

## **AUBAGIO 14 mg Film-coated Tablets**

### **NAME OF THE MEDICINAL PRODUCT**

AUBAGIO 14 mg film-coated tablets

### **QUALITATIVE AND QUANTITATIVE COMPOSITION**

Each film-coated tablet contains 14 mg of teriflunomide.

Excipient with known effect: Each tablet contains 72 mg of lactose (as monohydrate) and 0.3 mg of sodium.

### **PHARMACEUTICAL FORM**

Film-coated tablet (tablet).

Pale blue to pastel blue, pentagonal film-coated tablets with imprint on one side ('14') and engraved with a corporate logo on the other side.

### **CLINICAL PARTICULARS**

#### **Therapeutic indications**

AUBAGIO is indicated for the treatment of adult patients with relapsing remitting multiple sclerosis (MS). (please refer to section *Pharmacodynamic properties* for important information on the population for which efficacy has been established).

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

The treatment should be initiated and supervised by a physician experienced in the management of multiple sclerosis.

##### Posology

The recommended dose of AUBAGIO is 14 mg once daily.

##### Special populations

###### *Elderly population*

AUBAGIO should be used with caution in patients aged 65 years and over due to insufficient data on safety and efficacy.

###### *Renal impairment*

No dosage adjustment is necessary for patients with mild, moderate or severe renal impairment not undergoing dialysis.

Patients with severe renal impairment undergoing dialysis were not evaluated. Teriflunomide is contraindicated in this population (see section *Contraindications*).

###### *Hepatic impairment*

No dosage adjustment is necessary for patients with mild and moderate hepatic impairment. Teriflunomide is contraindicated in patients with severe hepatic impairment (see section *Contraindications*).

###### *Paediatric population*

The safety and efficacy of AUBAGIO in children aged from 10 to less than 18 years has not yet been established. There is no relevant use of teriflunomide in children aged from birth to less than 10 years for the treatment of multiple sclerosis.

No data are available.

##### Method of administration

The film-coated tablets are for oral use. The tablets should be swallowed whole with some water. AUBAGIO can be taken with or without food.

## **Contraindications**

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

Patients with severe hepatic impairment (Child-Pugh class C).

Pregnant women, or women of childbearing potential who are not using reliable contraception during treatment with teriflunomide and thereafter as long as its plasma levels are above 0.02 mg/l (see section *Fertility, pregnancy and lactation*). Pregnancy must be excluded before start of treatment (see section *Fertility, pregnancy and lactation*).

Breast-feeding women (see section *Fertility, pregnancy and lactation*).

Patients with severe immunodeficiency states, e.g. AIDS.

Patients with significantly impaired bone marrow function or significant anaemia, leucopenia, neutropenia or thrombocytopenia.

Patients with severe active infection until resolution (see section *Special warnings and precautions for use*).

Patients with severe renal impairment undergoing dialysis, because insufficient clinical experience is available in this patient group.

Patients with severe hypoproteinaemia, e.g. in nephrotic syndrome.

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

### Monitoring

#### *Before treatment*

Before starting treatment with teriflunomide the following should be assessed:

- Blood pressure
- Alanine aminotransferase/serum glutamic pyruvic transaminase (ALT/SGPT)
- Complete blood cell count including differential white blood cell and platelet count.

#### *During treatment*

During treatment with teriflunomide the following should be monitored:

- Blood pressure
  - Check periodically
- Alanine aminotransferase/serum glutamic pyruvic transaminase (ALT/SGPT)
  - Liver enzymes should be assessed at least every four weeks during the first 6 months of treatment and regularly thereafter.
  - Consider additional monitoring when AUBAGIO is given in patients with pre-existing liver disorders, given with other potentially hepatotoxic drugs or as indicated by clinical signs and symptoms such as unexplained nausea, vomiting, abdominal pain, fatigue, anorexia, or jaundice and/or dark urine. Liver enzymes should be assessed every two weeks during the first 6 months of treatment, and at least every 8 weeks thereafter for at least 2 years from initiation of treatment.
  - For ALT (SGPT) elevations between 2- and 3-fold the upper limit of normal, monitoring must be performed weekly.
- Complete blood cell counts should be performed based on signs and symptoms (e.g. infections) during treatment.

### Accelerated elimination procedure

Teriflunomide is eliminated slowly from the plasma. Without an accelerated elimination procedure, it takes an average of 8 months to reach plasma concentrations less than 0.02 mg/l, although due to individual variation in substance clearance it may take up to 2 years. An accelerated elimination procedure can be

used at any time after discontinuation of teriflunomide (see section *Fertility, pregnancy and lactation and Pharmacokinetic properties* for procedural details).

#### Hepatic effects

Elevations of liver enzymes have been observed in patients receiving teriflunomide (see section *Undesirable effects*). These elevations occurred mostly within the first 6 months of treatment.

Cases of drug-induced liver injury (DILI) have been observed during treatment with teriflunomide, sometimes life-threatening. Most cases of DILI occurred with time to onset of several weeks or several months after treatment initiation of teriflunomide, but DILI can also occur with prolonged use.

The risk for liver enzyme increases and DILI with teriflunomide might be higher in patients with pre-existing liver disorder, concomitant treatment with other hepatotoxic drugs, and/or consumption of substantial quantities of alcohol. Patients should therefore be closely monitored for signs and symptoms of liver injury.

Teriflunomide therapy should be discontinued and accelerated elimination procedure considered if liver injury is suspected. Consider to discontinue teriflunomide therapy if elevated liver enzymes (greater than 3-fold ULN) are confirmed.

In case of treatment discontinuation, liver tests should be pursued until normalisation of transaminase levels.

