIDOSIS, EXACERBATIONS OF HEPATITIS B IN CO-INFECTED PATIENTS UPON DISCONTINUATION

Zidovudine, one of the 2 active ingredients in lamivudine and zidovudine, has been associated with hematologic toxicity including neutropenia and anemia, particularly in patients with advanced HIV-1 disease (see Warnings and Precautions (5.1)).

Prolonged use of zidovudine has been associated with symptomatic myopathy (see Warnings and Precautions (5.2)).

Lactic acidosis and hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogues alone or in combination, including lamivudine, zidovudine, and other antiretrovirals. Suspend treatment if clinical or laboratory findings suggestive of lactic acidosis or pronounced hepatotoxicity occur (see Warnings and Precautions (5.3)).

Acute exacerbations of hepatitis B have been reported in patients who are co-infected with hepatitis B virus (HBV) and HIV -1 and have discontinued lamivudine, which is one component of lamivudine and zidovudine. Hepatic function should be monitored closely with both clinical and laboratory follow-up for at least several months in patients who discontinue lamivudine and zidovudine and are co-infected with HIV-1 and HBV. If appropriate, initiation of anti-hepatitis B therapy may be warranted (see Warnings and Precautions (5.4)).

1 INDICATIONS AND USAGE

Lamivudine and zidovudine tablets, a combination of two nucleoside analogues, are indicated in combination with other antiretrovirals for the treatment of HIV-1 infection.

2 DOSAGE AND ADMINISTRATION

2.1 Pediatric Patients

The recommended oral dosage of Lamivudine and Zidovudine tablets for HIV-1-infected pediatric patients (≥ 5 Kg) is shown in the table below. For patients having difficulty in swallowing tablets, dispersion can be prepared by dispersing required number of tablets in water.

Lamivudine and Zidovudine tablets are scored and may be taken with or without food.

Preparation of Suspension:

1. Place the tablet(s) in container and add two teaspoonfuls (10 mL) of water per tablet.
2. Swirl the container until tablet(s) breaks up into pieces small enough for the child to swallow, a spoon can be used to crush the pieces, if needed.
3. Drink the mixture within 12 hours.
4. Rinse the container with an additional small amount of water and drink the contents to assure that the entire dosage is taken.

The recommended oral dose of lamivudine and zidovudine tablet for pediatric patients who weigh greater than or equal to 30 kg and for whom a solid oral dosage form is appropriate is 1 tablet (containing 150 mg of lamivudine and 300 mg of zidovudine) administered twice daily.

Pediatric dosing for Lamivudine and Zidovudine Tablets (30/60mg, Scored tablets) as follows:

Weight Range (Body weight, Kgs)	Dosing	Lamivudine (Mg)*	Zidovudine (Mg)*
5	1 Tablet twice daily	30/30	60/60
6 - <11	1.5 Tablets twice daily	45/45	90/90
11 - <14	2 Tablets twice daily	60/60	120/120
14 - <18	2.5 Tablets twice daily	75/75	150/150
18 - <22	3 Tablets twice daily	90/90	180/180
22 - <25	3.5 Tablets twice daily	105/105	210/210
25 - <28	4 Tablets twice daily	120/120	240/240
28 - <30	4.5 Tablets twice daily	135/135	270/270
≥30	To be treated with recommended adult dose		

* Dosage is mentioned as am/pm dosage in mg dose.

2.2 Patients Requiring Dosage Adjustment

Because lamivudine and zidovudine tablets are a fixed-dose combination tablet, they should not be prescribed for pediatric patients weighing less than 5 kg or patients requiring dosage adjustment, such as those with reduced renal function (creatinine clearance less than 50 mL/min), patients with hepatic impairment, or patients experiencing dose-limiting adverse reactions. Liquid and solid oral formulations of the individual components of lamivudine and zidovudine are available for these populations.

3 DOSAGE FORMS AND STRENGTHS

Lamivudine and zidovudine Tablets are white, round, biconvex film-coated tablet with breakline on one side and debossed with “M29” on other side.

4 CONTRAINDICATIONS

Lamivudine and zidovudine Tablets are contraindicated in patients with previously demonstrated clinically significant hypersensitivity (e.g., anaphylaxis, Stevens-Johnson syndrome) to any of the components of the product.

5 WARNINGS AND PRECAUTIONS

5.1 Hemotologic Toxicity/Bone Marrow Suppression

Zidovudine, a component of lamivudine and zidovudine, has been associated with hematologic toxicity including neutropenia and anemia, particularly in patients with advanced HIV-1 disease. Lamivudine and zidovudine should be used with caution in

patients who have bone marrow compromise evidenced by granulocyte count less than 1,000 cells/mm³ or hemoglobin less than 9.5 g/dL (see Adverse Reactions (6.1)).

Frequent blood counts are strongly recommended in patients with advanced HIV-1 disease who are treated with lamivudine and zidovudine. Periodic blood counts are recommended for other HIV-1-infected patients. If anemia or neutropenia develops, dosage interruption may be needed.

5.2 Myopathy

Myopathy and myositis, with pathological changes similar to that produced by HIV-1 disease, have been associated with prolonged use of zidovudine, and therefore may occur with therapy with lamivudine and zidovudine.

5.3 Lactic Acidosis/Hepatomegaly With Steatosis

Lactic acidosis and hepatomegaly with steatosis, including fatal cases, have been reported nucleoside analogues alone or in combination, including lamivudine, zidovudine, with the use of and other antiretrovirals. A majority of these cases have been in women. Obesity and prolonged nucleoside exposure may be risk factors. Particular caution should be exercised when administering lamivudine and zidovudine to any patient with known risk factors for liver disease; however, cases have also been reported in patients with no known risk factors. Treatment with lamivudine and zidovudine should be suspended in any patient who develops clinical or laboratory findings suggestive of lactic acidosis or pronounced hepatotoxicity (which may include hepatomegaly and steatosis even in the absence of marked transaminase elevations).

5.4 Patients With HIV-1 and Hepatitis B Virus Co-infection

Posttreatment Exacerbations of Hepatitis: In clinical trials in non-HIV-1-infected patients treated with lamivudine for chronic HBV, clinical and laboratory evidence of hepatitis have occurred after discontinuation of lamivudine. These exacerbations of exacerbations have been detected primarily by serum ALT elevations in addition to hepatitis B viral DNA (HBV DNA). Although most events appear to have been self-limited, fatalities have been reported in some cases. Similar events have been reported from re-emergence of post-marketing experience after changes from lamivudine-containing HIV-1 treatment regimens to non-lamivudine-containing regimens in patients infected with both HIV-1 and HBV. The causal relationship to discontinuation of lamivudine treatment is unknown.

Patients should be closely monitored with both clinical and laboratory follow-up for at least several months after stopping treatment. There is insufficient evidence to determine whether re-initiation of lamivudine alters the course of posttreatment exacerbations of hepatitis.

Important Differences Among Lamivudine-Containing Products: Lamivudine and zidovudine Tablets contain a higher dose of the same active ingredient (lamivudine) than EPIVIR-HBV[®] (lamivudine) Tablets and Oral Solution. EPIVIR-HBV was developed for treating chronic hepatitis B. Safety and efficacy of lamivudine have not been established for treatment of chronic hepatitis B in patients co-infected with HIV-1 and HBV.

