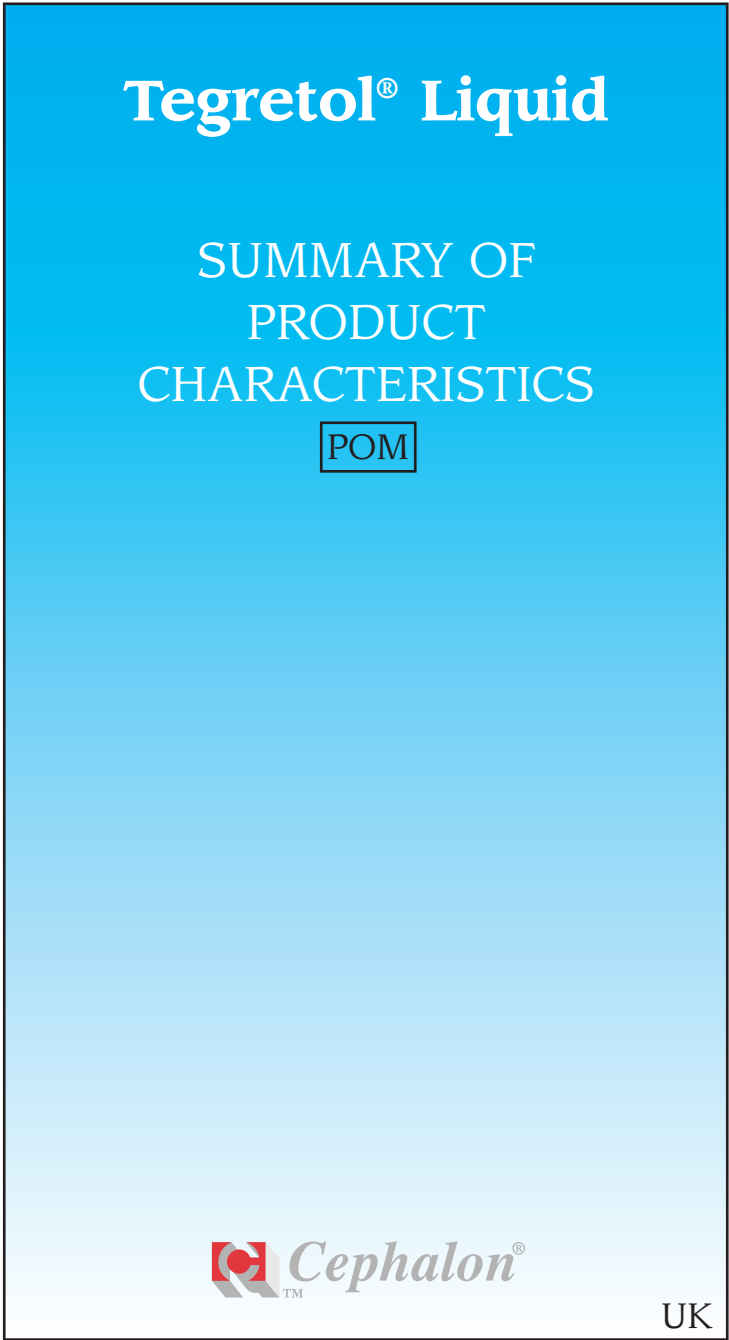


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407 Sep 2001



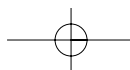
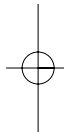
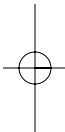
# Tegretol<sup>®</sup> Liquid

## SUMMARY OF PRODUCT CHARACTERISTICS

POM



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**1.  
Trade Name of the  
Medicinal Product**Tegretol<sup>®</sup> Liquid 100 mg/5 ml**2.  
Qualitative and  
Quantitative Composition**

The active ingredient is 5-Carbamoyl-5-H-dibenz(b,f)azepine.

The liquid contains 100 mg carbamazepine Ph.Eur. in each 5 ml.

**3. Pharmaceutical Form**

Tegretol Liquid is a white oral suspension.

**4.  
Clinical Particulars****4.1  
Therapeutic Indications**

Epilepsy - generalised tonic-clonic and partial seizures.

Note: Tegretol is not usually effective in absences (petit mal) and myoclonic seizures. Moreover, anecdotal evidence suggests that seizure exacerbation may occur in patients with atypical absences.

The paroxysmal pain of trigeminal neuralgia.