#### Hypoproteinaemia

Since teriflunomide is highly protein bound and as the binding is dependent upon the concentrations of albumin, unbound plasma teriflunomide concentrations are expected to be increased in patients with hypoproteinaemia, e.g. in nephrotic syndrome. Teriflunomide should not be used in patients with conditions of severe hypoproteinaemia.

#### Blood pressure

Elevation of blood pressure may occur during treatment with teriflunomide (see section *Undesirable effects*). Blood pressure must be checked before the start of teriflunomide treatment and periodically thereafter. Blood pressure elevation should be appropriately managed before and during treatment with teriflunomide.

#### Infections

Initiation of treatment with teriflunomide should be delayed in patients with severe active infection until resolution.

In placebo-controlled studies, no increase in serious infections was observed with teriflunomide (see section *Undesirable effects*). However, based on the immunomodulatory effect of AUBAGIO, if a patient develops a serious infection, suspending treatment with AUBAGIO should be considered and the benefits and risks should be reassessed prior to re-initiation of therapy. Due to the prolonged half-life, accelerated elimination with cholestyramine or charcoal may be considered.

Patients receiving AUBAGIO should be instructed to report symptoms of infections to a physician. Patients with active acute or chronic infections should not start treatment with AUBAGIO until the infection(s) is resolved.

The safety of AUBAGIO in individuals with latent tuberculosis infection is unknown, as tuberculosis screening was not systematically performed in clinical studies. For patients testing positive in tuberculosis screening, treat by standard medical practice prior to therapy with AUBAGIO.

#### Respiratory reactions

Interstitial lung disease (ILD) has been reported with teriflunomide in the postmarketing setting.

ILD and worsening of pre-existing ILD have been reported during treatment with leflunomide, the parent compound of teriflunomide. The risk is increased in patients who had a history of ILD when treated with leflunomide.

ILD may occur acutely at any time during therapy with a variable clinical presentation.

ILD may be fatal. New onset or worsening pulmonary symptoms, such as persistent cough and dyspnoea, may be a reason for discontinuation of the therapy and for further investigation, as appropriate. If discontinuation of the drug is necessary, consider initiation of an accelerated elimination procedure.

#### Haematological effects

A mean decrease less than 15% from baseline affecting white blood cell count has been observed (see section *Undesirable effects*). As a precaution, a recent complete blood cell count, including differential white blood cell count and platelets, should be available before the initiation of treatment with AUBAGIO and the complete blood cell count should be assessed during AUBAGIO therapy as indicated by clinical signs and symptoms (e.g., infections).

In patients with pre-existing anaemia, leucopenia, and /or thrombocytopenia as well as in patients with impaired bone marrow function or those at risk of bone marrow suppression, the risk of haematological disorders is increased. If such effects occur, the accelerated elimination procedure (see above) to reduce plasma levels of teriflunomide should be considered.

In cases of severe haematological reactions, including pancytopenia, AUBAGIO and any concomitant myelosuppressive treatment must be discontinued and a teriflunomide accelerated elimination procedure should be considered.

#### Skin reactions

Cases of serious skin reactions, sometimes fatal including Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN), and drug reaction with eosinophilia and systemic symptoms (DRESS), have been reported with AUBAGIO.

If skin and /or mucosal reactions (ulcerative stomatitis) are observed which raise the suspicion of severe generalised major skin reactions (Stevens-Johnson syndrome, toxic epidermal necrolysis-Lyell's syndrome, or drug reaction with eosinophilia and systemic symptoms), teriflunomide and any other possibly associated treatment must be discontinued, and an accelerated procedure initiated immediately. In such cases patients should not be re-exposed to teriflunomide (see section *Contraindications*).

New onset of psoriasis (including pustular psoriasis) and worsening of pre-existing psoriasis have been reported during the use of teriflunomide. Treatment withdrawal and initiation of an accelerated elimination procedure may be considered taking into account patient's disease and medical history.

#### Peripheral neuropathy

Cases of peripheral neuropathy have been reported in patients receiving AUBAGIO (see section *Undesirable effects*). Most patients improved after discontinuation of AUBAGIO. However, there was a wide variability in final outcome, i.e. in some patients the neuropathy resolved and some patients had persistent symptoms. If a patient taking AUBAGIO develops a confirmed peripheral neuropathy, consider discontinuing AUBAGIO therapy and performing the accelerated elimination procedure.

#### Vaccination

Two clinical studies have shown that vaccinations to inactivated neoantigen (first vaccination), or recall antigen (reexposure) were safe and effective during AUBAGIO treatment. The use of live attenuated vaccines may carry a risk of infections and should therefore be avoided.

#### Immunosuppressive or immunomodulating therapies

As leflunomide is the parent compound of teriflunomide, co-administration of teriflunomide with leflunomide is not recommended.

Co-administration with antineoplastic or immunosuppressive therapies used for treatment of MS has not been evaluated. Safety studies, in which teriflunomide was concomitantly administered with interferon beta or with glatiramer acetate for up to one year did not reveal any specific safety concerns, but a higher adverse

reaction rate as compared to teriflunomide monotherapy was observed. The long term safety of these combinations in the treatment of multiple sclerosis has not been established.

#### Switching to or from AUBAGIO

Based on the clinical data related to concomitant administration of teriflunomide with interferon beta or with glatiramer acetate, no waiting period is required when initiating teriflunomide after interferon beta or glatiramer acetate or when starting interferon beta or glatiramer acetate, after teriflunomide.

Due to the long half-life of natalizumab, concomitant exposure, and thus concomitant immune effects, could occur for up to 2-3 months following discontinuation of natalizumab if AUBAGIO was immediately started. Therefore, caution is required when switching patients from natalizumab to AUBAGIO.