Emergence of Lamivudine-Resistant HBV: In non-HIV-infected patients treated with lamivudine for chronic hepatitis B, emergence of lamivudine-resistant HBV has been detected and has been associated with diminished treatment response (see full prescribing information for hepatitis B virus variants associated with resistance to lamivudine has also been reported in HIV-1-infected patients who have EPIVIR-HBV for additional information). Emergence of hepatitis B virus variants associated with resistance to lamivudine has also been reported in HIV-1 infected patients who have received lamivudine-containing antiretroviral regimens in the presence of concurrent infection with hepatitis B virus.

5.5 Use With Other, Lamivudine-, Zidovudine-, and/or Emtricitabine-Containing Products

Lamivudine and zidovudine tablets are a fixed-dose combination of lamivudine and zidovudine. Lamivudine and zidovudine tablets should not be administered concomitantly with other lamivudine- or zidovudine-containing products including EPIVIR[®] (lamivudine) Tablets and Oral Solution, EPIVIR-HBV Tablets and Oral Solution, RETROVIR[®] (zidovudine) Tablets, Capsules, Syrup, and IV Infusion, EPZICOM[®] (abacavir sulfate and lamivudine) Tablets, or TRIZIVIR[®] (abacavir sulfate, lamivudine, and zidovudine) Tablets; or emtricitabine-containing products, including ATRIPLA[®] (efavirenz, emtricitabine, and tenofovir), EMTRIVA[®] (emtricitabine), or TRUVADA[®] (emtricitabine and tenofovir).

5.6 Use With Inteneron- and Ribavirin-Based Regimens

In vitro studies have shown ribavirin can reduce the phosphorylation of pyrimidine nucleoside analogues such as lamivudine and zidovudine. Although no evidence of a pharmacokinetic or pharmacodynamic interaction (e.g., loss of HIV-1/HCV virologic suppression) was seen when ribavirin was co administered with lamivudine or zidovudine in HIV-1/HCV co-infected patients (see Clinical Pharmacology (12.3)).

Hepatic decompensation (some fatal) has occurred in HIV-1/HCV co-infected patients receiving combination antiretroviral therapy for HIV-1 and interferon alfa with or without ribavirin. Patients receiving interferon alfa with or without ribavirin and Lamivudine and zidovudine should be closely monitored for treatment-associated toxicities, especially hepatic decompensation, neutropenia, and anemia.

Discontinuation of lamivudine and zidovudine 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 (e.g., Childs Pugh greater than 6) (see the complete prescribing information for interferon and ribavirin).

Exacerbation of anemia has been reported in HIV-1/HCV co-infected patients receiving ribavirin and zidovudine. Co-administration of ribavirin and zidovudine is not advised.

5.7 Pancreatitis

Lamivudine and zidovudine should be used with caution in patients with a history of pancreatitis or other significant risk factors for the development of pancreatitis. Treatment with lamivudine and zidovudine should be stopped immediately if clinical signs, symptoms, or laboratory abnormalities suggestive of pancreatitis occur [see *Adverse Reactions* (6.1)].

5.8 Immune Reconstitution Syndrome

Immune reconstitution syndrome has been reported in patients treated with combination antiretroviral therapy, including lamivudine and zidovudine. During the initial phase of combination antiretroviral treatment, patients whose immune systems respond may develop an inflammatory response to indolent or residual opportunistic infections (such as *Mycobacterium avium* infection, cytomegalovirus, *Pneumocystis jirovecii* pneumonia (PCP), or tuberculosis), which may necessitate further evaluation and treatment.

5.9 Fat Redistribution

Redistribution/accumulation of body fat including central obesity, dorsocervical fat enlargement (buffalo hump), peripheral wasting, facial wasting, breast enlargement, and "cushingoid appearance" have been observed in patients receiving antiretroviral therapy. The mechanism and long-term consequences of these events are currently unknown. A causal relationship has not been established.

6 ADVERSE REACTIONS

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

- Hematologic toxicity, including neutropenia and anemia [*see Boxed Warning, Warnings and Precautions (5.1)*].
- Symptomatic myopathy [*see Boxed Warning, Warnings and Precautions (5.2)*].
- Lactic acidosis and hepatomegaly with steatosis (*see Boxed Warning, Warnings and Precautions (5.3)*).
- Severe acute exacerbations of hepatitis B [*see Boxed Warning, Warnings and Precautions (5.4)*].
- Hepatic decompensation in patients co-infected with HIV-1 and hepatitis C [*see Warnings and Precautions (5.6)*].
- Exacerbation of anemia in HIV-1/HCV co-infected patients receiving ribavirin and zidovudine [*see Warnings and Precautions (5.6)*].
- Pancreatitis [*see Warnings and Precautions (5.7)*].

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

Lamivudine Plus Zidovudine Administered As Separate Formulations: In 4 randomized, controlled trials of EPIVIR 300 mg per day plus RETROVIR 600 mg per day, the following selected adverse reactions and laboratory abnormalities were observed (see Tables 1 and 2).

Table 1. Selected Clinical Adverse Reactions (≥5% Frequency) in 4 Controlled Clinical Trials With EPIVIR 300 mg/day and RETROVIR 600 mg/day.

Adverse Reaction	EPIVIR plus RETROVIR (n=251)
Body as a whole	
Headache	35%
Malaise & fatigue	27%
Fever or chills	10%
Digestive	
Nausea	33%
Diarrhea	18%
Nausea & vomiting	13%
Anorexia and/or decreased appetite	10%
Abdominal pain	9%
Abdominal cramps	6%
Dyspepsia	5%
Nervous system	
Neuropathy	12%
Insomnia & other sleep disorders	11%
Dizziness	10%
Depressive disorders	9%
Respiratory	
Nasal signs & symptoms	20%
Cough	18%
Skin	
Skin rashes	9%
Musculoskeletal	
Musculoskeletal pain	12%
Myalgia	8%
Arthralgia	5%

Pancreatitis was observed in 9 of the 2,613 adult patients (0.3%) who received EPIVIR in controlled clinical trials [see *Warnings and Precautions* (5.7)].

Selected laboratory abnormalities observed during therapy are listed in Table 2.

Table 2. Frequencies of Selected Laboratory Abnormalities Among Adults in 4 Controlled Clinical Trails of EPIVIR 300 mg/day plus RETROVIR 600 mg/day*

Test (Abnormal Level)	EPIVIR plus RETROVIR % (n)
Neutropenia (ANC<750/mm ³)	7.2% (237)
Anemia (Hgb<8.0 g/dL)	2.9% (241)
Thrombocytopenia (platelets<50,000/mm ³)	0.4% (240)
ALT (>5.0 x ULN)	3.7% (241)
AST (>2.5 x ULN)	1.7% (241)
Bilirubin (>2.5 x ULN)	0.8% (241)
Amylase (>2.0 x ULN)	4.2% (72)

ULN = Upper limit of normal.

ANC = Absolute neutrophil count.

n= Number of patients assessed.

* Frequencies of these laboratory abnormalities were higher in patients with mild laboratory abnormalities at baseline.

