

# NEW ZEALAND DATA SHEET

## 1 PRODUCT NAME

Epilim IV powder for injection with diluent, 100 mg/mL

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Epilim IV powder for injection with diluent - each pack contains one glass vial of 400 mg sodium valproate freeze-dried powder and one glass ampoule containing 4 mL of solvent (Water for Injections).

For the full list of excipients, see Section 6.1 List of Excipients.

## 3 PHARMACEUTICAL FORM

Powder 400 mg and solvent 4 mL for solution for injection.

## 4 CLINICAL PARTICULARS

### 4.1 THERAPEUTIC INDICATIONS

#### ***Epilepsy***

Primary generalised epilepsy (petit mal absences, various forms of myoclonic epilepsy and tonic-clonic grand mal seizures). Partial (focal) epilepsy either alone or as adjuvant therapy. In women of child bearing potential effective contraception must also be prescribed.

#### ***Bipolar Disorder***

For the treatment of manic episodes, maintenance and prophylactic treatment of bipolar disorder when other treatments have failed. In women of child bearing potential effective contraception must also be prescribed. The safety and efficacy of sodium valproate for the treatment of manic episodes in bipolar disorder have not been evaluated in patients aged less than 18 years.

#### ***Epilim IV***

The treatment of patients with epilepsy or bipolar disorder, who would normally be maintained on oral sodium valproate/valproic acid, and for whom oral therapy is temporarily not possible.

## 4.2 DOSE AND METHOD OF ADMINISTRATION

### *Epilim IV - epilepsy and bipolar disorder*

Epilim IV may be given by direct slow intravenous injection or by slow intravenous infusion in 0.9% NaCL (normal saline), 5% glucose solution or glucose saline, using a separate intravenous line. The recommended concentration of the intravenous infusion solution is 4 mg/mL, with 8 mg/mL being the maximum concentration.

Epilim IV should not be administered at the same time as other intravenous additives via the same IV line. The intravenous solution is suitable for infusion by PVC, polyethylene or glass containers.

To reconstitute, inject the solvent provided (4mL) into the vial, allow to dissolve and extract the appropriate dose. Due to displacement of solvent by sodium valproate the concentration of reconstituted sodium valproate is 95mg/mL. Epilim IV should be replaced by oral Epilim therapy as soon as practicable.

Each ampoule of Epilim IV is for single dose injection only. To reduce microbiological hazard, use as soon as practicable after reconstitution. If storage is necessary hold at 2 to 8°C for not more than 24 hours. Epilim IV is intended for use in one patient on one occasion only, any unused portion should be discarded. **NEVER ADMINISTER EPILIM IV OTHER THAN BY THE INTRAVENOUS ROUTE** (see Section 4.3 Contraindications).

### Monotherapy

Daily dosage requirements vary according to age and body weight:

#### Adults

Patients already satisfactorily treated with Epilim may be continued at their current dosage using continuous infusion. For example, a patient stabilised on 25 mg/kg administered daily should be continued with an infusion at the rate of 1 mg/kg/hr.

Other patients may be given a slow intravenous injection over 3-5 minutes, usually 400-800 mg depending on body weight (up to 10 mg/kg) followed by continuous infusion of 1-2 mg/kg/hr up to a maximum of 2500 mg/day, according to the patient's clinical response.

#### Children

The daily requirement for children is usually in the range 20-30 mg/kg/day and method of administration is as above. Where adequate control is not achieved within this range the dose may be increased up to 40 mg/kg/day but only in patients in whom plasma valproic acid levels can be monitored. Above 40 mg/kg/day clinical chemistry and haematological parameters should be monitored.

## **Special Populations**

### Female children, women of childbearing potential and pregnant women

Treatment must be initiated and supervised by a specialist experienced in the management of epilepsy or bipolar disorder. Valproate should not be used in female children and women of childbearing potential unless other treatments are ineffective or not tolerated (see Section 4.3 Contraindications, Section 4.4 Special Warnings and Precautions for Use, and Section 4.6 Fertility, Pregnancy and Lactation)

In the exceptional circumstances when valproate is the only treatment option during pregnancy in epileptic women, valproate should preferably be prescribed as monotherapy, at the lowest effective dose.

The daily dose of non-prolonged release formulations should be divided into at least two single doses during pregnancy.

### Use in renal impairment

Lower doses may be required since free drug levels may be high owing to lowered serum albumin and poor urinary excretion of free drug metabolites (see Section 4.4 Special Warnings and Precautions for Use). Dosage should be adjusted according to clinical monitoring since monitoring of plasma concentrations may be misleading (see Section 5.2 Pharmacokinetic Properties).

### Use in elderly

Although the pharmacokinetics of Epilim are modified in the elderly, they have limited clinical significance and dosage should be determined by seizure control and/or control of symptoms. The volume of distribution is increased in the elderly and because of decreased binding to serum albumin, the proportion of free drug is increased. This will affect the clinical interpretation of plasma valproic acid levels.

### **Paediatric population**

Use in children and adolescents: The safety and efficacy of sodium valproate/valproic acid for the treatment of manic episodes in bipolar disorder have not been evaluated in patients aged less than 18 years.

### **Combined Therapy**

When starting Epilim in patients on other anticonvulsants, these should be tapered slowly: initiation of Epilim therapy should then be gradual, with target dose being reached after about 2 weeks. In certain cases it may be necessary to raise the dose by 5 to 10 mg/kg/day when used in combination with anticonvulsants, which induce liver enzyme activity, e.g. phenytoin, phenobarbital and carbamazepine. Once known enzyme inducers have been withdrawn it may be

possible to maintain seizure control on a reduced dose of Epilim. When barbiturates are being administered concomitantly, the dosage of barbiturate should be reduced if sedation is observed.