Based on the half-life of fingolimod, a 6-week interval without therapy is needed for clearance from the circulation and a 1 to 2 month period is needed for lymphocytes to return to normal range following discontinuation of fingolimod. Starting AUBAGIO during this interval will result in concomitant exposure to fingolimod. This may lead to an additive effect on the immune system and caution is, therefore, indicated.

In MS patients, the median  $t_{1/2z}$  was approximately 19 days after repeated doses of 14 mg. If a decision is made to stop treatment with AUBAGIO, during the interval of 5 half-lives (approximately 3.5 months although may be longer in some patients), starting other therapies will result in concomitant exposure to AUBAGIO. This may lead to an additive effect on the immune system and caution is, therefore, indicated.

#### Lactose

Since AUBAGIO tablets contain lactose, patients with rare hereditary problems of galactose intolerance, the Lapp lactase deficiency or glucose-galactose malabsorption, should not take this medicinal product.

#### Sodium

This medicine contains less than 1 mmol sodium (23 mg) per tablet, that is to say essentially "sodium free".

#### Interference with determination of ionised calcium levels

The measurement of ionised calcium levels might show falsely decreased values under treatment with leflunomide and/or teriflunomide (the active metabolite of leflunomide) depending on the type of ionized calcium analyser used (e.g. blood gas analyser). Therefore, the plausibility of observed decreased ionized calcium levels needs to be questioned in patients under treatment with leflunomide or teriflunomide. In case of doubtful measurements, it is recommended to determine the total albumin adjusted serum calcium concentration.

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

#### Pharmacokinetic interactions of other substances on teriflunomide

The primary biotransformation pathway for teriflunomide is hydrolysis, with oxidation being a minor pathway.

Potent cytochrome P450 (CYP) and transporter inducers: Co-administration of repeated doses (600 mg once daily for 22 days) of rifampicin (a CYP2B6, 2C8, 2C9, 2C19, 3A inducer), as well as an inducer of the efflux transporters P-glycoprotein [P-gp] and breast cancer resistant protein [BCRP] with teriflunomide (70 mg single dose) resulted in an approximately 40% decrease in teriflunomide exposure. Rifampicin and other known potent CYP and transporter inducers such as carbamazepine, phenobarbital, phenytoin and St John's Wort should be used with caution during the treatment with teriflunomide.

#### *Cholestyramine or activated charcoal*

It is recommended that patients receiving teriflunomide are not treated with cholestyramine or activated charcoal because this leads to a rapid and significant decrease in plasma concentration unless an accelerated elimination is desired. The mechanism is thought to be by interruption of enterohepatic recycling and/or gastrointestinal dialysis of teriflunomide.

### Pharmacokinetic interactions of teriflunomide on other substances

#### *Effect of teriflunomide on CYP2C8 substrate: repaglinide*

There was an increase in mean repaglinide  $C_{max}$  and AUC (1.7- and 2.4-fold, respectively), following repeated doses of teriflunomide, suggesting that teriflunomide is an inhibitor of CYP2C8 *in vivo*. Therefore, medicinal products metabolised by CYP2C8, such as repaglinide, paclitaxel, pioglitazone or rosiglitazone, should be used with caution during treatment with teriflunomide.

#### *Effect of teriflunomide on oral contraceptive: 0.03 mg ethinylestradiol and 0.15 mg levonorgestrel*

There was an increase in mean ethinylestradiol  $C_{max}$  and AUC<sub>0-24</sub> (1.58- and 1.54-fold, respectively) and levonorgestrel  $C_{max}$  and AUC<sub>0-24</sub> (1.33- and 1.41-fold, respectively) following repeated doses of teriflunomide. While this interaction of teriflunomide is not expected to adversely impact the efficacy of oral contraceptives, it should be considered when selecting or adjusting oral contraceptive treatment used in combination with teriflunomide.

#### *Effect of teriflunomide on CYP1A2 substrate: caffeine*

Repeated doses of teriflunomide decreased mean  $C_{max}$  and AUC of caffeine (CYP1A2 substrate) by 18% and 55%, respectively, suggesting that teriflunomide may be a weak inducer of CYP1A2 *in vivo*. Therefore, medicinal products metabolised by CYP1A2 (such as duloxetine, alosetron, theophylline and tizanidine) should be used with caution during treatment with teriflunomide, as it could lead to the reduction of the efficacy of these products.

#### *Effect of teriflunomide on warfarin*

Repeated doses of teriflunomide had no effect on the pharmacokinetics of S-warfarin, indicating that teriflunomide is not an inhibitor or an inducer of CYP2C9. However, a 25% decrease in peak international normalised ratio (INR) was observed when teriflunomide was coadministered with warfarin as compared with warfarin alone. Therefore, when warfarin is co-administered with teriflunomide, close INR follow-up and monitoring is recommended.

#### *Effect of teriflunomide on organic anion transporter 3 (OAT3) substrates:*

There was an increase in mean cefaclor  $C_{max}$  and AUC (1.43- and 1.54-fold, respectively), following repeated doses of teriflunomide, suggesting that teriflunomide is an inhibitor of OAT3 *in vivo*. Therefore, when teriflunomide is coadministered with substrates of OAT3, such as cefaclor, benzylpenicillin, ciprofloxacin, indometacin, ketoprofen, furosemide, cimetidine, methotrexate, zidovudine, caution is recommended.

#### *Effect of teriflunomide on BCRP and /or organic anion transporting polypeptide B1 and B3 (OATP1B1/B3) substrates:*

There was an increase in mean rosuvastatin  $C_{max}$  and AUC (2.65- and 2.51-fold, respectively), following repeated doses of teriflunomide. However, there was no apparent impact of this increase in plasma rosuvastatin exposure on the HMG-CoA reductase activity. For rosuvastatin, a dose reduction by 50% is recommended for coadministration with teriflunomide. For other substrates of BCRP (e.g., methotrexate, topotecan, sulfasalazine, daunorubicin, doxorubicin) and the OATP family especially HMG-Co reductase inhibitors (e.g., simvastatin, atorvastatin, pravastatin, methotrexate, nateglinide, repaglinide, rifampicin) concomitant administration of teriflunomide should also be undertaken with caution. Patients should be closely monitored for signs and symptoms of excessive exposure to the medicinal products and reduction of the dose of these medicinal products should be considered.