6.2 Postmarketing Experience

In addition to adverse reactions reported from clinical trials, the following reactions have been identified during post-approval use of EPIVIR, RETROVIR, and/or lamivudine and zidovudine. Because they are reported voluntarily from a population of unknown size, estimates of frequency cannot be made. These events have been chosen for inclusion due to a combination of their seriousness, frequency of reporting, or potential casual connection to EPIVIR, RETROVIR, and/or lamivudine and zidovudine.

Body as a Whole: Back pain, chest pain, flu-like syndrome, generalized pain, Redistribution/accumulation of body fat [see *Warnings and Precautions (5.9)*].

Cardiovascular: Cardiomyopathy, syncope.

Endocrine and Metabolic: Gynecomastia, hyperglycemia.

Eye: macular edema.

Gastrointestinal: Oral mucosal pigmentation, dysphagia, flatulence, mouth ulcer.

General: Vasculitis, weakness, sensitization reactions including anaphylaxis and angioedema.

Hemic and Lymphatic: Anemia, (including pure red cell aplasia and anemias progressing on therapy), lymphadenopathy.

Hepatic and Pancreatic: Lactic acidosis and hepatomegaly with steatosis, pancreatitis, posttreatment exacerbation of hepatitis B [see *Boxed Warning, Warnings and Precautions (5.3), (5.4), (5.7)*].

Hypersensitivity: Sensitization reactions (including anaphylaxis), urticaria.

Musculoskeletal: Muscle weakness, CPK elevation, rhabdomyolysis, tremor.

Nervous: Anxiety, confusion, depression, dizziness, loss of mental acuity, mania, paresthesia, seizures, somnolence, vertigo.

Respiratory: Dyspnea, rhinitis, sinusitis.

Skin: Alopecia, pruritis, erythema multiforme, Stevens-Johnson syndrome.

Special Senses: Amblyopia, hearing loss, photophobia, taste perversion.

Urogenital: Urinary frequency, urinary hesitancy.

7 DRUG INTERACTIONS

No drug interaction studies have been conducted using lamivudine and zidovudine Tablets (see *Clinical Pharmacology (12.3)*).

7.1 Antiretroviral Agents

Lamivudine: Zalcitabine: Lamivudine and zalcitabine may inhibit the intracellular phosphorylation of one another. Therefore, use of lamivudine and zidovudine in combination with zalcitabine is not recommended.

Zidovudine: Stavudine: Concomitant use of lamivudine and zidovudine with stavudine should be avoided since an antagonistic relationship with zidovudine has been demonstrated *in vitro*.

Nucleoside Analogues Affecting DNA Replication: Some nucleoside analogues affecting DNA replication, such as ribavirin, antagonize the *in vitro* antiviral activity of zidovudine against HIV-1; concomitant use of such drugs should be avoided.

7.2 Doxorubicin

Zidovudine: Concomitant use of lamivudine and zidovudine with doxorubicin should be avoided since an antagonistic relationship with zidovudine has been demonstrated *in vitro*.

7.3 Hematologic/Bone Marrow Suppressive/Cytotoxic Agents

Zidovudine: Coadministration of ganciclovir, interferon alfa, ribavirin, and other bone marrow suppressive or cytotoxic agents may increase the hematologic toxicity of zidovudine.

7.4 Interferon- and Ribavirin-Based Regimens

Lamivudine: Although no evidence of a pharmacokinetic or pharmacodynamic interaction (e.g., loss of HIV-1/HCV virologic suppression) was seen when ribavirin was co administered with lamivudine in HIV –1/HCV co-infected patients, hepatic decompensation (some fatal) has occurred in HIV-1/HCV co-infected patients receiving combination antiretroviral therapy for HIV-1 and interferon alfa with or without ribavirin [see Warnings and Precautions (5.5), Clinical Pharmacology (12.3)]

7.5 Trimethoprim/Sulfamethoxazole (TMP/SMX)

Lamivudine: No change in dose of either drug is recommended. There is no information regarding the effect on lamivudine pharmacokinetics of higher doses of TMP/SMX such as those used to treat PCP.

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Pregnancy Category C.

Fetal Risk Summary: There are no adequate and well-controlled studies of lamivudine and zidovudine (lamivudine and zidovudine) in pregnant women. Clinical trial data demonstrate that maternal zidovudine treatment during pregnancy reduces vertical transmission of HIV-1 infection to the fetus. Animal reproduction studies performed with lamivudine and zidovudine showed increased embryotoxicity and fetal malformations (zidovudine), and increased embryoletality (lamivudine). Lamivudine and zidovudine should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Clinical Considerations: Treatment of HIV during pregnancy optimizes the health of both mother and fetus. Clinical trial data reviewed by FDA demonstrate that maternal zidovudine treatment significantly reduces vertical transmission of HIV-1 infection to the fetus (see Clinical Studies (14.2)). Published data suggest that combination antiretroviral regimens may reduce the rate of vertical transmission even further.

Pharmacokinetics of lamivudine and zidovudine in pregnant women are similar to the pharmacokinetics in nonpregnant women. No dose adjustments are needed during pregnancy.

In a clinical trial, adverse events among HIV-1-infected women were not different among untreated women and women treated with zidovudine. It is not known whether risks of adverse events associated with lamivudine are altered in pregnant women compared with other HIV-1-infected patients (see Human data below).

Data: Human Data: Lamivudine: Lamivudine pharmacokinetics were studied in pregnant women during 2 clinical studies conducted in South Africa. The study assessed pharmacokinetics in: 16 women at 36 weeks gestation using 150 mg lamivudine twice daily with zidovudine, 10 women at 38 weeks gestation using 150 mg lamivudine twice daily with zidovudine, and 10 women at 38 weeks gestation using lamivudine 300 mg twice daily without other antiretrovirals. Lamivudine pharmacokinetics in pregnant women were similar to those seen in nonpregnant adults and in postpartum women.

Lamivudine concentrations were generally similar in maternal, neonatal, and umbilical cord serum samples.

Zidovudine: A randomized, double-blind, placebo-controlled trial was conducted in HIV-1-infected pregnant women to determine the utility of zidovudine for the prevention of maternal-fetal HIV-1 transmission. Zidovudine treatment during pregnancy reduced the rate of maternal-fetal HIV-1 transmission from 24.9% for infants born to placebo-treated mothers to 7.8% for infants born to mothers treated with zidovudine. There were no differences in pregnancy-related adverse events between the treatment groups. Congenital abnormalities occurred with similar frequency between neonates born to mothers who received zidovudine and neonates born to mothers who received placebo. The observed abnormalities included problems in embryogenesis (prior to 14 weeks) or were recognized on ultrasound before or immediately after initiation of study drug (see *Clinical Studies (14.2)*).

Zidovudine pharmacokinetics were studied in a Phase 1 study of 8 women during the last trimester of pregnancy. As pregnancy progressed, there was no evidence of drug accumulation. The pharmacokinetics of zidovudine were similar to that of nonpregnant adults. Consistent with passive transmission of the drug across the placenta, zidovudine concentrations in neonatal plasma at birth were essentially equal to those in maternal plasma at delivery.