### **4.3 CONTRAINDICATIONS**

Epilim is contraindicated in the following situations:

#### ***Treatment of epilepsy***

- In pregnancy unless there is no suitable alternative treatment (see Section 4.4 Special Warnings and Precautions for Use and Section 4.6 Fertility, Pregnancy and Lactation)
- In women of childbearing potential, unless the physician has provided information in regards to the potential effects of valproate during pregnancy and recommendations on the use of valproate

#### ***Treatment of bipolar disorder***

- In pregnancy (see Section 4.4 Special Warnings and Precautions for Use and Section 4.6 Fertility, Pregnancy and Lactation)
- In women of childbearing potential, unless the physician has provided information in regards to the potential effects of valproate during pregnancy and recommendations on the use of valproate

#### ***All Indications***

Known hypersensitivity to sodium valproate/valproic acid or any of the excipients listed in Section 6.1 List of Excipients.

Pre-existing, acute or chronic hepatic dysfunction or family history of severe hepatitis, particularly medicine related.

Known systemic primary carnitine deficiency with uncorrected hypocarnitinemia (see Section 4.4 Special Warnings and Precautions for Use).

Known urea cycle disorders (see Section 4.4 Special Warnings and Precautions for Use).

Known hepatic porphyria.

Patients known to have mitochondrial disorders caused by mutations in the nuclear gene encoding mitochondrial enzyme polymerase  $\gamma$  (POLG eg Alpers-Huttenlocher Syndrome) and in children under two years of age who are suspected of having POLG-related disorder.

Epilim IV should not be injected intramuscularly as it may produce tissue necrosis.

#### 4.4 SPECIAL WARNINGS AND PRECAUTIONS FOR USE

##### ***Pregnancy and Women of Childbearing Potential***

Valproate has a high teratogenic potential and children exposed *in utero* to valproate have a high risk for congenital malformations and neurodevelopmental disorders (see Section 4.6 Fertility, Pregnancy and Lactation).

Valproate should not be used in female children and women of childbearing potential unless other treatments are ineffective or not tolerated (see Section 4.3 Contraindications, Section 4.4 Special Warnings and Precautions for Use, and Section 4.6 Fertility, Pregnancy and Lactation).

In the exceptional circumstance when valproate is the only treatment option available for women of childbearing potential:

- Individual circumstances are evaluated and discussed with the patient. This is to guarantee the patient's engagement and understanding of the therapeutic options together with the risks and the measures needed to mitigate the risks.
- The potential for pregnancy is assessed for all female patients.
- The patient understands the risks of congenital malformations and neurodevelopmental disorders including the magnitude of these risks for children exposed to valproate *in utero*.
- The patient understands the need to undergo pregnancy testing prior to initiation of treatment and during treatment, as needed.
- The patient is counselled regarding contraception, and that the patient is capable of complying with the need to use effective contraception (see Section 4.4 Special Warnings and Precautions for Use - Pregnancy and Women of Childbearing Potential - Contraception), without interruption during the entire duration of treatment with valproate.
- The patient understands the need for regular (at least annual) review of treatment by a specialist experienced in the management of epilepsy, or bipolar disorders.
- The patient understands the need to consult her physician as soon as she is planning pregnancy to ensure timely discussion and switching to alternative treatment options prior to conception, and before contraception is discontinued.
- The patient understands the need to urgently consult her physician in case of pregnancy.
- The patient is aware that a patient guide is available electronically through a QR code on the carton ([www.sanofi.com.au/valproate](http://www.sanofi.com.au/valproate)).
- The patient understands the hazards and necessary precautions associated with valproate use.

These conditions also concern women who are not currently sexually active unless the prescriber considers that there are compelling reasons to indicate that there is no risk of pregnancy.

Pharmacist or other healthcare professional must:

- Review the CMI with the patient (or parent/caregiver) and confirm that she can access the educational tools available electronically through the QR code located on the carton ([www.sanofi.com.au/valproate](http://www.sanofi.com.au/valproate))
- Advise the patient (or parent/caregiver) not to stop valproate medication and to immediately contact a specialist in case of planned or suspected pregnancy

### Female children

- The prescriber must ensure that parents/caregivers of female children understand the need to contact the specialist once the female child using valproate experiences menarche.
- The prescriber must ensure that parents/caregivers of female children who have experienced menarche are provided with comprehensive information about the risks of congenital malformations and neurodevelopmental disorders including the magnitude of these risks for children exposed to valproate *in utero*.
- In patients who experience menarche, the prescribing specialist must reassess the need for valproate therapy annually and consider alternative treatment options. If valproate is the only suitable treatment, the need for using an effective contraception program should be discussed. Every effort should be made by the specialist to switch female children to alternative treatment before they reach adulthood.

### Pregnancy Test

Pregnancy must be excluded before the start of treatment with valproate. Treatment with valproate must not be initiated in women of child bearing potential without a negative pregnancy test (plasma pregnancy test) result, confirmed by a health care provider, to rule out unintended use in pregnancy.

### Contraception

Women of childbearing potential who are prescribed valproate must use effective contraception, without interruption during the entire duration of treatment with valproate. These patients must be provided with comprehensive information on pregnancy prevention. If they are not using effective contraception they should be referred for contraceptive advice.

At least one effective method of contraception (preferably a user-independent form such as an intra-uterine device or implant) or two complementary forms of contraception including a barrier method should be used.

Individual circumstances should be evaluated in consultation with the patient when choosing a contraceptive method. This will increase patient engagement and compliance with the chosen contraceptive measures.

Even if the patient has amenorrhea she must follow all the advice on effective contraception.

### Annual Treatment Review

The specialist should review, at least annually, whether valproate is the most suitable treatment for the patient.