### **Fertility, pregnancy and lactation**

#### Use in males

The risk of male-mediated embryo-foetal toxicity through teriflunomide treatment is considered low (see section *Preclinical safety data*).

#### Pregnancy

There are limited amount of data from the use of teriflunomide in pregnant women. Studies in animals have shown reproductive toxicity (see section *Preclinical safety data*).

Teriflunomide may cause serious birth defects when administered during pregnancy. Teriflunomide is contraindicated in pregnancy (see section *Contraindications*).

Women of childbearing potential have to use effective contraception during treatment and after treatment as long as teriflunomide plasma concentration is above 0.02 mg/l. During this period women should discuss any plans to stop or change contraception with the treating physician.

The patient must be advised that if there is any delay in onset of menses or any other reason to suspect pregnancy, they must notify the physician immediately for pregnancy testing, and if positive, the physician and patient must discuss the risk to the pregnancy. It is possible that rapidly lowering the blood level of teriflunomide, by instituting the accelerated elimination procedure described below, at the first delay of menses, may decrease the risk to the foetus.

For women receiving teriflunomide treatment, who wish to become pregnant, the medicine should be stopped and an accelerated elimination procedure is recommended in order to more rapidly achieve concentration below 0.02 mg/l (see below):

If an accelerated elimination procedure is not used, teriflunomide plasma levels can be expected to be above 0.02 mg/l for an average of 8 months, however, in some patients it may take up to 2 years to reach plasma concentration below 0.02 mg/l. Therefore, teriflunomide plasma concentrations should be measured before a woman begins to attempt to become pregnant. Once the teriflunomide plasma concentration is determined to be below 0.02 mg/l, the plasma concentration must be determined again after an interval of at least 14 days.

If both plasma concentrations are below 0.02 mg/l, no risk to the foetus is to be expected.

For further information on the sample testing please contact the Marketing Authorisation Holder or its local representative.

#### Accelerated elimination procedure

After stopping treatment with teriflunomide:

- cholestyramine 8 g is administered 3 times daily for a period of 11 days, or cholestyramine 4 g three times a day can be used, if cholestyramine 8 g three times a day is not well tolerated,
- alternatively, 50 g of activated powdered charcoal is administered every 12 hours for a period of 11 days.

However, also following either of the accelerated elimination procedures, verification by 2 separate tests at an interval of at least 14 days and a waiting period of one-and-a-half months between the first occurrence of a plasma concentration below 0.02 mg/l and fertilisation is required.

Both cholestyramine and activated powdered charcoal may influence the absorption of oestrogens and progestogens such that reliable contraception with oral contraceptives may not be guaranteed during the accelerated elimination procedure with cholestyramine or activated powdered charcoal. Use of alternative contraceptive methods is recommended.

#### Breast-feeding

Animal studies have shown excretion of teriflunomide in breast milk. Breast-feeding women must, therefore, not receive teriflunomide.

#### Fertility

Results of studies in animals have not shown an effect on fertility (see section *Preclinical safety data*). Although human data are lacking, no effect on male and female fertility is anticipated.

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

AUBAGIO has no or negligible influence on the ability to drive and use machines.

In the case of adverse reactions such as dizziness, which has been reported with leflunomide, the parent compound, the patient's ability to concentrate and to react properly may be impaired. In such cases, patients should refrain from driving cars and using machines.

### Undesirable effects

#### Summary of the safety profile

A total of 2267 patients were exposed to teriflunomide (1155 on teriflunomide 7 mg and 1112 on teriflunomide 14 mg) once daily for a median duration of about 672 days in four placebo-controlled studies (1045 and 1002 patients for teriflunomide 7 mg and 14 mg, respectively) and one active comparator study (110 patients in each of the teriflunomide treatment groups) in patients with relapsing forms of MS (Relapsing Multiple Sclerosis, RMS).

Teriflunomide is the main metabolite of leflunomide. The safety profile of leflunomide in patients suffering from rheumatoid arthritis or psoriatic arthritis may be pertinent when prescribing teriflunomide in MS patients.

The placebo-controlled pooled analysis was based on 2047 patients with Relapsing Multiple Sclerosis treated with teriflunomide once daily. Within this safety population, the most commonly reported adverse reactions in the teriflunomide treated patients were: headache, diarrhoea, increased ALT, nausea, and alopecia. In general, headache, diarrhoea, nausea and alopecia, were mild to moderate, transient and infrequently led to treatment discontinuation.

#### Tabulated list of adverse reactions

Adverse reactions reported with AUBAGIO in placebo-controlled studies, reported for teriflunomide 7 mg or 14 mg at  $\geq 1\%$  higher rate than for placebo, are shown below. Frequencies were defined using the following convention: very common ( $\geq 1/10$ ); common ( $\geq 1/100$  to  $< 1/10$ ); uncommon ( $\geq 1/1,000$  to  $< 1/100$ ); rare ( $\geq 1/10,000$  to  $< 1/1,000$ ); very rare ( $< 1/10,000$ ); not known (cannot be estimated from the available data). Within each frequency grouping, adverse reactions are ranked in order of decreasing seriousness.