Animal Data: Lamivudine: Animal reproduction studies performed at oral doses up to 130 and 60 times the adult dose in rats and rabbits, respectively, revealed no evidence of teratogenicity due to lamivudine. Increased early embryoletality occurred in rabbits at exposure levels similar to those in humans. However, there was no indication of this effect in rats at exposure levels up to 35 times those in humans. Based on animal studies, lamivudine crosses the placenta and is transferred to the fetus (see *Nonclinical Toxicology (13.2)*).

Zidovudine: Increased fetal resorptions occurred in pregnant rats and rabbits treated with doses of zidovudine that produced drug plasma concentrations 66 to 226 times (rats) and 12 to 87 times (rabbits) the mean steady-state peak human plasma concentration following a single 100-mg dose of zidovudine. There were no other reported developmental anomalies. In another developmental toxicity study, pregnant

rats received zidovudine up to near-lethal doses that produced peak plasma concentrations 350 times peak human plasma concentrations (300 times the daily AUC in humans given 600 mg/day zidovudine). This dose was associated with marked maternal toxicity and an increased incidence of fetal malformations. However, there were no signs of teratogenicity at doses up to one fifth the lethal dose [see *Nonclinical Toxicology* (13.2)].

8.3 Nursing Mothers

The Centers for Disease Control and Prevention recommend that HIV-1-infected mothers in the United States not breastfeed their infants to avoid risking postnatal transmission of HIV-1 infection. Because of both the potential for HIV-1 transmission and serious adverse reactions in nursing infants, mothers should be instructed not to breastfeed if they are receiving lamivudine and zidovudine.

Although no studies of lamivudine and zidovudine excretion in breast milk have been performed, lactation studies performed with lamivudine and zidovudine show that both drugs are excreted in human breast milk. Samples of breast milk obtained from 20 mothers receiving lamivudine monotherapy (300 mg twice daily) or combination therapy (150 mg lamivudine twice daily and 300 mg zidovudine twice daily) had measurable concentrations of lamivudine. In another study, after administration of a single dose of 200 mg zidovudine to 13 HIV –1-infected women, the mean concentration of zidovudine was similar in human milk and serum.

8.4 Pediatric Use

Lamivudine and zidovudine should not be administered to pediatric patients weighing less than 5 kg, because it is a fixed-dose combination that cannot be adjusted for this patient population.

8.5 Geriatric Use

Clinical studies of lamivudine and zidovudine did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. In general, dose selection for an elderly patient should be cautious, reflecting the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy. Lamivudine and zidovudine is not

recommended for patients with impaired renal function (i.e., creatinine clearance less than 50 mL/min) because it is a fixed-dose combination that cannot be adjusted.

8.6 Renal Impairment

Reduction of the dosages of lamivudine and zidovudine is recommended for patients with impaired renal function. Patients with creatinine clearance less than 50 mL/min should not receive lamivudine and zidovudine because it is a fixed-dose combination that cannot be adjusted.

8.7 Hepatic Impairment

A reduction in the daily dose of zidovudine may be necessary in patients with mild to moderate impaired hepatic function or liver cirrhosis. Lamivudine and zidovudine is not recommended for patients with impaired hepatic function because it is a fixed-dose combination that cannot be adjusted.

10 OVERDOSAGE

Lamivudine and zidovudine: There is no known antidote for Lamivudine and zidovudine.

Lamivudine: One case of an adult ingesting 6 grams of lamivudine was reported; there were no clinical signs or symptoms noted and hematologic tests remained normal. Because a negligible amount of lamivudine was removed via (4-hour) hemodialysis, continuous ambulatory peritoneal dialysis, and automated peritoneal dialysis, it is not known if continuous hemodialysis would provide clinical benefit in a lamivudine overdose event.

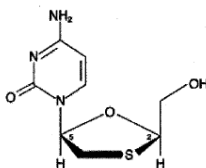
Zidovudine: Acute overdoses of zidovudine have been reported in pediatric patients and adults. These involved exposures up to 50 grams. The only consistent findings were nausea and vomiting. Other reported occurrences included headache, dizziness, drowsiness, lethargy, confusion, and 1 report of a grand mal seizure. Hematologic changes were transient. All patients recovered. Hemodialysis and peritoneal dialysis appear to have a negligible effect on the removal of zidovudine, while elimination of its primary metabolite, 3' -azido-3' -deoxy-5' -O- β -D glucopyranuronosylthymidine (GZDV), is enhanced.

11 DESCRIPTION

Lamivudine and zidovudine: Lamivudine and zidovudine Tablets are combination tablets containing lamivudine and zidovudine. Lamivudine (EPIVIR) and zidovudine (RETROVIR, azidothymidine, AZT, or ZDV) are synthetic nucleoside analogues with activity against HIV-1.

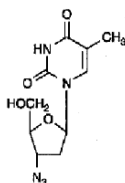
Lamivudine and zidovudine Tablets are for oral administration. Each film-coated tablet contains 30 mg of lamivudine, 60 mg of zidovudine, and the inactive ingredients colloidal silicon dioxide, hypromellose, magnesium stearate, microcrystalline cellulose, propylene glycol, sodium starch glycolate, and titanium dioxide.

Lamivudine: The chemical name of lamivudine is (2R,cis)-4-amino-1-(2-hydroxymethyl-1,3-oxathiolan-5-yl)-(1H)-pyrimidin-2-one. Lamivudine is the (-)-enantiomer of a dideoxy analogue of cytidine. Lamivudine has also been referred to as (-)-2',3'-dideoxy, 3'-thiacytidine. It has a molecular formula of $C_8H_{11}N_3O_3S$ and a molecular weight of 229.3. It has the following structural formula:



Lamivudine is a white to off-white crystalline solid with a solubility of approximately 70 mg/mL in water at 20°C.

Zidovudine: The chemical name of zidovudine is 3'-azido-3'-deoxythymidine. It has a molecular formula of $C_{10}H_{13}N_5O_4$ and a molecular weight of 267.24. It has the following structural formula:



Zidovudine is a white to beige, odorless, crystalline solid with a solubility of 20.1 mg/mL in water at 25°C.

12. CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

Lamivudine and zidovudine are antiviral agents [see *Clinical Pharmacology (12.4)*].

12.3 Pharmacokinetics

Pharmacokinetics in Adults: *Lamivudine and zidovudine:* One lamivudine and zidovudine Tablet (150mg/300mg) was bioequivalent to one Combivir Tablet containing lamivudine 150 mg and zidovudine 300mg when administered to healthy volunteers in the fasted and fed state.

Lamivudine: The pharmacokinetic properties of lamivudine in fasting patients are summarized in Table 3. Following oral administration, lamivudine is rapidly absorbed and extensively distributed. Binding to plasma protein is low. Approximately 70% of an intravenous dose of lamivudine is recovered as unchanged drug in the urine. Metabolism of lamivudine is a minor route of elimination. In humans, the only known metabolite is the trans-sulfoxide metabolite (approximately 5% of an oral dose after 12 hours).