### Pregnancy planning

For the epilepsy indication, if a patient on valproate is planning to become pregnant, a specialist experienced in the management of epilepsy must reassess the therapy and consider alternative treatment options. Every effort should be made to switch to appropriate alternative treatment prior to conception, and before contraception is discontinued (see Section 4.6 Fertility, Pregnancy and Lactation). If switching is not possible, the patient should receive further counselling regarding the risks of valproate for the unborn child to support her informed decision making regarding family planning.

For the bipolar disorder indication, if a woman is planning to become pregnant, a specialist experienced in the management of bipolar disorder must be consulted. Treatment with valproate should be discontinued prior to conception, and before contraception is discontinued. If needed, alternative treatment options should be considered.

### In case of pregnancy

If a woman using valproate becomes pregnant, she must be immediately referred to a specialist to re-evaluate treatment with valproate and consider alternative options. The patients with a valproate exposed pregnancy and their partners should be referred to a specialist experienced in pre-natal medicine for evaluation and counselling regarding the exposed pregnancy (see Section 4.6 Fertility, Pregnancy and Lactation).

### Educational materials

To reinforce the warnings and provide guidance regarding use of valproate in women of childbearing potential, educational materials are available electronically through a QR code on the carton ([www.sanofi.com.au/valproate](http://www.sanofi.com.au/valproate)). A patient guide should be provided/available to all women of childbearing potential using valproate.

### Estrogen-containing products

Valproate does not reduce the efficacy of hormonal contraceptives.

However, estrogen-containing products, including estrogen-containing hormonal contraceptives, may increase the clearance of valproate, which may result in decreased serum concentration of valproate and potentially decreased valproate efficacy. Prescribers should monitor clinical response (seizure control or mood control) when initiating, or discontinuing estrogen-containing products. Consider monitoring of valproate serum levels (see Section 4.5 Interaction with Other Medicines and Other Forms of Interaction).

### ***Use in males of reproductive potential***

A retrospective observational study indicates an increased risk of neurodevelopmental disorders (NDDs) in children born to men treated with valproate at time of conception compared to those treated with lamotrigine or levetiracetam (see section 4.6).

As a precautionary measure, the prescriber should inform the male patients of this potential risk and consider alternative therapeutic options with the patient. In men initiating or remaining on valproate treatment, the need for effective contraception should be discussed with the patient, at least annually. The prescriber should ensure the male patient has acknowledged the risk and precautions associated with valproate use.

### **Educational materials**

To reinforce the warnings and provide guidance regarding use of valproate in men of reproductive potential, educational materials are available electronically through a QR code on the carton ([www.sanofi.com.au/valproate](http://www.sanofi.com.au/valproate)). A patient guide should be provided/available to all men of reproductive potential using valproate

### ***Hepatic Dysfunction***

#### Conditions of occurrence

Severe liver damage and/or hepatic failure resulting in fatalities have occurred in patients whose treatment included valproic acid or sodium valproate/valproic acid. Patients most at risk of liver injury are those on multiple anticonvulsant therapy including those on cannabidiol (see section 4.5 Interactions with Other Medicines and Other Forms of Interactions and section 4.8 Undesirable Effects). Dose adjustment or discontinuation of valproate or the concomitant drug should be considered if transaminase elevations occur. Children, particularly those under the age of 3 years and those with congenital metabolic disorders including mitochondrial disorders such as carnitine deficiency, urea cycle disorders, POLG mutations (see Section 4.4 Special Warnings and Precautions for Use) or degenerative disorders, organic brain disease or severe seizure disorders associated with brain damage and/or mental retardation are also at higher risk of liver injury.

The incidents usually occurred during the first six months of therapy, the period of maximum risk being 2 to 12 weeks, and usually involved multiple anticonvulsant therapy. Monotherapy is to be preferred in this group of patients.

After the age of 3 years, the risk is significantly reduced and it progressively decreases with age. In most cases, such liver damage occurred during the first 6 months of therapy.

#### Suggestive signs

Clinical symptoms are usually more helpful than laboratory investigations in the early stages of hepatic failure. Jaundice, serious or fatal hepatotoxicity may be preceded by nonspecific symptoms, usually of sudden onset, such as loss of seizure control, malaise, asthenia, weakness,



lethargy, facial oedema, anorexia, vomiting, abdominal pain, drowsiness, jaundice. In patients with epilepsy, recurrence of seizures can occur. These are an indication for immediate withdrawal of the medicine.

Patients should be monitored closely for the appearance of these symptoms. Patients (and their family) should be instructed to immediately report any such signs to the clinician for investigation should they occur. Investigations including clinical examination and laboratory assessment of liver functions should be undertaken immediately.

### Detection

Although published evidence does not establish which, if any investigation could predict this possible adverse effect, liver function tests should be performed prior to therapy and frequently thereafter until 6 months after the controlling dose is reached, when less frequent monitoring may be appropriate. It is also advisable to monitor tests that reflect protein synthesis, e.g. prothrombin time, serum fibrinogen and albumin levels, especially in those who seem most at risk and those with a prior history of hepatic disease.

As with most antiepileptic drugs, a slight increase in liver enzymes may be noted, particularly at the beginning of therapy. They are transient and isolated. More extensive biological investigations (including prothrombin rate) are recommended in those patients. An adjustment of dosage may be considered when appropriate and tests should be repeated as necessary.

Raised liver enzymes are not uncommon during treatment with Epilim, **particularly if used in conjunction with other anticonvulsants**, and are usually transient or respond to dosage reduction. Patients with such biochemical abnormalities should be reassessed clinically and tests of liver function should be monitored more frequently. Among the usual investigations, tests which reflect protein synthesis particularly prothrombin rate, are most relevant. An abnormally low prothrombin rate, particularly in association with other relevant abnormalities (significant decrease in fibrinogen and coagulation factors; increased bilirubin level and raised transaminases) requires cessation of treatment and the substitution of alternative medicines to avoid precipitating convulsions. Uneventful recovery has been recorded in several cases where therapy with Epilim has ceased, but death has occurred in some patients in spite of the medicine being withdrawn. Any concomitant use of salicylates should be stopped, since they employ the same metabolic pathway.