System organ class	Very common	Common	Uncommon	Rare	Very rare	Not known
Infections and infestations		Influenza, Upper respiratory tract infection, Urinary tract Infection, Bronchitis, Sinusitis, Pharyngitis, Cystitis, Gastroenteritis viral, Oral herpes, Tooth infection, Laryngitis, Tinea pedis				Severe infections including sepsis <sup>a</sup>
Blood and lymphatic system disorders		Neutropenia <sup>b</sup> , Anaemia	Mild thrombocytopenia (platelets $< 100$ G/l)			
Immune system disorders		Mild allergic reactions				Hypersensitivity reactions

						(immediate or delayed) including anaphylaxis and angioedema
Psychiatric disorders		Anxiety				
Nervous system disorders	Headache	Paraesthesia, Sciatica, Carpal tunnel syndrome	Hyperaesthesia, Neuralgia, Peripheral neuropathy			
Cardiac disorders		Palpitations				
Vascular disorders		Hypertension <sup>b</sup>				
Respiratory, thoracic and mediastinal disorders						Interstitial lung disease
Gastrointestinal disorders	Diarrhoea, Nausea	Abdominal pain upper, Vomiting, Toothache				Pancreatitis, Stomatitis
Hepatobiliary disorders	Alanine aminotransferase (ALT) increase <sup>b</sup>	Gamma-glutamyl transferase (GGT) increase <sup>b</sup> , Aspartate aminotransferase <sup>b</sup> increase		Acute hepatitis		Drug-induced liver injury (DILI)
Metabolism and nutrition disorders						Dyslipidaemia
Skin and subcutaneous tissue disorders	Alopecia	Rash, Acne	Nail Disorders, Severe skin reactions <sup>a</sup>			Psoriasis (including pustular) <sup>b</sup>
Musculoskeletal and connective tissue disorders		Musculoskeletal pain, Myalgia, Arthralgia				
Renal and urinary disorders		Pollakiuria				
Reproductive system and breast disorders		Menorrhagia				
General disorders and administration		Pain, Asthenia <sup>a</sup>				

site conditions						
Investigations		Weight decrease, Neutrophil count decrease <sup>b</sup> , White blood cell count decrease <sup>b</sup> , Blood creatine phosphokinase increased				
Injury, poisoning and procedural complications			Post-traumatic pain			

a: please refer to the detailed description section

b: see section *Special warnings and precautions for use*

#### Description of selected adverse reactions

##### *Alopecia*

Alopecia was reported as hair thinning, decreased hair density, hair loss, associated or not with hair texture change, in 13.9% of patients treated with 14 mg teriflunomide versus 5.1% in patients treated with placebo. Most cases were described as diffuse or generalised over the scalp (no complete hair loss reported) and occurred most often during the first 6 months and with resolution in 121 of 139 (87.1%) patients treated with teriflunomide 14 mg. Discontinuation because of alopecia was 1.3% in the teriflunomide 14 mg teriflunomide group, versus 0.1% in the placebo group.

##### *Hepatic effects*

During placebo-controlled studies the following was detected:

<b>ALT increase (based on laboratory data) according to baseline status – Safety population in placebo-controlled studies</b>		
	<b>placebo (N=997)</b>	<b>Teriflunomide 14 mg (N=1002)</b>
>3 ULN	66/994 (6.6%)	80/999 (8.0%)
>5 ULN	37/994 (3.7%)	31/999 (3.1%)
>10 ULN	16/994 (1.6%)	9/999 (0.9%)
>20 ULN	4/994 (0.4%)	3/999 (0.3%)
ALT >3 ULN and TBILI >2 ULN	5/994 (0.5%)	3/999 (0.3%)

Mild increases in transaminase, ALT below or equal to 3-fold ULN, were more frequently seen in teriflunomide-treated groups as compared to placebo. The frequency of elevations above 3-fold ULN and higher was balanced across treatment groups. These elevations in transaminase occurred mostly within the first 6 months of treatment and were reversible after treatment cessation. The recovery time varied between months and years.

##### *Blood pressure effects*

In placebo-controlled studies the following was established:

- systolic blood pressure was >140 mm Hg in 19.9% of patients receiving 14 mg/day teriflunomide as compared to 15.5% receiving placebo;
- systolic blood pressure was >160 mm Hg in 3.8% of patients receiving 14 mg/day teriflunomide as compared to 2.0% receiving placebo;
- diastolic blood pressure was >90 mm Hg in 21.4% of patients receiving 14 mg/day teriflunomide as compared to 13.6% receiving placebo.

##### *Infections*

In placebo-controlled studies, no increase in serious infections was observed with teriflunomide 14 mg (2.7%) as compared to placebo (2.2%). Serious opportunistic infections occurred in 0.2% of each group. Severe infections including sepsis, sometimes fatal have been reported postmarketing.

#### *Haematological effects*

A mean decrease affecting white blood cell (WBC) count (<15% from baseline levels, mainly neutrophil and lymphocytes decrease) was observed in placebo-controlled trials with AUBAGIO, although a greater decrease was observed in some patients. The decrease in mean count from baseline occurred during the first 6 weeks then stabilised over time while on-treatment but at decreased levels (less than a 15% decrease from baseline). The effect on red blood cell (RBC) (<2%) and platelet counts (<10%) was less pronounced.

#### *Peripheral neuropathy*

In placebo-controlled studies, peripheral neuropathy, including both polyneuropathy and mononeuropathy (e.g., carpal tunnel syndrome), was reported more frequently in patients taking teriflunomide than in patients taking placebo. In the pivotal, placebo-controlled studies, the incidence of peripheral neuropathy confirmed by nerve conduction studies was 1.9% (17 patients out of 898) on 14 mg of teriflunomide, compared with 0.4% (4 patients out of 898) on placebo. Treatment was discontinued in 5 patients with peripheral neuropathy on teriflunomide 14 mg. Recovery following treatment discontinuation was reported in 4 of these patients.