Zidovudine: The pharmacokinetic properties of zidovudine in fasting patients are summarized in Table 3. Following oral administration, zidovudine is rapidly absorbed and extensively distributed. Binding to plasma protein is low. Zidovudine is eliminated primarily by hepatic metabolism. The major metabolite of zidovudine is GZDV. GZDV area under the curve (AUC) is about 3-fold greater than the zidovudine AUC. Urinary recovery of zidovudine and GZDV accounts for 14% and 74% of the dose following oral administration, respectively. A second metabolite, 3'-amino-3'-deoxythymidine (AMT), has been identified in plasma. The AMT AUC was one fifth of the zidovudine AUC.

Table 3. Pharmacokinetic Parameters* for Lamivudine and Zidovudine in Adults

Parameter	Lamivudine		Zidovudine	
Oral bioavailability (%)	86±16	N = 12	64 ± 10	N = 5
Apparent volume of distribution (L/kg)	1.3 ± 0.4	N = 20	1.6 ± 0.6	N = 8
Plasma protein binding (%)	<36		<38	
CSF: plasma ratio†	0.12 [0.04 to 0.47]	N = 38‡	0.60 [0.04 to 2.62]	N = 39§
Systemic clearance (L/hr/kg)	0.33 ± 0.06	N = 20	1.6 ± 0.6	N = 6
Renal clearance (L/hr/kg)	0.22 ± 0.06	N = 20	0.34 ± 0.05	N = 9
Elimination half-life (hr)	5 to 7		0.5 to 3	

* Data presented as mean ± standard deviation except where noted.

† Median [range].

‡ Children.

§ Adults.

^{||} Approximate range.

Effect of Food on Absorption of lamivudine and zidovudine: lamivudine and zidovudine may be administered with or without food. The extent of lamivudine and zidovudine absorption (AUC) following administration of lamivudine and zidovudine with food was similar when compared to fasting healthy subjects (n=24).

Special Populations:

Pregnancy: See *Use in Specific Populations* (8.1).

Lamivudine and zidovudine: No data are available.

Zidovudine: Zidovudine pharmacokinetics has been studied in a Phase 1 study of 8 women during the last trimester of pregnancy. As pregnancy progressed, there was no evidence of drug accumulation. The pharmacokinetics of zidovudine was similar to that of nonpregnant adults. Consistent with passive transmission of the drug across the placenta, zidovudine concentrations in neonatal plasma at birth were essentially equal to those in maternal plasma at delivery. Although data are limited, methadone maintenance therapy in 5 pregnant women did not appear to alter zidovudine pharmacokinetics. In a nonpregnant adult population, a potential for interaction has been identified.

Nursing Mothers: See *Use in Specific Populations* (8.3).

Pediatric Patients: Lamivudine and zidovudine should not be administered to pediatric patients weighing less than 5 kg.

Geriatric Patients: The pharmacokinetics of lamivudine and zidovudine have not been studied in patients over 65 years of age.

Gender: A pharmacokinetic study in healthy male (n = 12) and female (n = 12) subjects showed no gender differences in zidovudine exposure (AUC_∞). There are no significant gender differences in lamivudine pharmacokinetics.

Race: Lamivudine: There are no significant racial differences in lamivudine pharmacokinetics.

Zidovudine: The pharmacokinetics of zidovudine with respect to race have not been determined.

Drug Interactions: See *Drug Interactions* (7.0). No drug interaction studies have been conducted using lamivudine and zidovudine Tablets. However, Table 4 presents drug

interaction information for the individual components of lamivudine and zidovudine. *Lamivudine Plus Zidovudine*: No clinically significant alterations in lamivudine or zidovudine pharmacokinetics were observed in 12 asymptomatic HIV-1-infected adult patients given a single dose of zidovudine (200 mg) in combination with multiple doses of lamivudine (300 mg q 12 hr).

Table 4. Effect of Coadministered Drugs on Lamivudine and Zidovudine AUC*

Note: ROUTINE DOSE MODIFICATION OF LAMIVUDINE AND ZIDOVUDINE IS NOT WARRANTED WITH COADMINISTRATION OF THE FOLLOWING DRUGS.

Drugs That May Alter Lamivudine Blood Concentrations					
Coadministered Drug and Dose	Lamivudine Dose	n	Lamivudine Concentration		Concentration of Coadministered Drug
			AUC	Variability	
Nelfinavir 750 mg q 8 hr x 7 to 10 days	single 150 mg	11	↑AUC 10%	95% CI: 1% to 20%	↔
Trimethoprim 160 mg/ Sulfamethoxazole 800 mg daily x 5 days	single 300 mg	14	↑AUC 43%	90% CI: 32% to 55%	↔
Drugs That May Alter Zidovudine Blood Concentrations					
Coadministered Drug and Dose	Lamivudine Dose	n	Lamivudine Concentration		Concentration of Coadministered Drug
			AUC	Variability	
Atovaquone 750 mg q 12 hr with food	200 mg q 8 hr	14	↑AUC 31%	Range 23% to 78% †	↔
Clarithromycin 500 mg twice daily	100 mg q 4 hr x 7 days	4	↓AUC 12%	Range ↓34% to ↑14%	Not Reported
Fluconazole 400 mg daily	200 mg q 8 hr	12	↑AUC 74%	95% CI: 54% to 98%	Not reported
Methadone 30 to 90 mg daily	200 mg q 4 hr	9	↑AUC 43%	Range 16% to 64% †	↔
Nelfinavir 750 mg q 8 hr x 7 to 10 days	Single 200 mg	11	↓AUC 35%	Range 28% to 41%	↔
Probenecid 500 mg q 6 hr x 2 days	2 mg/kg q 8 hr x 3 days	3	↑AUC 106%	Range 100% to 170% †	Not assessed
Rifampin 600 mg daily x 14 days	200 mg q 8 hr x 14 days	8	↓AUC 47%	90% CI: 41% to 53%	Not assessed
Ritonavir 300 mg q 6 hr x 4 days	200 mg q 8 hr x 4 days	9	↓AUC 25%	95% CI: 15% to 34%	↔
Valproic acid 250 mg or 500 mg q 8 hr x 4 days	100 mg q 8 hr x 4 days	6	↑AUC 80%	Range 64% to 130% †	Not assessed

↑= Increase; ↓= Decrease; ↔= no significant change; AUC= area under the concentration versus time curve; CI= confidence interval.

* This table is not all inclusive.

† Estimated range of percent difference.

Ribavirin: *In vitro* data indicate ribavirin reduces phosphorylation of lamivudine, stavudine, and zidovudine. However, no pharmacokinetic (e.g., plasma concentrations or intracellular triphosphorylated active metabolite concentrations) or pharmacodynamic (e.g., loss of HIV-1/HCV virologic suppression) interaction was observed when ribavirin and lamivudine (n = 18), stavudine (n = 10), or zidovudine (n = 6) were co administered

as part of a multi-drug regimen to HIV -1/HCV co-infected patients [see *Warnings and Precautions (5.5)*]

12.4 Microbiology

Mechanism of Action: *Lamivudine:* Intracellularly, lamivudine is phosphorylated to its active 5' -triphosphate metabolite, lamivudine triphosphate (3TC- TP). The principal mode of action of 3TC-TP is inhibition of reverse transcriptase (RT) via DNA chain termination after incorporation of the nucleotide analogue. 3TC- TP is a weak inhibitor of cellular DNA polymerases α , β , and γ .