For the prophylaxis of manic-depressive psychosis in patients unresponsive to lithium therapy.

**4.2  
Posology and Method  
of Administration**

Tegretol Liquid is given orally, usually in two or three divided doses.

Tegretol Liquid (the liquid should be shaken before use) may be taken during, after or between meals.

Since a given dose of Tegretol Liquid will produce higher peak levels than the same dose in tablet form, it is advisable to start with low doses of the liquid and to increase them slowly so as to avoid adverse effects on the central nervous system such as dizziness and lethargy.

When switching a patient from tablets to liquid the same overall dose may be used but in smaller, more frequent, doses.

*Epilepsy:*

*Adults:* It is advised that with all formulations of Tegretol, a gradually increasing dosage scheme

is used and this should be adjusted to suit the needs of the individual patient. It may be helpful to monitor the plasma concentration of carbamazepine to establish the optimum dose (see **Pharmacokinetics, Precautions and Interactions**).

Tegretol should be taken in a number of divided doses although initially 100-200 mg once to twice daily is recommended. This may be followed by a slow increase until the best response is obtained, often 800-1200 mg daily. In some instances, 1600 mg or even 2000 mg daily may be necessary.

#### *Elderly:*

Due to the potential for drug interactions, the dosage of Tegretol should be selected with caution in elderly patients.

#### *Children:*

It is advised that with all formulations of Tegretol, a gradually increasing dosage scheme is used and this should be adjusted to suit the needs of the individual patient. It may be helpful to monitor the plasma concentration of carbamazepine to establish the optimum dose (see **Pharmacokinetics, Precautions and Interactions**).

Usual dosage 10-20 mg/kg bodyweight daily in several divided doses.

Age:	up to 1 year:	5-10 ml liquid per day
	1-5 years:	10-20 ml liquid per day
	5-10 years:	20-30 ml liquid per day to be taken in divided doses
	10-15 years:	30-50 ml liquid per day to be taken in several divided doses.

Wherever possible anti-epileptic agents should be prescribed as the sole drug anti-epileptic agent but, if used in polytherapy, the same incremental dosage pattern is advised.

When Tegretol is added to existing antiepileptic therapy, this should be done gradually while maintaining or, if necessary, adapting the dosage of the other antiepileptic(s) (see 4.5 **Interaction with other Medicaments and other forms of Interaction**).

#### *Trigeminal neuralgia:*

Slowly raise the initial dosage of 200-400 mg daily (100 mg twice daily in elderly patients) until freedom from pain is achieved (normally at 200 mg 3-4 times daily). In the majority of patients a dosage of 200 mg 3 or 4 times a day is sufficient to maintain a pain free state. In some instances, doses of 1600 mg Tegretol daily may be needed. However, once the pain is in remission, the dosage should be gradually reduced to the lowest possible maintenance level.

#### *For the prophylaxis of manic depressive psychosis in patients unresponsive to lithium therapy:*

Initial starting dose of 100-200 mg daily, in divided doses, increasing gradually until symptoms are controlled or a total of 1600 mg given in divided doses is reached. The usual dosage range is 400-600 mg daily, given in divided doses.

### **4.3 Contraindications**

Known hypersensitivity to carbamazepine or structurally related drugs (e.g. tricyclic antidepressants) or any other component of the formulation.

Patients with atrioventricular block, a history of bone marrow depression or a history of acute intermittent porphyria.

Because it is structurally related to tricyclic anti-depressants, the use of Tegretol is not recommended in combination with monoamine oxidase inhibitors (MAOIs); before administering Tegretol, MAOIs should be discontinued for a minimum of 2 weeks, or longer if the clinical situation permits.

### **4.4 Special Warnings and Precautions for Use**

#### **4.4.1 Warnings**

Agranulocytosis and aplastic anaemia have been associated with Tegretol; however, due to the very low incidence of these conditions, meaningful risk estimates for Tegretol are difficult to obtain. The overall risk in the general untreated population has been estimated at 4.7 persons per million per year for agranulocytosis and 2.0 persons per million per year for aplastic anaemia.

Decreased platelet or white blood cell counts occur occasionally to frequently in association with the use of Tegretol. Nonetheless, complete pre-treatment blood counts, including platelets and possibly reticulocytes and serum iron, should be obtained as a baseline, and periodically thereafter.