#### *Neoplasms benign, malignant and unspecified (incl. cysts and polyps)*

There does not appear to be an increased risk of malignancy with teriflunomide in the clinical trial experience. The risk of malignancy, particularly lymphoproliferative disorders, is increased with use of some other agents that affect the immune system (class effect).

#### *Severe skin reactions*

Cases of severe skin reactions have been reported with teriflunomide post-marketing (see section *Special warnings and precautions for use*).

#### *Asthenia*

In placebo-controlled studies, frequencies for asthenia were 2.0%, 1.6% and 2.2% in the placebo, teriflunomide 7 mg and teriflunomide 14 mg group, respectively

#### Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system.

### **Overdose**

#### Symptoms

There is no experience regarding teriflunomide overdose or intoxication in humans. Teriflunomide 70 mg daily was administered up to 14 days in healthy subjects. The adverse reactions were consistent with the safety profile for teriflunomide in MS patients.

#### Management

In the event of relevant overdose or toxicity, cholestyramine or activated charcoal is recommended to accelerate elimination. The recommended elimination procedure is cholestyramine 8 g three times a day for 11 days. If this is not well tolerated, cholestyramine 4 g three times a day for 11 days can be used. Alternatively, when cholestyramine is not available, activated charcoal 50 g twice a day for 11 days may also be used. In addition, if required for tolerability reasons, administration of cholestyramine or activated charcoal does not need to occur on consecutive days (see section *Pharmacokinetic properties*).

## **PHARMACOLOGICAL PROPERTIES**

### **Pharmacodynamic properties**

Pharmacotherapeutic group: Immunosuppressants, Selective immunosuppressants, ATC Code: L04AA31.

#### Mechanism of action

Teriflunomide is an immunomodulatory agent with anti-inflammatory properties that selectively and reversibly inhibits the mitochondrial enzyme dihydroorotate dehydrogenase (DHO-DH), which functionally connects with the respiratory chain. As a consequence of the inhibition, teriflunomide generally reduces the proliferation of dividing cells that depend on de novo synthesis of pyrimidine to expand. The exact mechanism by which teriflunomide exerts its therapeutic effect in MS is not fully understood, but this is mediated by a reduced number of T-lymphocytes.

#### Pharmacodynamic effects

##### *Immune system*

Effects on immune cell numbers in the blood: In the placebo-controlled studies, teriflunomide 14 mg once a day led to a mild mean reduction in lymphocyte count, of less than  $0.3 \times 10^9/l$ , which occurred over the first 3 months of treatment and levels were maintained until the end of the treatment.

##### *Potential to prolong the QT interval*

In a placebo-controlled thorough QT study performed in healthy subjects, teriflunomide at mean steady-state concentrations did not show any potential for prolonging the QTcF interval compared with placebo: the largest time matched mean difference between teriflunomide and placebo was 3.45 ms with the upper bound of the 90% CI being 6.45 ms.

##### *Effect on renal tubular functions*

In the placebo-controlled studies, mean decreases in serum uric acid at a range of 20 to 30% were observed in patients treated with teriflunomide compared to placebo. Mean decrease in serum phosphorus was around 10% in the teriflunomide group compared to placebo. These effects are considered to be related to increase in renal tubular excretion and not related to changes in glomerular functions.

#### Clinical efficacy and safety

The efficacy of AUBAGIO was demonstrated in two placebo controlled studies, the TEMSO and the TOWER study, that evaluated once daily doses of teriflunomide 7 mg and 14 mg in patients with RMS.

A total of 1088 patients with RMS were randomised in TEMSO to receive 7 mg (n=366) or 14 mg (n=359) of teriflunomide or placebo (n= 363) for 108 weeks duration. All patients had a definite diagnosis of MS (based on McDonald criteria (2001)), exhibited a relapsing clinical course, with or without progression, and experienced at least 1 relapse over the year preceding the trial or at least 2 relapses over the 2 years preceding the trial. At entry, patients had an Expanded Disability Status Scale (EDSS) score  $\leq 5.5$ .

The mean age of the study population was 37.9 years. The majority of patients had relapsing–remitting multiple sclerosis (91.5%), but a subgroup of patients had secondary progressive (4.7%) or progressive relapsing multiple sclerosis (3.9%). The mean number of relapses within the year before study inclusion was 1.4 with 36.2% of patients having gadolinium-enhancing lesions at baseline. The median EDSS score at baseline was 2.50; 249 patients (22.9%) had an EDSS score  $> 3.5$  at baseline. The mean duration of disease, since first symptoms, was 8.7 years. A majority of patients (73%) had not received disease-modifying therapy during the 2 years before study entry. The study results are shown in Table 1.

Long term follow-up results from TEMSO long term extension safety study (overall median treatment duration approximately 5 years, maximum treatment duration approximately 8.5 years) did not present any new or unexpected safety findings.

A total of 1169 patients with RMS were randomised in TOWER to receive 7 mg (n=408) or 14 mg (n=372) of teriflunomide or placebo (n= 389) for a variable treatment duration ending at 48 weeks after last patient randomised. All patients had a definite diagnosis of MS (based on McDonald criteria (2005)), exhibited a relapsing clinical course, with or without progression, and experienced at least 1 relapse over the year preceding the trial or at least 2 relapses over the 2 years preceding the trial. At entry, patients had an Expanded Disability Status Scale (EDSS) score  $\leq 5.5$ .

The mean age of the study population was 37.9 years. The majority of patients had relapsing–remitting multiple sclerosis (97.5%), but a subgroup of patients had secondary progressive (0.8%) or progressive relapsing multiple sclerosis (1.7%). The mean number of relapses within the year before study inclusion was 1.4. Gadolinium-enhancing lesions at baseline: no data. The median EDSS score at baseline was 2.50; 298 patients (25.5%) had an EDSS score > 3.5 at baseline. The mean duration of disease, since first symptoms, was 8.0 years. A majority of patients (67.2%) had not received disease-modifying therapy during the 2 years before study entry. The study results are shown in Table 1.