Zidovudine: Intracellularly, zidovudine is phosphorylated to its active 5' -triphosphate metabolite, zidovudine triphosphate (ZDV - TP). The principal mode of action of ZDV - TP is inhibition of RT via DNA chain termination after incorporation of the nucleotide analogue. ZDV-TP is a weak inhibitor of the cellular DNA polymerases α and γ and has been reported to be incorporated into the DNA of cells in culture.

Antiviral Activity: *Lamivudine Plus Zidovudine:* In HIV-1-infected MT-4 cells, lamivudine in combination with zidovudine at various ratios exhibited synergistic antiretroviral activity.

Lamivudine: The antiviral activity of lamivudine against HIV -1 was assessed in a lines (including monocytes and fresh human peripheral blood lymphocytes) using number of cell standard susceptibility assays. EC₅₀ values (50% effective concentrations) were in the range of 0.003 to 15 μ M (1 μ M = 0.23 mcg/mL). HIV-1 from therapy-naive subjects with no amino acid substitutions associated with resistance gave median EC₅₀ values of 0.429 μ M (range: 0.200 to 2.007 μ M) from Virco (n = 92 baseline samples from COLA40263) and 2.35 μ M (1.37 to 463 3.68 μ M) from Monogram Biosciences (n = 135 baseline samples from ESS30009). The EC₅₀ values of lamivudine against different HIV-1 clades (A-G) ranged from 0.001 to 0.120 μ M, and against HIV-2 isolates from 0.003 to 0.120 μ M in peripheral blood mononuclear cells. Ribavirin (50 μ M) decreased the anti-HIV-1 activity of lamivudine by 3.5 fold in MT-4 cells.

Zidovudine: The antiviral activity of zidovudine against HIV-1 was assessed in a number of cell lines (including monocytes and fresh human peripheral blood lymphocytes). The number of cell EC₅₀ and EC₉₀ values for zidovudine were 0.01 to 0.49 μ M (1 μ M = 0.27 mcg/mL) and 0.1 to 9 μ M, respectively. HIV-1 from therapy-naive subjects with no amino

acid substitutions associated with resistance gave median EC₅₀ values of from Virco (n = 92 baseline samples from COLA40263) and 0.0017 μM (0.006 to 0.0340 μM) from Monogram Biosciences (n = 135 baseline samples from ESS30009). The EC₅₀ values of zidovudine against different HIV-1 clades (A~G) ranged from 0.00018 to 0.02 μM, and against HIV-2 isolates from 0.00049 to 0.004 μM. In cell culture drug combination studies, zidovudine demonstrates synergistic activity with the nucleoside reverse transcriptase inhibitors (NRTIs) abacavir, didanosine, lamivudine, and zalcitabine; the non-nucleoside reverse transcriptase inhibitors (NNRTIs) delavirdine and nevirapine; and the protease inhibitors (PIs) indinavir, ne1finavir, ritonavir, and saquinavir; and additive activity with interferon alfa. Ribavirin has been found to inhibit the phosphorylation of zidovudine in cell culture.

Resistance: *Lamivudine Plus Zidovudine Administered As Separate Formulations:* In patients receiving lamivudine monotherapy or combination therapy with lamivudine plus zidovudine, HIV -1 isolates from most patients became phenotypically and genotypically resistant to lamivudine within 12 weeks. In some patients harboring zidovudine-resistant virus at baseline, phenotypic sensitivity to zidovudine was restored by treatment with lamivudine and zidovudine. Combination therapy with lamivudine 12 weeks of plus zidovudine delayed the emergence of amino acid substitutions conferring resistance to zidovudine.

HIV -1 strains resistant to both lamivudine and zidovudine have been isolated from patients after prolonged lamivudine/zidovudine therapy. Dual resistance required the presence of which maybe G333E. The incidence of dual resistance and the duration of combination therapy required before dual resistance occurs multiple amino acid substitutions, the most essential of are unknown.

Lamivudine: Lamivudine-resistant isolates of HIV-1 and have also been recovered from patients treated with lamivudine or lamivudine plus zidovudine. Genotypic analysis of isolates selected in cell culture and recovered from lamivudine-treated patients showed that the resistance was due to a specific amino acid substitution in the HIV-1 reverse transcriptase at codon 184 changing the methionine to either isoleucine or valine (M184V/I).

Zidovudine: HIV-1 isolates with reduced susceptibility to zidovudine have been selected in cell culture and were also recovered from patients treated with zidovudine. Genotypic analyses of the isolates selected in cell culture and recovered from zidovudine-treated patients showed substitutions in the HIV-1 RT gene resulting in 6 amino acid substitutions (M41L, D67N, K70R, L210W, T215Y or F, and K219Q) that confer zidovudine resistance. In general, higher levels of resistance were associated with greater number of amino acid substitutions.

Cross-Resistance: Cross-resistance has been observed among NRTIs.

Lamivudine Plus Zidovudine: Cross-resistance between lamivudine and zidovudine has not been reported. In some patients treated with lamivudine alone or in combination with zidovudine, isolates have emerged with a substitution at codon 184, which confers resistance to lamivudine. Cross-resistance to abacavir, didanosine, tenofovir, and zalcitabine has been 18 observed in some patients harboring lamivudine-resistant HIV -1 isolates. In some patients treated with zidovudine plus didanosine or zalcitabine, isolates resistant to multiple drugs, including lamivudine, have emerged (see under Zidovudine below).

Lamivudine: See Lamivudine Plus Zidovudine (above).

Zidovudine: In a study of 167 HIV-1-infected patients, isolates (n = 2) with multi-drug resistance to didanosine, lamivudine, stavudine, zalcitabine, and zidovudine were recovered from patients treated for 2:1 year with zidovudine plus didanosine or zidovudine plus zalcitabine. The pattern of resistance-associated amino acid substitutions with such combination therapies was different (A62V, V75I, F77L, F116Y, Q151M) from the pattern with zidovudine monotherapy, with the Q151M substitution being most commonly associated with multi-drug resistance. The substitution at codon 151 in combination with substitutions at 62, 75, 77, and 116 results in a virus with reduced susceptibility to didanosine, lamivudine, stavudine, zalcitabine, and zidovudine. Thymidine analogue mutations (TAMs) are selected by zidovudine and confer cross-resistance to abacavir, didanosine, stavudine, tenofovir, and Zalcitabine.

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenicity: *Lamivudine*: Long-term carcinogenicity studies with lamivudine in mice and rats showed no evidence of carcinogenic potential at exposures up to 10 times (mice) 13 NON and 58 times (rats) those observed in humans at the recommended therapeutic dose for HIV-1 infection.

Zidovudine: Zidovudine was administered orally at 3 dosage levels to separate groups of mice and rats (60 females and 60 males in each group). Initial single daily doses were 30, 60, and 120 mg/kg/day in mice and 80, 220, and 600 mg/kg/day in rats. The doses in mice were reduced to 20, 30, and 40 mg/kg/day after day 90 because of treatment-related anemia, whereas in rats only the high dose was reduced to 450 mg/kg/day on day 91 and then to 300 mg/kg/day on day 279.