Patients and their relatives should be made aware of early toxic signs and symptoms indicative of a potential haematological problem, as well as symptoms of dermatological or hepatic reactions. If reactions such as fever, sore throat, rash, ulcers in the mouth, easy bruising, petechial or purpuric haemorrhage appear, the patient should be advised to consult his physician immediately.

If the white blood cell or platelet count is definitely low or decreased during treatment, the patient and the complete blood count should be closely monitored (see Section 4.8 Undesirable Effects). However, treatment with Tegretol should be discontinued if the patient develops leucopenia which is severe, progressive or accompanied by clinical manifestations, e.g. fever or sore throat. Tegretol should be discontinued if any evidence of significant bone marrow depression appears.

Liver function tests should also be performed before commencing treatment and periodically thereafter, particularly in patients with a history of liver disease and in elderly patients. The drug should be withdrawn immediately in cases of aggravated liver dysfunction or acute liver disease.

Some liver function tests in patients receiving carbamazepine may be found to be abnormal, particularly gamma glutamyl transferase. This is probably due to hepatic enzyme induction. Enzyme induction may also produce modest elevations in alkaline phosphatase. These enhancements of hepatic metabolising capacity are not an indication for the withdrawal of carbamazepine.

Severe hepatic reactions to carbamazepine occur very rarely. The development of signs and symptoms of liver dysfunction or active liver disease should be urgently evaluated and treatment with Tegretol suspended pending the outcome of the evaluation.

Mild skin reactions e.g. isolated macular or maculopapular exanthemata, are mostly transient and not hazardous, and they usually

disappear within a few days or weeks, either during the continued course of treatment or following a decrease in dosage; however, the patient should be kept under close surveillance and a worsening rash or accompanying symptoms are an indication for the immediate withdrawal of Tegretol.

If signs and symptoms suggestive of severe skin reactions (e.g. Stevens-Johnson syndrome, Lyell's syndrome (toxic epidermal necrolysis)) appear, Tegretol should be withdrawn at once.

Tegretol should be used with caution in patients with mixed seizures which include absences, either typical or atypical. In all these conditions, Tegretol may exacerbate seizures. In case of exacerbation of seizures, Tegretol should be discontinued.

An increase in seizure frequency may occur during switchover from an oral formulation to suppositories.

***Abrupt withdrawal of Tegretol may precipitate seizures:***

If treatment with Tegretol has to be withdrawn abruptly, the changeover to another anti-epileptic drug should, if necessary, be effected under the cover of a suitable drug (e.g. diazepam i.v., rectal; or phenytoin i.v.).

Isolated reports of impaired male fertility and/or abnormal spermatogenesis are on file. A causal relationship has not been established.

***Tegretol and oral contraception:***

The induction of hepatic enzymes by carbamazepine may reduce the activity of the hormones contained in the combined oral contraceptive pill. This may appear clinically as breakthrough bleeding or spotting. Patients taking Tegretol and requiring oral contraception should receive a preparation containing not less than 50 mcg oestrogen or use of some alternative non-hormonal method of contraception should be considered.

Although correlations between dosages and plasma levels of carbamazepine, and between plasma levels and clinical efficacy or tolerability are rather tenuous, monitoring of the plasma levels may be useful in the following conditions: dramatic increase in seizure, frequency/verification of patient compliance; during pregnancy; when treating children or adolescents; in suspected absorption disorders; in suspected toxicity when more than one drug

is being used (see 4.5 **Interaction with other Medicaments and other forms of Interaction**).

There have been a few cases of neonatal seizures and/or respiratory depression associated with maternal Tegretol and other concomitant anticonvulsant drug use. A few cases of neonatal vomiting, diarrhoea and/or decreased feeding have also been reported in association with maternal Tegretol use. These reactions may represent a neonatal withdrawal syndrome.

#### 4.4.2 Precautions

Tegretol should be prescribed only after a critical benefit-risk appraisal and under close monitoring in patients with a history of cardiac, hepatic or renal damage, adverse haematological reactions to other drugs, or interrupted courses of therapy with Tegretol.

Baseline and periodic complete urinalysis and BUN determinations are recommended.

Tegretol has shown mild anticholinergic activity; patients with increased intraocular pressure should therefore be warned and advised regarding possible hazards.

The possibility of activation of a latent psychosis, and in elderly patients the possibility of agitation or confusion, especially when high doses of Tegretol are administered, should be borne in mind.