**Table 1 - Main Results (for the approved dose, ITT population)**

	TEMESO-study		TOWER-study	
	Teriflunomide 14 mg	Placebo	Teriflunomide 14 mg	Placebo
N	358	363	370	388
<b>Clinical Outcomes</b>				
Annualised relapse rate	0.37	0.54	0.32	0.50
<i>Risk difference (CI<sub>95%</sub>)</i>	-0.17 (-0.26, -0.08)***		-0.18 (-0.27, -0.09)****	
Relapse-free week 108	56.5%	45.6%	57.1%	46.8%
<i>Hazard ratio (CI<sub>95%</sub>)</i>	0.72, (0.58, 0.89)**		0.63, (0.50, 0.79)****	
3-month Sustained Disability Progression week 108	20.2%	27.3%	15.8%	19.7%
<i>Hazard ratio (CI<sub>95%</sub>)</i>	0.70 (0.51, 0.97)*		0.68 (0.47, 1.00)*	
6-month Sustained Disability Progression week 108	13.8%	18.7%	11.7%	11.9%
<i>Hazard ratio (CI<sub>95%</sub>)</i>	0.75 (0.50, 1.11)		0.84 (0.53, 1.33)	
<b>MRI endpoints</b>				
Change in BOD week 108 <sup>(1)</sup>	0.72	2.21	Not measured	
<i>Change relative to placebo</i>	67%***			
Mean Number of Gd-enhancing lesions at week 108	0.38	1.18		

<i>Change relative to placebo (CI<sub>95%</sub>)</i>	-0.80 (-1.20, -0.39) <sup>****</sup>	
Number of unique active lesions /scan	0.75	2.46
<i>Change relative to placebo (CI<sub>95%</sub>)</i>	69%, (59%; 77%) <sup>****</sup>	

\*\*\*\* p<0.0001 \*\*\* p<0.001 \*\* p<0.01 \* p<0.05 compared to placebo

(1) BOD: burden of disease: total lesion volume (T2 and T1 hypointense) in ml

Efficacy in patients with high disease activity:

A consistent treatment effect on relapses and time to 3-month sustained disability progression in a subgroup of patients in TEMSO (n= 127) with high disease activity was observed. Due to the design of the study, high disease activity was defined as 2 or more relapses in one year, and with one or more Gd-enhancing lesion on brain MRI. No similar subgroup analysis was performed in TOWER as no MRI data were obtained. No data are available in patients who have failed to respond to a full and adequate course (normally at least one year of treatment) of beta-interferon, having had at least 1 relapse in the previous year while on therapy, and at least 9 T2-hyperintense lesions in cranial MRI or at least 1 Gd-enhancing lesion, or patients having an unchanged or increased relapse rate in the prior year as compared to the previous 2 years.

TOPIC was a double-blind, placebo-controlled study that evaluated once daily doses of teriflunomide 7 mg and 14 mg for up to 108 weeks in patients with first clinical demyelinating event (mean age 32.1 years). The primary endpoint was time to a second clinical episode (relapse). A total of 618 patients were randomized to receive 7 mg (n=205) or 14 mg (n=216) of teriflunomide or placebo (n=197). The risk of a second clinical attack over two years was 35.9% in the placebo group and 24.0% in the teriflunomide 14 mg treatment group (hazard ratio: 0.57, 95% confidence interval: 0.38 to 0.87, p=0.0087). The results from the TOPIC study confirmed the efficacy of teriflunomide in RRMS (including early RRMS with first clinical demyelinating event and MRI lesions disseminated in time and space).

Teriflunomide effectiveness was compared to that of a subcutaneous interferon beta-1a (at the recommended dose of 44 µg three times a week) in 324 randomised patients in a study (TENERE) with minimum treatment duration of 48 weeks (maximum 114 weeks). The risk of failure (confirmed relapse or permanent treatment discontinuation whichever came first) was the primary endpoint. The number of patients with permanent treatment discontinuation in the teriflunomide 14 mg group was 22 out of 111 (19.8%), the reasons being adverse events (10.8%), lack of efficacy (3.6%), other reason (4.5%) and lost to follow-up (0.9%). The number of patients with permanent treatment discontinuation in the subcutaneous interferon beta-1a group was 30 out of 104 (28.8%), the reasons being adverse events (21.2%), lack of efficacy (1.9%), other reason (4.8%) and poor compliance to protocol (1%). Teriflunomide 14 mg/day was not superior to interferon beta-1a on the primary endpoint: the estimated percentage of patients with treatment failure at 96 weeks using the Kaplan-Meier method was 41.1% versus 44.4% (teriflunomide 14 mg versus interferon beta-1a group, p=0.595).

### Pharmacokinetic properties

#### Absorption

Median time to reach maximum plasma concentrations occurs between 1 to 4 hours post-dose following repeated oral administration of teriflunomide, with high bioavailability (approximately 100%).

Food does not have a clinically relevant effect on teriflunomide pharmacokinetics.

From the mean predicted pharmacokinetic parameters calculated from the population pharmacokinetic (PopPK) analysis using data from healthy volunteers and MS patients, there is a slow approach to steady-state concentration (i.e., approximately 100 days (3.5 months) to attain 95% of steady-state concentrations) and the estimated AUC accumulation ratio is approximately 34-fold.

#### Distribution

Teriflunomide is extensively bound to plasma protein (>99%), probably albumin and is mainly distributed in plasma. The volume of distribution is 11 l after a single intravenous (IV) administration. However, this is most likely an underestimation since extensive organ distribution was observed in rats.