### *Patients with known or suspected mitochondrial disease*

Valproate may trigger or worsen clinical signs of underlying mitochondrial diseases caused by mutations of mitochondrial DNA as well as the nuclear-encoded POLG gene. In particular, acute liver failure and liver-related deaths have been associated with valproate treatment at a higher rate in patients with hereditary neurometabolic syndromes caused by mutations in the gene for mitochondrial enzyme polymerase  $\gamma$  (POLG eg Alpers-Huttenlocher Syndrome).

POLG-related disorders should be suspected in patients with a family history or suggestive symptoms of a POLG-related disorder, including but not limited to un-explained encephalopathy, refractory epilepsy (focal, myoclonic), status epilepticus at presentation, developmental delays,

psychomotor regression, axonal sensorimotor neuropathy, myopathy cerebellar ataxia, ophthalmoplegia, or complicated migraine with occipital aura. POLG mutation testing should be performed in accordance with current clinical practice for the diagnostic evaluation of such disorders.

#### *Urea cycle disorders and risk of hyperammonemia*

When an urea cycle enzymatic deficiency is suspected, metabolic investigations should be performed prior to treatment because of the risk of hyperammonemia with valproate (See Sections 4.3 Contraindications and 4.4 Special Warnings and Precautions for Use).

#### *Patients at risk of hypocarnitinemia*

Valproate administration may trigger occurrence or worsening of hypocarnitinemia that can result in hyperammonemia (that may lead to hyperammonemic encephalopathy). Other symptoms such as liver toxicity, hypoketotic hypoglycaemia, myopathy including cardiomyopathy, rhabdomyolysis, Fanconi syndrome have been observed, mainly in patients with risk factors for hypocarnitinemia or pre-existing hypocarnitinemia. Valproate may decrease carnitine blood and tissue levels and therefore impair mitochondrial metabolism including the mitochondrial urea cycle. Patients at increased risk for symptomatic hypocarnitinemia when treated with valproate include patients with metabolic disorders including mitochondrial disorders related to carnitine, impairment in carnitine nutritional intake, patients younger than 10 years old, concomitant use of pivalate-conjugated medicines or other antiepileptics.

Patients should be warned to report immediately any signs of hyperammonemia such as ataxia, impaired consciousness, vomiting for further investigation. Carnitine supplementation should be considered when symptoms of hypocarnitinemia are observed.

Patients with known systemic primary carnitine deficiency and corrected for hypocarnitinemia should be treated with valproate only if the benefits of valproate treatment outweigh the risks in these patients and there is no suitable therapeutic alternative. In these patients, close monitoring for recurrence of hypocarnitinemia should be implemented.

Patients with an underlying carnitine palmitoyltransferase (CPT) type II deficiency should be warned of the greater risk of rhabdomyolysis when taking valproate. Carnitine supplementation should be considered in these patients.

#### ***Pancreatitis***

Severe pancreatitis, which may result in fatalities, has been very rarely reported. Some cases have occurred shortly after initial use while others have occurred after several years of use. There have also been cases in which pancreatitis recurred after rechallenge with sodium valproate/valproic acid. Some of the cases have been described as haemorrhagic with a rapid progression from initial symptoms to death. In clinical trials, there were two cases of pancreatitis without alternative aetiology in 2416 patients, representing 1044 patient-years experience.

Young children are at particular risk but this risk decreases with increasing age. Severe seizures, neurological impairment or anticonvulsant polytherapy may be risk factors. Hepatic failure with pancreatitis increases the risk of fatal outcome.

Patients and guardians should be warned that acute abdominal pain, nausea, vomiting, and/or anorexia can be symptoms of pancreatitis that require prompt medical attention. If pancreatitis is diagnosed, sodium valproate/valproic acid should be discontinued and alternative treatment for the underlying medical condition initiated as clinically indicated.

### ***Use in renal impairment***

Lower doses may be required since free drug levels may be high owing to lowered serum albumin and poor urinary excretion of free drug metabolites. As monitoring of plasma concentrations may be misleading, dosage should be adjusted according to clinical monitoring.

### ***Diabetes***

Care should be taken when treating diabetic patients with Epilim syrup which contains sucrose 3.6 g/5 mL. In such patients, Epilim Sugar-Free Liquid would be a preferable medication. See also Section 4.4 Special Warnings and Precautions for Use - Effects on Laboratory Tests.

### ***Dilutions***

If it is necessary to dilute the syrup, the recommended diluent is Syrup BP. Syrup containing sulfur dioxide as a preservative should not be used. The diluted product will have a 14-day shelf-life. The Sugar-Free Liquid should not be diluted.

### ***Lupus Erythematosus***

Although immune disorders have been noted only exceptionally during the use of Epilim, the potential benefit of Epilim should be weighed against its potential risk in patients with systemic lupus erythematosus.

### ***Hyperammonaemia***

Hyperammonaemia, which may be present in the absence of abnormal liver function tests, can occur in patients during treatment with sodium valproate/valproic acid. This may occasionally present clinically, with or without lethargy or coma, as vomiting, ataxia and increasing clouding of consciousness. Should these symptoms occur, hyperammonaemic encephalopathy should be considered (see 4.4 Special Warnings and Precautions for Use - Urea Cycle Disorders (UCD)) and Epilim should be discontinued.

### ***Urea Cycle Disorders (UCD)***

Hyperammonaemic encephalopathy, sometimes fatal, has been reported following initiation of valproate therapy in patients with urea cycle disorders, a group of uncommon genetic abnormalities, particularly ornithine transcarbamylase deficiency.