#### 4.5 Interactions with other Medicaments and other forms of Interaction

Cytochrome P450 3A4 (CYP 3A4) is the main enzyme catalysing formation of carbamazepine 10, 11-epoxide. Co-administration of inhibitors of CYP 3A4 may result in increased plasma concentrations which could induce adverse reactions. Co-administration of CYP 3A4 inducers might increase the rate of Tegretol metabolism, thus leading to a potential decrease in carbamazepine serum level and potential decrease in the therapeutic effect.

##### **Agents that may raise Tegretol plasma levels:**

Isoniazid, verapamil, diltiazem, ritonavir, dextropropoxyphene, viloxazine, fluoxetine, fluvoxamine, possibly cimetidine, acetazolamide, danazol, nicotinamide (in adults, only in high dosage), nefazodone, macrolide antibiotics (e.g. erythromycin, clarithromycin), azoles

(e.g. itraconazole, ketoconazole, fluconazole), terfenadine, loratadine. Since raised plasma carbamazepine levels may result in adverse reactions (e.g. dizziness, drowsiness, ataxia, diplopia), the dosage of Tegretol should be adjusted accordingly and/or the plasma levels monitored.

##### **Agents that may decrease Tegretol plasma levels:**

Phenobarbitone, phenytoin, primidone, or theophylline, rifampicin, cisplatin or doxorubicin and, although the data are partly contradictory, possibly also clonazepam or valproic acid. Mefloquine may antagonise the anticonvulsant effect of Tegretol. On the other hand, valproic acid and primidone have been reported to raise the plasma level of the pharmacologically active carbamazepine 10, 11-epoxide metabolite. The dose of Tegretol may consequently have to be adjusted.

Isotretinoin has been reported to alter the bioavailability and/or clearance of carbamazepine and carbamazepine 10, 11-epoxide; carbamazepine plasma concentrations should be monitored.

Serum levels of carbamazepine can be reduced by concomitant use of the herbal remedy St John's wort (*Hypericum perforatum*).

##### **Effect of Tegretol on plasma levels of concomitant agents:**

Carbamazepine may lower the plasma level, diminish or even abolish the activity of certain drugs. The dosage of the following drugs may have to be adjusted to clinical requirement: levothyroxine, clobazam, clonazepam, ethosuximide, primidone, valproic acid, alprazolam, corticosteroids, (e.g. prednisolone, dexamethasone); cyclosporin, digoxin, doxycycline; dihydropyridine derivatives, e.g. felodipine and isradipine; indinavir, saquinavir, ritonavir, haloperidol, imipramine, methadone, tramadol, oral contraceptives (alternative contraceptive methods should be considered) see Section 4.4 "Special Warnings and Precautions for Use", gestrinone, tibolone, toremifene, theophylline, oral anticoagulants (warfarin), lamotrigine, tiagabine, topiramate, tricyclic antidepressants (e.g. imipramine, amitriptyline, nortriptyline, clomipramine), clozapine, olanzapine and risperidone.

Plasma phenytoin levels have been reported both to be raised and to be lowered by carbamazepine, and plasma mephenytoin levels have been reported in rare instances to increase.

**Combinations to be taken into consideration:**

Co-administration of carbamazepine and paracetamol may reduce the bioavailability of paracetamol/acetaminophen.

Concomitant use of carbamazepine and isoniazid has been reported to increase isoniazid-induced hepatotoxicity.

The combination of lithium and carbamazepine may cause enhanced neurotoxicity in spite of lithium plasma concentrations being within the therapeutic range.

Combined use of carbamazepine with metoclopramide or major tranquilisers e.g. haloperidol, thioridazine may also result in an increase in neurological side-effects.

Because it (carbamazepine) is structurally related to tricyclic anti-depressants, the use of Tegretol is not recommended in combination with monoamine oxidase inhibitors (MAOIs); before administering Tegretol, MAOIs should be discontinued for a minimum of 2 weeks, or longer if the clinical situation permits.

Concomitant medication with Tegretol and some diuretics (hydrochlorothiazide, frusemide) may lead to symptomatic hyponatraemia.

Carbamazepine may antagonise the effects of non-depolarising muscle relaxants (e.g. pancuronium); their dosage should be raised and patients monitored closely for a more rapid recovery from neuromuscular blockade than expected.

Tegretol, like other psychoactive drugs, may reduce alcohol tolerance; it is therefore advisable for the patient to abstain from alcohol.