#### Biotransformation

Teriflunomide is moderately metabolised and is the only component detected in plasma. The primary biotransformation pathway for teriflunomide is hydrolysis with oxidation being a minor pathway. Secondary pathways involve oxidation, N-acetylation and sulfate conjugation.

#### Elimination

Teriflunomide is excreted in the gastrointestinal tract mainly through the bile as unchanged medicinal product and most likely by direct secretion. Teriflunomide is a substrate of the efflux transporter BCRP, which could be involved in direct secretion. Over 21 days, 60.1% of the administered dose is excreted via feces (37.5%) and urine (22.6%). After the rapid elimination procedure with cholestyramine, an additional 23.1% was recovered (mostly in feces). Based on individual prediction of pharmacokinetic parameters using the PopPK model of teriflunomide in healthy volunteers and MS patients, median  $t_{1/2z}$  was approximately 19 days after repeated doses of 14 mg. After a single IV administration, the total body clearance of teriflunomide is 30.5 ml/h.

#### *Accelerated Elimination Procedure: Cholestyramine and activated charcoal*

The elimination of teriflunomide from the circulation can be accelerated by administration of cholestyramine or activated charcoal, presumably by interrupting the reabsorption processes at the intestinal level.

Teriflunomide concentrations measured during an 11-day procedure to accelerate teriflunomide elimination with either 8 g cholestyramine three times a day, 4 g cholestyramine three times a day or 50 g activated charcoal twice a day following cessation of teriflunomide treatment have shown that these regimens were effective in accelerating teriflunomide elimination, leading to more than 98% decrease in teriflunomide plasma concentrations, with cholestyramine being faster than charcoal. Following discontinuation of teriflunomide and the administration of cholestyramine 8 g three times a day, the plasma concentration of teriflunomide is reduced 52% at the end of day 1, 91% at the end of day 3, 99.2% at the end of day 7, and 99.9% at the completion of day 11. The choice between the 3 elimination procedures should depend on the patient's tolerability. If cholestyramine 8 g three times a day is not well-tolerated, cholestyramine 4 g three times a day can be used. Alternatively, activated charcoal may also be used (the 11 days do not need to be consecutive unless there is a need to lower teriflunomide plasma concentration rapidly).

#### Linearity/non-linearity

Systemic exposure increases in a dose proportional manner after oral administration teriflunomide from 7 to 14 mg.

#### Characteristics in specific groups of patients

##### *Gender, Elderly, Paediatric patients*

Several sources of intrinsic variability were identified in healthy subjects and MS patients based on the PopPK analysis: age, body weight, gender, race, and albumin and bilirubin levels. Nevertheless, their impact remains limited ( $\leq 31\%$ ).

##### *Hepatic impairment*

Mild and moderate hepatic impairment had no impact on the pharmacokinetic of teriflunomide. Therefore no dose adjustment is anticipated in mild and moderate hepatic-impaired patients. However, teriflunomide is contraindicated in patients with severe hepatic impairment (see sections *Posology and method of administration* and *Contraindications*).

### *Renal impairment*

Severe renal impairment had no impact on the pharmacokinetic of teriflunomide. Therefore no dose adjustment is anticipated in mild, moderate and severe renal-impaired patients.

### **Preclinical safety data**

Repeated oral administration of teriflunomide to mice, rats and dogs for up to 3, 6, and 12 months, respectively, revealed that the major targets of toxicity were the bone marrow, lymphoid organs, oral cavity/gastro intestinal tract, reproductive organs, and pancreas. Evidence of an oxidative effect on red blood cells was also observed. Anemia, decreased platelet counts and effects on the immune system, including leukopenia, lymphopenia and secondary infections, were related to the effects on the bone marrow and/or lymphoid organs. The majority of effects reflect the basic mode of action of the compound (inhibition of dividing cells). Animals are more sensitive to the pharmacology, and therefore toxicity, of teriflunomide than humans. As a result, toxicity in animals was found at exposures equivalent or below human therapeutic levels.

Teriflunomide was not mutagenic *in vitro* or clastogenic *in vivo*. Clastogenicity observed *in vitro* was considered to be an indirect effect related to nucleotide pool imbalance resulting from the pharmacology of DHO-DH inhibition. The minor metabolite TFMA (4-trifluoromethylaniline) caused mutagenicity and clastogenicity *in vitro* but not *in vivo*.

No evidence of carcinogenicity was observed in rats and mice.

Fertility was unaffected in rats despite adverse effects of teriflunomide on male reproductive organs, including reduced sperm count. There were no external malformations in the offspring of male rats administered teriflunomide prior to mating with untreated female rats. Teriflunomide was embryotoxic and teratogenic in rats and rabbits at doses in the human therapeutic range. Adverse effects on the offspring were also seen when teriflunomide was administered to pregnant rats during gestation and lactation. The risk of male-mediated embryo-fetal toxicity through teriflunomide treatment is considered low. The estimated female plasma exposure via the semen of a treated patient is expected to be 100 times lower than the plasma exposure after 14 mg of oral teriflunomide.

## **PHARMACEUTICAL PARTICULARS**

### **List of excipients**

#### Tablet core

lactose monohydrate  
maize starch  
microcrystalline cellulose  
sodium starch glycolate (Type A)  
hydroxypropylcellulose  
magnesium stearate

#### Tablet coating

hypromellose  
titanium dioxide (E171)  
talc  
macrogol 8000  
indigo carmine aluminum lake (E132)

### **Shelf life**

Please refer to expiry date on label.

### **Special precautions for storage**

Store below 30°C.

**Nature and contents of container**

Aluminium-aluminium blisters inserted in wallet (28 film-coated tablets) and packed in carton.  
Each wallet is placed in a protective sleeve.

**Manufacturer**

Sanofi Winthrop Industrie  
56 route de Choisy au Bac  
60205 Compiègne France

**Date of revision**

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