Prior to the initiation of valproate therapy, evaluation for UCD should be considered in the following patients:

- 1) those with a history of unexplained encephalopathy or coma, encephalopathy associated with a protein load, pregnancy-related or postpartum encephalopathy, unexplained mental retardation, or history of elevated plasma ammonia or glutamine;
- 2) those with cyclical vomiting and lethargy, episodic extreme irritability, ataxia, low BUN, or protein avoidance;
- 3) those with a family history of UCD or a family history of unexplained infant deaths (particularly males);
- 4) those with other signs or symptoms of UCD.

Patients who develop symptoms of unexplained hyperammonaemic encephalopathy while receiving valproate therapy should receive prompt treatment (including discontinuation of valproate therapy) and be evaluated for underlying urea cycle disorders.

### ***Ornithine Transcarbamylase (OTC) Deficiency***

The females who are heterozygous for OTC deficiency have a spectrum of clinical and biochemical findings, depending on the extent of inactivation of the X-chromosome. Females may show a range of symptoms due to hyperammonaemia which, may be episodic, and therefore difficult to diagnose. The acute symptoms include headaches, vomiting, irritability, bizarre behaviour, lethargy, ataxia, tremors, seizures (generalised tonic-clonic or focal) and coma.

Valproate may precipitate hyperammonaemia symptoms in those who have pre-existing OTC deficiency. As the symptoms may include seizures, any female with valproate-associated symptomatic hyperammonaemia should be evaluated for OTC deficiency. Investigations should include measurement of plasma amino acids and the immediate cessation of valproate should result in clinical improvement.

### ***Surgery***

Prolongation of bleeding time, sometimes with thrombocytopenia, has occurred with Epilim therapy. Platelet function should be monitored before surgery is undertaken in patients receiving Epilim.

## **Other**

Blood tests (blood cell count, including platelet count, bleeding time and coagulation tests) are recommended prior to initiation of therapy or before surgery, and in case of spontaneous bruising or bleeding.

## **Suicidal Behaviour and Ideation**

Antiepileptic drugs, including sodium valproate increase the risk of suicidal thoughts or behaviour in patients taking these drugs for any indication. Patients treated with any anti-epileptic drug (AED) for any indication should be monitored for the emergence or worsening of depression, suicidal thoughts or behaviour, and/or any unusual changes in mood or behavior, and appropriate treatment should be considered.

Pooled analyses of 199 placebo-controlled clinical trials (mono- and adjunctive therapy) of 11 different AEDs showed that patients randomised to one of the AEDs had approximately twice the risk (adjusted Relative Risk 1.8, 95% CI:1.2, 2.7) of suicidal thinking or behaviour compared to patients randomised to placebo. In these trials, which had a median treatment duration of 12 weeks, the estimated incidence rate of suicidal behaviour or ideation among 27,863 AED-treated patients was 0.43%, compared to 0.24% among 16,029 placebo-treated patients, representing an increase of approximately one case of suicidal thinking or behaviour for every 530 patients treated.

There were four suicides in drug-treated patients in the trials and none in placebo-treated patients, but the number is too small to allow any conclusion about drug effect on suicide. The increased risk of suicidal thoughts or behaviour with AEDs was observed as early as one week after starting drug treatment with AEDs and persisted for the duration of treatment assessed. Because most trials included in the analysis did not extend beyond 24 weeks, the risk of suicidal thoughts or behaviour beyond 24 weeks could not be assessed. The risk of suicidal thoughts or behaviour was generally consistent among drugs in the data analysed.

The finding of increased risk with AEDs of varying mechanisms of action and across a range of indications suggests that the risk applies to all AEDs used for any indication. The risk did not vary substantially by age (5-100 years) in the clinical trials analysed. The mechanism of this effect is unknown. The following Table shows absolute and relative risk by indication for all evaluated AEDs.

<b>Indication</b>	<b>Placebo patients with events/1000 patients</b>	<b>Drug patients with events/1000 patients</b>	<b>Relative Risk: Incidence of events in Drug patients/Incidence in Placebo patients</b>	<b>Relative Difference: Additional Drug patients with events per 1000 patients</b>
Epilepsy	1.0	3.4	3.5	2.4
Psychiatric	5.7	8.5	1.5	2.9
Other	1.0	1.8	1.9	0.9
Total	2.4	4.3	1.8	1.9

Indication	Placebo patients with events/1000 patients	Drug patients with events/1000 patients	Relative Risk: Incidence of events in Drug patients/Incidence in Placebo patients	Relative Difference: Additional Drug patients with events per 1000 patients
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The relative risk for suicidal thoughts or behaviour was higher in clinical trials for epilepsy than in clinical trials for psychiatric or other conditions, but the absolute risk differences were similar for the epilepsy and psychiatric indications.

Anyone considering prescribing sodium valproate or any other AED must balance this risk with the risk of untreated illness. Epilepsy and many other illnesses for which AEDs are prescribed are themselves associated with morbidity and mortality and an increased risk of suicidal thoughts and behaviour.

Should suicidal thoughts and behaviour emerge during treatment, the prescriber needs to consider whether the emergence of these symptoms in any given patient may be related to the illness being treated.

Patients, their caregivers, and families should be informed that AEDs increase the risk of suicidal thoughts and behaviour and should be advised of the need to be alert for the emergence or worsening of the signs and symptoms of depression, any unusual changes in mood or behaviour, or the emergence of suicidal thoughts, behaviour, or thoughts about self-harm. Behaviours of concern should be reported immediately to the treating doctor.

### ***Abrupt Withdrawal***

The possible risk of fits after sudden cessation of Epilim should be borne in mind. If it is the only anticonvulsant used and has to be withdrawn for more than 12 hours because of surgery, control of epilepsy may be lost.

### ***Carbapenem Agents***

The concomitant use of sodium valproate/valproic acid and carbapenem antibiotics is not recommended (see also Section 4.5 Interaction with Other Medicines and Other Forms of Interaction).