#### 4.6 Pregnancy and Lactation

In animals (mice, rats and rabbits) oral administration of carbamazepine during organogenesis led to increased embryo mortality at daily doses which caused maternal toxicity (above 200 mg/kg b.w. daily i.e. 20 times the usual human dosage). In the rat there was also some evidence of abortion at 300 mg/kg b.w. daily. Near-term rat fetuses showed growth retardation, again at maternally toxic doses. No evidence of a teratogenic effect was observed in the three species tested, but in one study using mice, carbamazepine (40-240 mg/kg b.w. daily orally) caused defects (mainly dilatation of cerebral ventricles) in 4.7% of exposed fetuses compared with 1.3% in controls.

Pregnant women with epilepsy should be treated with special care.

In women of childbearing age Tegretol should, wherever possible, be prescribed as monotherapy, because the incidence of congenital abnormalities in the offspring of women treated with a combination of antiepileptic drugs is greater than in those of mothers receiving the individual drugs as monotherapy.

If pregnancy occurs in a woman receiving Tegretol, or if the problem of initiating treatment with Tegretol arises during pregnancy, the drug's potential benefits must be carefully weighed against its possible hazards, particularly in the first three months of pregnancy. Minimum effective doses should be given and monitoring of plasma levels is recommended.

Offspring of epileptic mothers with untreated epilepsy are known to be more prone to developmental disorders, including malformations. The possibility that carbamazepine, like all major antiepileptic drugs, increases the risk has been reported, although conclusive evidence from controlled studies with carbamazepine monotherapy is lacking. However, there are reports on developmental disorders and malformations, including spina bifida, in association with Tegretol. Patients should be counselled regarding the possibility of an increased risk of malformations and given the opportunity of antenatal screening.

Folic acid deficiency is known to occur in pregnancy. Antiepileptic drugs have been reported to aggravate deficiency. This deficiency may contribute to the increased incidence of birth defects in the offspring of treated epileptic women. Folic acid supplementation has therefore been recommended before and during pregnancy.

Vitamin K<sub>1</sub> to be given to the mother during the last weeks of pregnancy as well as to the newborn to prevent bleeding disorders in the offspring, has also been recommended.

**Use during lactation:**

Carbamazepine passes into the breast milk (about 25-60% of the plasma concentrations). The benefits of breast-feeding should be weighed against the remote possibility of adverse effects occurring in the infant. Mothers taking Tegretol may breast-feed their infants, provided the infant is observed for possible

adverse reactions (e.g. excessive somnolence, allergic skin reaction).

#### 4.7 Effects on Ability to Drive and Use Machines

The patient's ability to react may be impaired by dizziness and drowsiness caused by Tegretol, especially at the start of treatment or in connection with dose adjustments; patients should therefore exercise due caution when driving a vehicle or operating machinery.

#### 4.8 Undesirable Effects

Particularly at the start of treatment with Tegretol, or if the initial dosage is too high, or when treating elderly patients, certain types of adverse reaction occur very commonly or commonly, e.g. CNS adverse reactions (dizziness, headache, ataxia, drowsiness, fatigue, diplopia); gastrointestinal disturbances (nausea, vomiting), as well as allergic skin reactions.

The dose-related adverse reactions usually abate within a few days, either spontaneously or after a transient dosage reduction. The occurrence of CNS adverse reactions may be a manifestation of relative overdosage or significant fluctuation in plasma levels. In such cases it is advisable to monitor the plasma levels and divide the daily dosage into small (i.e. 3-4) fractional doses.

*Frequency estimate:* very common  $\geq 10\%$ , common  $\geq 1\%$  to  $< 10\%$ ; uncommon  $\geq 0.1\%$  to  $< 1\%$ ; rare  $\geq 0.01\%$  to  $< 0.1\%$ ; very rare  $< 0.01\%$

##### **Central nervous system:**

Neurological:

*Very common:*

Dizziness, ataxia, drowsiness, fatigue.

*Common:*

Headache, diplopia, accommodation disorders (e.g. blurred vision).

*Uncommon:*

Abnormal involuntary movements (e.g. tremor, asterixis, dystonia, tics); nystagmus.

*Rare:*

Orofacial dyskinesia, oculomotor disturbances, speech disorders (e.g. dysarthria or slurred speech), choreoathetotic disorders, peripheral neuritis, paraesthesia, muscle weakness, and parietic symptoms.