In mice, 7 late-appearing (after 19 months) vaginal neoplasms (5 nonmetastasizing squamous cell carcinomas, 1 squamous cell papiloma, and 1 squamous polyp) occurred in the animals given the highest dose. One late-appearing squamous cell papiloma occurred vagina of a middle-dose animal. No vaginal tumors were found at the lowest dose.

In rats, 2 late-appearing (after 20 months), nonmetastasizing vaginal squamous cell carcinomas occurred in animals given the highest dose. No vaginal tumors occurred at the low or middle dose in rats. No other drug-related tumors were observed in either sex of either species.

At doses that produced tumors in mice and rats, the estimated drug exposure (as measured by AUC) was approximately 3 times (mouse) and 24 times (rat) the estimated human exposure at the recommended therapeutic dose of 100 mg every 4 hours.

It is not known how predictive the results of rodent carcinogenicity studies may be for humans.

Mutagenicity: *Lamivudine*: Lamivudine was mutagenic in an L5178Y/TK⁺ mouse lymphoma assay and clastogenic in a cytogenetic assay using cultured human lymphocytes. Lamivudine was negative in a microbial mutagenicity assay, in an *in vitro*

cell transformation assay, in a rat micronucleus test, in a rat bone marrow cytogenetic assay, and in an assay for unscheduled DNA synthesis in rat liver.

Zidovudine: Zidovudine was mutagenic in an L5178Y/TK^{+/−} mouse lymphoma assay, positive in an *in vitro* cell transformation assay, clastogenic in a cytogenetic assay using cultured human lymphocytes, and positive in mouse and rat micronucleus tests after repeated doses. It was negative in a cytogenetic study in rats given a single dose.

Impairment of Fertility: Lamivudine: In a study of reproductive performance, lamivudine, administered to male and female rats at doses up to 130 times the usual adult dose based on body surface area considerations, revealed no evidence of impaired fertility (judged by conception rates) and no effect on the survival, growth, and development to weaning of the offspring.

Zidovudine: Zidovudine, administered to male and female rats at doses up to 7 times the usual adult dose based on body surface area considerations, had no effect on fertility judged by conception rates.

13.2 Reproductive and Developmental Toxicology Studies

Lamivudine: Reproduction studies have been performed in rats and rabbits at orally administered doses up to 4,000 mg/g/day and 1,000 mg/g/day, respectively, producing plasma levels up to approximately 35 times that for the adult HIV dose. No evidence of teratogenicity lethality was seen in the rabbit at due to lamivudine was observed. Evidence of early embryo exposure levels similar to those observed in humans, but there was no indication of this effect in the rat at exposure levels up to 35 times those in humans. Studies in pregnant rats and rabbits showed that lamivudine is transferred to the fetus through the placenta.

Zidovudine: Oral teratology studies in the rat and in the rabbit at doses up to 500 mg/g/day revealed no evidence of teratogenicity with zidovudine. Zidovudine treatment resulted in embryo/fetal toxicity as evidenced by an increase in the incidence of fetal resorptions in rats given 150 or 450 mg/kg/day and rabbits given 500 mg/kg/day. The doses used in the daily dose) in rats 66 to 226 times, and in rabbits 12 to 87 times, mean steady-state peak human teratology studies resulted in peak zidovudine plasma concentrations (after one half of the daily dose) achieved with the recommended daily plasma concentrations (after one sixth of dose(100 mg every 4 hours). In an *in vitro*

experiment with fertilized mouse oocytes, zidovudine exposure resulted in a dose-dependent reduction in blastocyst formation. In an additional teratology study in rats, a dose of 3,000 mg/kg/day (very near the oral median lethal dose in rats fetal malformations. This dose resulted in peak zidovudine plasma concentrations 350 times peak of 3,683 mg/g) caused marked maternal toxicity and an increase in the incidence of human plasma concentrations. (Estimated area under the curve (AVCJ in rats at this dose level was 300 times the daily Ave in humans given 600 mg/day.) No evidence of teratogenicity was seen in this experiment at doses of 600 mg/kg/day or less.

14 CLINICAL STUDIES

See *Clinical Pharmacology* (12.3) for information about bioequivalence. One lamivudine and zidovudine Tablet given twice daily is an alternative regimen to EPIVIR Tablets 150 mg twice daily plus RETROVIR 600 mg per day in divided doses.

14.1 Adults

Lamivudine Plus Zidovudine: The NUCB3007 (CAESAR) study was conducted using EPIVIR 150-mg Tablets (150 mg twice daily) and RETROVIR 100-mg Capsules (2 x 100 mg 3 times daily). CAESAR was a multi-center, double-blind, placebo-controlled study comparing continued current therapy (zidovudine alone (62% of patients) or zidovudine with didanosine or zalcitabine (38% of patients)) to the addition of EPIVIR or EPIVIR plus an investigational non 600 nucleoside reverse transcriptase inhibitor, randomized 1:2:1. A total of 1,816 HIV-1-infected adults with 25 to 250 (median 122) CD4 cells/mm³ at baseline were enrolled: median age was 602 36 years, 87% were male, 84% were nucleoside-experienced, and 16% were therapy-naive. The median duration on study was 12 months. Results are summarized in Table 5.

Table 5. Number of Patients (%) With At Least 1 HIV-1 Disease-Progression Event or Death

Endpoint	Current Therapy	EPIVIR plus Current Therapy (n=896)	EPIVIR plus a NNRTI* plus Current Therapy (n=460)
HIV-1 progression or death	90 (19.6%)	86 (9.6%)	41 (8.9%)
Death	27 (5.9%)	23 (2.6%)	14 (3.0%)

* An investigational non-nucleoside reverse transcriptase inhibitor not approved in the United States.

14.2 Pediatric Patients

Clinical Endpoint Study: ACTG300 was a multi-center, randomized, double-blind study that provided for comparison of EPIVIR plus RETROVIR (zidovudine) with didanosine monotherapy. A total of 471 symptomatic, HIV-1-infected therapy-naive (≤56 days of

antiretroviral therapy) pediatric patients were enrolled in these 2 treatment arms. The median age was 2.7 years (range: 6 weeks to 14 years), 58% were female, and 86% were non-Caucasian. The mean baseline CD4+ cell count was 868 cells/mm³ (mean: 1,060 cells/mm³ and range: 0 to 4,650 cells/mm³ for patients ≤5 years of age; mean: 419 cells/mm³ and range: 0 to 1,555 cells/mm³ for patients >5 years of age) and the mean baseline plasma HIV-1 RNA was 5.0 log₁₀ copies/mL. The median duration on study was 10.1 months for the patients receiving EPIVIR plus RETROVIR and 9.2 months for patients receiving didanosine monotherapy. Results are summarized in Table 6.