### ***Aggravated convulsions***

As with other antiepileptic drugs, some patients may experience, instead of an improvement, a reversible worsening of convulsion frequency and severity (including status epilepticus), or the onset of new types of convulsions with valproate. In case of aggravated convulsions, the patients should be advised to consult their physician immediately (see Section 4.8 Undesirable Effects).

### ***Thrombocytopenia***

Because of reports of thrombocytopenia, inhibition of the secondary phase of platelet aggregation, and abnormal coagulation parameters, platelet counts and coagulation tests are recommended before initiating therapy and at periodic intervals. Evidence of haemorrhage, bruising or a disorder of haemostasis/coagulation is an indication for reduction of Epilim dosage or withdrawal of therapy.

### ***Ornithine Transcarbamylase (OTC) Deficiency***

A familial history of infant mortality or patient history of OTC deficiency, or of seizures or coma in the presence of mental retardation suggests the need to exclude OTC deficiency.

### ***Weight Gain***

Patients should be warned of the risk of weight gain at the initiation of therapy, and appropriate strategies should be adopted to minimise the risk.

### ***Paediatric Use***

The potential benefit of Epilim should be weighed against the risk of liver damage or pancreatitis in such patients prior to initiation of therapy (see Section 4.4 Special Warnings and Precautions for Use and Section 4.5 Interactions with Other Medicines and Other Forms of Interactions). The concomitant use of salicylates should be avoided in children under 3 years of age due to the risk of liver toxicity and the concomitant use of barbiturates may require dosage adjustment (see Section 4.5 Interaction with Other Medicines and Other Forms of Interaction). Monotherapy is recommended in children under 3 years of age, when prescribing Epilim. Young children are at particular risk for pancreatitis, however this risk decreases with increasing age.

The safety and efficacy of sodium valproate/valproic acid for the treatment of manic episodes in bipolar disorder have not been evaluated in patients aged less than 18 years.

### ***Effects on laboratory tests***

Epilim is eliminated mainly through the kidneys, partly in the form of ketone bodies. This may give false positives in the urine testing of possible diabetics.

There have been reports of altered thyroid function test results associated with sodium valproate/valproic acid. The clinical significance of this is unknown.

## **4.5 INTERACTION WITH OTHER MEDICINES AND OTHER FORMS OF INTERACTION**

Caution is advised when using Epilim in combination with newer anti-epileptics whose pharmacodynamics may not be well established.

### ***Potential for valproate/valproic acid to effect other medicines***

Sodium valproate/valproic acid is an inhibitor of a variety of hepatic enzymes, including cytochrome P450, glucuronyl transferase and epoxide hydrolase, and may displace various drugs from plasma protein binding sites. The following list provides information about potential effects of valproate co-administration on a range of commonly prescribed medications. The list is not exhaustive, as new interactions may be reported.

#### Alcohol

Valproic acid may potentiate the CNS depressant activity of alcohol. Alcohol intake is not recommended during treatment with valproate.

#### Antiepileptic drug

Several antiepileptic drugs often used in conjunction with valproate (eg phenytoin, carbamazepine, phenobarbital) have the ability to increase the intrinsic clearance of valproate, presumably by enzymatic induction of metabolism.

#### Carbamazepine

Valproate may displace carbamazepine from protein binding sites and may inhibit the metabolism of both carbamazepine and its metabolite carbamazepine 10, 11 epoxide and consequently potentiate toxic effects of carbamazepine. Clinical monitoring is recommended especially at the beginning of combined therapy, with dosage adjustment when appropriate.

#### Lamotrigine

Sodium valproate/valproic acid reduces lamotrigine metabolism and increases mean half life by nearly two-fold. This interaction may lead to increased lamotrigine toxicity, in particular serious skin rashes. Clinical monitoring is recommended and lamotrigine dosage should be decreased as appropriate.

#### Phenobarbital

Sodium valproate/valproic acid blocks the metabolism of barbiturates causing an increase in phenobarbital plasma levels, which, particularly in children, may be associated with sedation. Combination of sodium valproate/valproic acid and phenobarbital can cause CNS depression without significant elevation of serum level of either drug. Therefore, clinical monitoring is recommended throughout the first 15 days of combined treatment with immediate reduction of phenobarbital doses if sedation occurs and determination of phenobarbital plasma levels when appropriate. A reduction in the dose of phenobarbital and/or valproate may be necessary and this should also be borne in mind if medicines that are metabolised to phenobarbital (e.g. primidone, methylphenobarbitone) are given with sodium valproate/valproic acid.



## Phenytoin

There have been reports of breakthrough seizures occurring with the combination of sodium valproate/valproic acid and phenytoin. Valproate decreases total plasma phenytoin concentration, however increases in total phenytoin levels have been reported. An initial fall in total phenytoin levels with subsequent increase in phenytoin levels has also been reported. In addition, a decrease in total serum phenytoin with an increase in the free versus protein bound phenytoin levels has been reported with possible overdose symptoms (valproic acid displaces phenytoin from its plasma protein binding sites and reduces its hepatic catabolism). Therefore, clinical monitoring is recommended. When phenytoin plasma levels are determined, the free form should be evaluated. The dosage of phenytoin may require adjustment when given in conjunction with valproate as required by the clinical situation.

## Medicines with extensive protein binding

The concomitant administration of sodium valproate/valproic acid with medicines that exhibit extensive protein binding (e.g. aspirin, carbamazepine, phenytoin, warfarin) may result in alteration of serum drug levels.

## Anticoagulants

The effect of Epilim on anticoagulants which modify platelet function is unknown (see Section 4.8 Undesirable Effects). Caution is recommended when administering anticoagulants and other products which have anticoagulant properties (e.g. warfarin and aspirin).