Cases of neuroleptic malignant syndrome have been reported. The causative role of carbamazepine in inducing or contributing to the development of a neuromalignant syndrome,

especially in conjunction with neuroleptics, is unclear.

##### **Psychiatric:**

*Rare:*

Hallucinations (visual or acoustic), depression, loss of appetite, restlessness, aggressive behaviour, agitation, confusion.

*Very rare:*

Activation of psychosis.

##### **Skin and appendages:**

*Very common:*

Allergic skin reactions, urticaria, which may be severe.

*Uncommon:*

Exfoliative dermatitis and erythroderma.

*Rare:*

Lupus erythematosus-like syndrome, pruritus.

*Very rare:*

Stevens-Johnson syndrome, toxic epidermal necrolysis, photosensitivity, erythema multiforme and nodosum, alterations in skin pigmentation, purpura, acne, sweating, hair loss.

Very rare cases of hirsutism have been reported, but the causal relationship is not clear.

##### **Blood:**

*Very common:*

Leucopenia.

*Common:*

Thrombocytopenia, eosinophilia.

*Rare:*

Leucocytosis, lymphadenopathy, folic acid deficiency.

*Very rare:*

Agranulocytosis, aplastic anaemia, pure red cell aplasia, megaloblastic anaemia, acute intermittent porphyria, reticulocytosis, and possibly haemolytic anaemia.

##### **Liver:**

*Very common:*

Elevated gamma-GT (due to hepatic enzyme induction), usually not clinically relevant.

*Common:*

Elevated alkaline phosphatase.

*Uncommon:*

Elevated transaminases.

*Rare:*

Hepatitis of cholestatic, parenchymal (hepatocellular) or mixed type, jaundice.

*Very rare:*

Granulomatous hepatitis.

##### **Gastro-intestinal tract:**

*Very common:*

Nausea, vomiting.

*Common:*

Dryness of the mouth. With suppositories rectal irritation may occur.

*Uncommon:*

Diarrhoea or constipation.

*Rare:*

Abdominal pain.

*Very rare:*

Glossitis, stomatitis, pancreatitis.

**Hypersensitivity reactions:***Rare:*

A delayed multi-organ hypersensitivity disorder with fever, skin rashes, vasculitis, lymphadenopathy, disorders mimicking lymphoma, arthralgia, leucopenia, eosinophilia, hepato-splenomegaly and abnormal liver function tests, occurring in various combinations. Other organs may also be affected (e.g. liver, lungs, kidneys, pancreas, myocardium, colon).

*Very rare:*

Aseptic meningitis, with myoclonus and peripheral eosinophilia; anaphylactic reaction, angioedema.

Treatment must be discontinued immediately if such hypersensitivity reactions occur.

**Cardiovascular system:***Rare:*

Disturbances of cardiac conduction, hypertension or hypotension.

*Very rare:*

Bradycardia, arrhythmias, AV-block with syncope, collapse, congestive heart failure, aggravation of coronary artery disease, thrombophlebitis, thrombo-embolism.

**Endocrine system and metabolism:***Common:*

Oedema, fluid retention, weight increase, hyponatraemia and reduced plasma osmolality due to an antidiuretic hormone (ADH)-like effect, leading in rare cases to water intoxication accompanied by lethargy, vomiting, headache, mental confusion, neurological abnormalities.

*Very rare:*

Increase in prolactin with or without clinical symptoms such as galactorrhoea, gynaecomastia, abnormal thyroid function tests; decreased l-thyroxine (FT<sub>4</sub>, T<sub>4</sub>, T<sub>3</sub>) and increased TSH, usually without clinical manifestations, disturbances of bone metabolism (decrease in plasma calcium and 25-OH-cholecalciferol), leading to osteomalacia, elevated levels of cholesterol, including HDL cholesterol and triglycerides.

**4.9  
Overdose****Urogenital system:***Very rare:*

Interstitial nephritis, renal failure, renal dysfunction (e.g. albuminuria, haematuria, oliguria and elevated BUN/ azotaemia), urinary frequency, urinary retention, sexual disturbances/impotence.

**Sense organs:***Very rare:*

Taste disturbances; lens opacities, conjunctivitis, hearing disorders, e.g. tinnitus, hyperacusis, hypoacusis, change in pitch perception.

**Musculoskeletal system:***Very rare:*

Arthralgia, muscle pain or cramp.

**Respiratory tract:***Very rare:*

Pulmonary hypersensitivity characterised e.g. by fever, dyspnoea, pneumonitis or pneumonia.