Table 6. Number of Patients (%) Reaching a Primary Clinical Endpoint (Disease Progression or Death)

Endpoint	EPIVIR plus RETROVIR (n = 236)	Didanosine (n = 235)
HIV-1 disease progression or death (total)	15 (6.4%)	37 (15.7%)
Physical growth failure	7 (3.0%)	6 (2.6%)
Central nervous system deterioration	4 (1.7%)	12 (5.1%)
CDC Clinical Category C	2 (0.8%)	8 (3.4%)
Death	2 (0.8%)	11 (4.7%)

14.3 Prevention of Maternal-Fetal HIV-1 Transmission

The utility of zidovudine alone for the prevention of maternal-fetal HIV-1 transmission was demonstrated in a randomized, double-blind, placebo-controlled trial conducted in HIV-1-infected pregnant women with CD4+ cell counts of 200 to 1,818 cells/in³ (median in the treated group: 560 cells/in³) who had little or no previous exposure to zidovudine. Oral zidovudine was initiated between 14 and 34 weeks of gestation (median 11 weeks of therapy) followed by intravenous administration of zidovudine during labor and delivery. Following birth, neonates received oral zidovudine syrup for 6 weeks. The study showed a statistically significant difference in the incidence of HIV-1 infection in the neonates (based on viral culture from peripheral blood) between the group receiving zidovudine and the group receiving placebo. Of 363 neonates evaluated in the study, the estimated risk of HIV-1 infection was 7.8% in the group receiving zidovudine and 24.9% in the placebo group, a relative reduction in transmission risk of 68.7%. Zidovudine was well tolerated by mothers and infants. There was no difference in pregnancy-related adverse events between the treatment groups.

16 HOW SUPPLIED/STORAGE AND HANDLING

Lamivudine and zidovudine Tablets, containing 30 mg lamivudine and 60 mg zidovudine, are white, round, biconvex film-coated tablets with breakline on one side and debossed with "M29" on other side.

They are available as follows:

60 Tablets/Bottle (NDC 65015-115-17).

Store at 25°C (77°F); excursions permitted to 15° to 30°C (59° to 86°F) [see USP Controlled Room Temperature].

17 PATIENT COUNSELING INFORMATION

17.1 Advice for the Patient

Neutropenia and Anemia: Patients should be informed that the important toxicities associated with zidovudine are neutropenia and/or anemia. They should be told of the extreme importance of having their blood counts followed closely while on therapy, especially for patients with advanced HIV-1 disease (see Warnings and Precautions (5.1)).

Co-infection With HIV-1 and HBV: Patients co-infected with HIV-1 and HBV should be informed that deterioration of liver disease has occurred in some cases when treatment with lamivudine was discontinued. Patients should be advised to discuss any changes in regimen with their physician (see Warnings and Precautions (5.4)).

Risk of Pancreatitis: Parents or guardians should be advised to monitor pediatric patients for signs and symptoms of pancreatitis (see Warnings and Precautions (5.7)).

Drug Interactions: Patients should be cautioned about the use of other medications, including ganciclovir, interferon alfa, and ribavirin, which may exacerbate the toxicity of zidovudine (see Drug Interactions (7.3)).

Redistribution/Accumulation of Body Fat: Patients should be informed that redistribution or accumulation of body fat may occur in patients receiving antiretroviral therapy and that the cause and long-term health effects of these conditions are not known at this time (see Warnings and Precautions (5.9)).

Information About Therapy with lamivudine and zidovudine: Lamivudine and zidovudine is not a cure for HIV-1 infection and patients may continue to experience illnesses


associated with HIV-1 infection, including opportunistic infections. Patients should be advised that the use of lamivudine and zidovudine has not been shown to reduce the risk of transmission of HIV-1 to others through sexual contact or blood contamination. Patients should be advised of the importance of taking lamivudine and zidovudine exactly as it is prescribed.

Lamivudine and zidovudine should not be coadministered with drugs containing lamivudine, zidovudine, or emtricitabine, including EPIVIR (lamivudine), EPVIR-HBV (lamivudine), RETROVIR (zidovudine), EPZICOM (abacavir sulfate and lamivudine), TRIZIVIR (abacavir sulfate, lamivudine, and zidovudine), ATRIPLA (efavirenz, emtricitabine, and tenofovir), EMTRIVA (emtricitabine), or TRUVADA (emtricitabine and tenofovir) (see Warnings and Precautions (5.5)).

EPIVIR, EPIVIR-HBV, RETROVIR, EPZICOM, and TRIZIVIR are registered trademarks of GlaxoSmithKline. ATRIPLA, EMTRIVA, and TRUVADA are trademarks of their respective owners and are not trademarks of GlaxoSmithKline. The makers of these brands are not affiliated with and do not endorse GlaxoSmithKline or its products.

Manufactured in India by:
Matrix Laboratories Limited
Secunderabad - 500 003, India

Each tablet contains 30 mg of lamivudine USP and 60 mg of zidovudine USP.
Store at 25°C (77°F); excursions permitted to 15° to 30°C (59° to 86°F) [see USP Controlled Room Temperature].
USUAL DOSAGE AND ADMINISTRATION:
See prescribing information.



N
3 6 5 0 1 5 1 1 5 1 7 1

NDC 65015-115-17

**Lamivudine
and Zidovudine
Tablets**

30 mg/60 mg

Rx Only

60 TABLETS

Let:
Exp.:

CODE No: MH/DRUGS/25/NKO/89
Manufactured by:
MATRIX
Laboratories Limited
Secunderabad, India

75XXXXXX



HDPE Drum Label

NDC 65015-115-99

Lamivudine and Zidovudine Tablets 30 mg/60 mg

Pack Size: 104000 Tablets (4 x 4 X 6500 Tablets)

Each tablet contains 30 mg of
lamivudine USP and 60 mg of zidovudine USP

Storage: Store at 25°C (77°F); excursions
permitted to 15° to 30°C (59° to 86°F)
[see USP Controlled Room Temperature].

CODE No.: MH/DRUGS/25/NKD/89

B. NO.:

MFD.:

EXP. :

Manufactured by:

M A T R I X 
Laboratories Limited
Secunderabad, India

FOR REPACKAGING ONLY

TO BE REPACKED WITHIN 12 MONTHS FROM MANUFACTURING DATE

FG CODE/ ITEM CODE

Triple Laminated Bag Label

Lamivudine and Zidovudine Tablets 30 mg/60 mg

Pack Size: 26000 Tablets (4 X 6500 Tablets)

Each tablet contains
30 mg of lamivudine USP and
60 mg of zidovudine USP

Storage: Store at 25°C (77°F); excursions
permitted to 15° to 30°C (59° to 86°F)
[see USP Controlled Room Temperature].

CODE No.: MH/DRUGS/25/NKD/89

B. NO.:

Manufactured by:

M A T R I X

Laboratories Limited

Secunderabad, India

MFD.:

EXP.:

FG CODE/ ITEM CODE

FOR REPACKAGING ONLY

TO BE REPACKED WITHIN 12 MONTHS FROM MANUFACTURING DATE

LDPE Bag Label

Lamivudine and Zidovudine Tablets 30 mg/60 mg

Pack Size: 6500 Tablets

Each tablet contains
30 mg of lamivudine USP and
60 mg of zidovudine USP

Storage: Store at 25°C (77°F); excursions
permitted to 15° to 30°C (59° to 86°F)
[see USP Controlled Room Temperature].

CODE No.: MH/DRUGS/25/NKD/89

B. NO.:

Manufactured by:

MFD.:

M A T R I X
Laboratories Limited
Secunderabad, India

EXP.:

FG CODE/ITEM CODE

FOR REPACKAGING ONLY

TO BE REPACKED WITHIN 12 MONTHS FROM MANUFACTURING DATE