## Ethosuximide

The interaction between ethosuximide and valproate is not normally of clinical significance. There is evidence that sodium valproate/valproic acid may inhibit ethosuximide metabolism, especially in the presence of other anticonvulsants. Patients receiving this combination should be monitored clinically.

## Oral contraceptives

The enzyme inducing effect of valproate/valproic acid is appreciably less than that of certain other anticonvulsants and loss of efficacy of oral contraceptive agents does not appear to be a problem.

## Estrogen-containing products

Valproate does not reduce the efficacy of hormonal contraceptives.

Estrogen-containing products, including estrogen-containing hormonal contraceptives, may increase the clearance of valproate, which may result in decreased serum concentration of valproate and potentially decreased valproate efficacy. Prescribers should monitor clinical response (seizure control or mood control) when initiating, or discontinuing estrogen-containing

products. Consider monitoring of valproate serum levels (see Section 4.5 Interaction with Other Medicines and Other Forms of Interaction).

### Psychotropic agents

Epilim may potentiate the effects of other psychotropics such as MAOIs, neuroleptics, benzodiazepines and other antidepressants, therefore clinical monitoring is advised and the dose of these medicines should be reduced accordingly.

### Clonazepam

The concomitant use of sodium valproate/valproic acid and clonazepam may produce absence status.

### Clozapine

Caution is advised during concomitant administration as competitive protein binding may potentiate an increase in clozapine or valproate levels.

### Diazepam

Sodium valproate/valproic acid displaces diazepam from its plasma binding sites and inhibits its metabolism. Monitoring of free diazepam levels may be necessary if the patient becomes sedated.

### Lorazepam

A decrease in lorazepam plasma clearance may occur with concomitant administration of sodium valproate/valproic acid.

### Midazolam

Free plasma midazolam may increase in patients receiving valproate. It appears likely that sodium valproate/valproic acid displaces midazolam from its plasma binding sites, potentially leading to an increase of the midazolam response.

### Primidone

Valproate/valproic acid increases primidone plasma levels with exacerbation of its adverse effects (such as sedation); these signs cease with long-term treatment. Clinical monitoring is recommended especially at the beginning of combined therapy with dosage adjustment when appropriate.

### Zidovudine

Valproate/valproic acid may raise zidovudine plasma concentrations leading to increased zidovudine toxicity.

### Tricyclic antidepressants

Sodium valproate/valproic acid may inhibit the metabolism of tricyclic antidepressants. Clinical monitoring of free antidepressant levels may be necessary.

### Olanzapine

Valproic acid may decrease the olanzapine plasma concentration.

### Felbamate

Valproic acid may decrease the felbamate mean clearance by up to 16%.

### Rufinamide

Valproic acid may lead to an increase in plasma level of rufinamide. This increase is dependent on concentration of valproic acid. Caution should be exercised, in particular in children as this effect is larger in this population.

### Propofol

Valproic acid may lead to an increased blood level of propofol. When co-administered with valproate, a reduction of the dose of propofol should be considered.

### Nimodipine

Concomitant treatment of nimodipine with valproic acid may increase nimodipine plasma concentration.

### Other medicines

There was no notable interaction between valproate/valproic acid and lithium.

### ***Potential for other medicines to effect valproate***

The dosage of Epilim may need to be increased by 5 to 10 mg/kg/day when used in combination with medicines which induce hepatic enzymes and thereby increase the clearance of valproate. In contrast, medicines that are inhibitors of cytochrome P450, may be expected to have only a minor effect on valproate clearance as cytochrome P450 mediated microsomal oxidation is a relatively minor secondary metabolic pathway to glucuronidation and  $\beta$ -oxidation. The list is not exhaustive, as new interactions may be reported.

### Aspirin

Concomitant administration of sodium valproate and aspirin may result in displacement of valproate from protein binding sites, resulting in a rise in free levels. In addition, aspirin appears to inhibit the metabolism of valproate. Thus caution is advisable when patients on sodium valproate are prescribed aspirin. Furthermore, patients requiring long-term aspirin therapy may require a reduction in dosage of sodium valproate.

### Felbamate

Felbamate may decrease valproic acid clearance and consequently increase valproate serum concentrations. Valproate dosage should be monitored when given in combination with felbamate.

### Phenobarbital, Phenytoin and Carbamazepine

These medicines can decrease steady-state valproate levels in patients by increasing the intrinsic clearance of valproate, presumably through enzymic induction of metabolism. The half-life is significantly reduced in patients on polytherapy with these medicines. Dosages should be adjusted according to clinical response and blood levels in case of combined therapy.

Valproic acid metabolite levels may be increased in case of concomitant use with phenytoin or phenobarbital. Therefore patients treated with either of these two drugs should be carefully monitored for signs and symptoms of hyperammonemia.

### Antidepressants

Antidepressants (including MAOIs, tricyclic antidepressants and SSRIs) may have the potential to inhibit the metabolism of valproate via the cytochrome P450 system. However, there is not expected to be any significant interaction within normal therapeutic doses. Antidepressants can lower the seizure threshold of non-stabilised epileptic patients, and so careful and regular monitoring of their condition is indicated.

### Clozapine

Caution is advised during concomitant administration as competitive protein binding may potentiate an increase in clozapine or valproate levels.

### Chlorpromazine

Chlorpromazine may inhibit the metabolism of valproate.

### Fluoxetine

Fluoxetine may inhibit the metabolism of valproate as it does with tricyclic antidepressants, carbamazepine and diazepam.

### Mefloquine

Mefloquine increases valproic acid metabolism and has a convulsing effect; therefore epileptic seizures may occur in cases of combined therapy.

### Cimetidine or Erythromycin

Valproate serum levels may be increased (as a result of reduced hepatic metabolism) in case of concomitant use with cimetidine or erythromycin.