**Signs and symptoms**

The presenting signs and symptoms of overdose involve the central nervous, cardiovascular or respiratory systems.

*Central nervous system:* CNS depression; disorientation, somnolence, agitation, hallucination, coma; blurred vision, slurred speech, dysarthria, nystagmus, ataxia, dyskinesia, initially hyperreflexia, later hyporeflexia; convulsions, psychomotor disturbances, myoclonus, hypothermia, mydriasis.

*Respiratory system:*

Respiratory depression, pulmonary oedema.

*Cardiovascular system:*

Tachycardia, hypotension and at times hypertension, conduction disturbance with widening of QRS complex; syncope in association with cardiac arrest.

*Gastro-intestinal system:*

Vomiting, delayed gastric emptying, reduced bowel motility.

*Renal function:*

Retention of urine, oliguria or anuria; fluid retention, water intoxication due to ADH-like effect of carbamazepine.

*Laboratory findings:*

Hyponatraemia, possibly metabolic acidosis, possibly hyperglycaemia, increased muscle creatinine phosphokinase.

**Treatment**

There is no specific antidote.

Management should initially be guided by the patient's clinical condition; admission to hospital. Measurement of the plasma level to confirm carbamazepine poisoning and to ascertain the size of the overdose.

Evacuation of the stomach, gastric lavage, and administration of activated charcoal. Delay in evacuating the stomach may result in delayed absorption, leading to relapse during recovery from intoxication. Supportive medical care in an intensive care unit with cardiac monitoring and careful correction of electrolyte imbalance.

*Special recommendations**Hypotension:*

Administer dopamine or dobutamine i.v.

*Disturbances of cardiac rhythm:*

To be handled on an individual basis.

*Convulsions:*

Administer a benzodiazepine (e.g. diazepam) or another anticonvulsant, e.g. phenobarbitone (with caution because of increased respiratory depression) or paraldehyde.

*Hyponatraemia (water intoxication):* Fluid restriction and slow and careful NaCl 0.9% infusion i.v. These measures may be useful in preventing brain damage.

Charcoal haemoperfusion has been recommended. Forced diuresis, haemodialysis, and peritoneal dialysis have been reported not to be effective.

Relapse and aggravation of symptomatology on the 2nd and 3rd day after overdose, due to delayed absorption, should be anticipated.

## 5. Pharmacological Properties

### 5.1 Pharmacodynamic Properties

Therapeutic class: Anti-epileptic, neurotropic and psychotropic agent; (ATC Code: N03 AX 1). Dibenzazepine derivative.

As an antiepileptic agent its spectrum of activity embraces: partial seizures (simple and complex) with and without secondary generalisation; generalised tonic-clonic seizures, as well as combinations of these types of seizures.

The mechanism of action of carbamazepine, the active substance of Tegretol, has only been partially elucidated. Carbamazepine stabilises hyperexcited nerve membranes, inhibits repetitive neuronal discharges, and reduces synaptic propagation of excitatory impulses. It is conceivable that prevention of repetitive firing of sodium-dependent action potentials in depolarised neurons via use- and voltage-dependent blockade of sodium channels may be its main mechanism of action.

Whereas reduction of glutamate release and stabilisation of neuronal membranes may account for the antiepileptic effects, the depressant effect on dopamine and noradrenaline turnover could be responsible for the antimanic properties of carbamazepine.

### 5.2 Pharmacokinetic Properties

*Absorption*

Carbamazepine is absorbed almost completely but relatively slowly from the tablets. The conventional tablets yield mean peak plasma concentrations of the unchanged substance within 12 hours (chewable tablets 6 hours; liquid 2 hours) following single oral doses. With respect to the amount of active substance absorbed, there is no clinically relevant difference between the oral dosage forms. After a single oral dose of 400 mg carbamazepine (tablets) the mean peak concentration of unchanged carbamazepine in the plasma is approx. 4.5 mcg/ml.

The bioavailability of Tegretol in various oral formulations has been shown to lie between 85-100%.

Ingestion of food has no significant influence on the rate and extent of absorption, regardless of the dosage form of Tegretol.

Steady-state plasma concentrations of carbamazepine are attained within about 1-2 weeks, depending individually upon auto-induction by carbamazepine and hetero-induction by other enzyme-inducing drugs, as well as on pre-treatment status, dosage, and duration of treatment.

Different preparations of carbamazepine may vary in bioavailability; to avoid reduced effect or risk of breakthrough seizures or excessive side effects, it may be prudent to avoid changing the formulation.

#### *Distribution*

Carbamazepine is bound to serum proteins to the extent of 70-80%. The concentration of unchanged substance in cerebrospinal fluid and saliva reflects the non-protein bound portion in plasma (20-30%). Concentrations in breast milk were found to be equivalent to 25-60% of the corresponding plasma levels.

Carbamazepine crosses the placental barrier.

Assuming complete absorption of carbamazepine, the apparent volume of distribution ranges from 0.8 to 1.9 L/kg.

#### *Elimination*

The elimination half-life of unchanged carbamazepine averages approx. 36 hours following a single oral dose, whereas after repeated administration it averages only 16-24 hours (auto-induction of the hepatic monooxygenase system), depending on the duration of the medication. In patients receiving concomitant treatment with other enzyme-inducing drugs (e.g. phenytoin, phenobarbitone), half-life values averaging 9-10 hours have been found.

The mean elimination half-life of the 10, 11-epoxide metabolite in the plasma is about 6 hours following single oral doses of the epoxide itself.

After administration of a single oral dose of 400 mg carbamazepine, 72% is excreted in the urine and 28% in the faeces. In the urine, about 2% of the dose is recovered as unchanged drug and about 1% as the pharmacologically active 10, 11-epoxide metabolite. Carbamazepine is metabolised in the liver, where the epoxide pathway of biotransformation is the most important one, yielding the 10, 11-transdiol derivative and its glucuronide as the main metabolites.

Cytochrome P450 3A4 has been identified as the major isoform responsible for the formation of carbamazepine 10, 11-epoxide from carbamazepine. 9-Hydroxy-methyl-10-carbamoyl acridan is a minor metabolite related to this pathway. After a single oral dose of carbamazepine about 30% appears in the urine as end-products of the epoxide pathway.

Other important biotransformation pathways for carbamazepine lead to various monohydroxylated compounds, as well as to the N-glucuronide of carbamazepine.

#### *Characteristics in patients*

The steady-state plasma concentrations of carbamazepine considered as "therapeutic range" vary considerably inter-individually; for the majority of patients a range between 4-12 mcg/ml corresponding to 17-50 µmol/l has been reported. Concentrations of carbamazepine 10, 11-epoxide (pharmacologically active metabolite): About 30% of carbamazepine levels.

Owing to enhanced carbamazepine elimination, children may require higher doses of carbamazepine (in mg/kg) than adults to maintain therapeutic concentrations.

There is no indication of altered pharmacokinetics of carbamazepine in elderly patients as compared with young adults.

No data are available on the pharmacokinetics of carbamazepine in patients with impaired hepatic or renal function.

### **5.3 Preclinical Safety Data**

In rats treated with carbamazepine for two years, the incidence of tumours of the liver was found to be increased. The significance of these findings relative to the use of carbamazepine in humans is, at present, unknown. Bacterial and mammalian mutagenicity studies yielded negative results.

## **6. Pharmaceutical Particulars**

### **6.1 List of Excipients**

Cremophor S9, Avicel RC581, sorbitol solution 70%, saccharin sodium, Natrosol 250g, methyl hydroxybenzoate, propyl hydroxybenzoate, sorbic acid, propylene glycol, caramel flavour 52.929A (E150), purified water.

### **6.2 Incompatibilities**

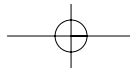
None known

### **6.3 Shelf Life**

Five years

### **6.4 Special Precautions for Storage**

Protect from heat (store below 25°C). Keep container tightly closed.



**6.5  
Nature and Contents  
of Container**

Tegretol Liquid comes in a 300 ml amber glass bottle with either a conventional cap, child resistant/tamper evident cap, tamper evident cap or child resistant cap.

**6.6  
Instructions for  
Use/Handling**

None

**Administrative Data**

**7.  
Marketing Authorisation  
Holder**

Novartis Pharmaceuticals UK Limited  
Trading as Geigy Pharmaceuticals  
Frimley Business Park  
Frimley  
Camberley  
Surrey  
GU16 7SR  
England.

**8.  
Marketing Authorisation  
Number**

PL 00101/0456

**9.  
Date Of First Authorisation/  
Renewal of Authorisation**

4 July 1997

**10.  
Date of (Partial) Revision  
of the Text**

March 2001