### Carbapenem antibiotics

Decreases in blood levels of valproic acid have been reported when it is co-administered with carbapenem agents resulting in a 60-100 % decrease in valproic acid levels in about two days. Due to the rapid onset and the extent of the decrease, co-administration of carbapenem agents in patients stabilised on valproic acid should be avoided. If treatment with these antibiotics cannot be avoided close monitoring of valproate blood level should be performed.

### Colestyramine

May decrease the absorption of valproate and may lead to a decrease in plasma level of valproate when co-administered.

### Vitamin K dependent factor anticoagulant

Close monitoring of prothrombin rate should be performed in case of concomitant use of vitamin K dependent factor anticoagulant.

### Rifampicin

Rifampicin may decrease the valproate blood levels resulting in a lack of therapeutic effect. Therefore, valproate dosage adjustment may be necessary when it is co-administered with rifampicin.

### Protease inhibitors

Protease inhibitors such as lopinavir, ritonavir decrease valproate plasma levels when co-administered.

### Medicines with extensive protein binding

The concomitant administration of sodium valproate/valproic acid with medicines that exhibit extensive protein binding (e.g. aspirin, carbamazepine, phenytoin, warfarin) may result in alteration of serum drug levels.

### Estrogen-containing products

Estrogen-containing products, including estrogen-containing hormonal contraceptives, may increase the clearance of valproate, which may result in decreased serum concentration of valproate and potentially decreased valproate efficacy. Prescribers should monitor clinical response (seizure control or mood control) when initiating, or discontinuing estrogen-containing products. Consider monitoring of valproate serum levels.

Valproate does not reduce the efficacy of oestroprogestative agents.

### Metamizole

Metamizole may decrease valproate serum levels when co-administered, which may result in potentially decreased valproate clinical efficacy. Prescribers should monitor clinical response (seizure control or mood control) and consider monitoring valproate serum levels as appropriate.

### Methotrexate

Some case reports describe a significant decrease in valproate serum levels after methotrexate administration, with occurrence of seizures. Prescribers should monitor clinical response (seizure control or mood control) and consider monitoring valproate serum levels as appropriate.

### ***Other interactions***

#### Risk of liver damage

The concomitant use of salicylates should be avoided in children under 3 years of age due to the risk of liver toxicity (see Section 4.4 Special Warnings and Precautions for Use Hepatic dysfunction and Paediatric use).

Concomitant use of valproate and multiple anticonvulsant therapy increases the risk of liver damage, especially in young children (see Section 4.4 Special Warnings and Precautions for Use Hepatic dysfunction and Paediatric use).

#### Cannabidiol

Concomitant use of sodium valproate and cannabidiol at doses 10 to 25 mg/kg may increase the incidence of transaminase enzyme elevations higher than 3 times the ULN (see section 4.4 Special Warnings and Precautions for Use and section 4.8 Undesirable Effects). The mechanism of this interaction remains unknown.

Appropriate liver monitoring should be exercised when valproate is used concomitantly with other anticonvulsants with potential hepatotoxicity, including cannabidiol, and dose reductions or discontinuation should be considered in case of significant anomalies of liver parameters (see Section 4.4 Special Warnings and Precautions for Use).

### Topiramate and acetazolamide

Concomitant administration of valproate and topiramate or acetazolamide has been associated with encephalopathy and/or hyperammonemia. Patients treated with those two drugs should be carefully monitored for signs and symptoms of hyperammonemic encephalopathy.

### Pivalate-conjugated medicines

Concomitant administration of valproate and pivalate-conjugated medicines that decrease carnitine levels (such as cefditoren pivoxil, adefovir dipivoxil, pivmecillinam and pivampicillin) may trigger occurrence of hypocarnitinemia (see Section 4.4 Special Warnings and Precautions for Use). Concomitant administration of these medicines with valproate is not recommended. Patients in whom coadministration cannot be avoided should be carefully monitored for signs and symptoms of hypocarnitinemia.

### Quetiapine

Co-administration of valproate and quetiapine may increase the risk of neutropenia/leucopenia.

## **4.6 FERTILITY, PREGNANCY AND LACTATION**

### ***Effects on Fertility***

Amenorrhoea, polycystic ovaries and increased testosterone levels have been reported in women using valproate (see Section 4.8 Undesirable Effects). Valproate administration may also impair fertility in men (see Section 4.8 Undesirable Effects). Case reports indicate that fertility dysfunctions are reversible after treatment discontinuation.

In the few cases in which the outcome of switching/discontinuing valproate was reported, the decrease in male fertility potential was reversible in most but not all cases, and successful conceptions have also been observed. There are insufficient data to comment on the effects of reducing the daily dose of valproate in the setting of male infertility.

### ***Use in pregnancy***

Category D

Before Epilim is prescribed for use in women with epilepsy of any form, who could become pregnant, they should receive specialist advice. Due to the potential risks to the foetus, the benefits of Epilim should be weighed against the risks. When treatment with Epilim is deemed necessary, precautions to minimise the potential teratogenic risk should be followed.

Overall, the risk of having a child with abnormalities as a result of antiepileptic medication is far outweighed by the dangers to the mother and foetus of uncontrolled epilepsy.

Notwithstanding the potential risks, no sudden discontinuation of antiepileptic therapy should be undertaken, without reassessment of the risks and benefits, as this may lead to breakthrough seizures which could have serious consequences for both the mother and the foetus. If after careful evaluation of the risks and benefits, sodium valproate treatment is to be continued during pregnancy, it is recommended to use sodium valproate in divided doses over the day at the lowest effective dose. The use of a prolonged release formulation may be preferable to any other treatment form.

Valproate is contraindicated as treatment for epilepsy during pregnancy unless there is no suitable alternative.

Valproate is contraindicated for use in women of childbearing potential unless the physician has provided education on the potential effects of valproate during pregnancy and recommendations on the use of valproate (see Section 4.3 Contraindications and Section 4.4 Special Warnings and Precautions for Use).

Valproate is contraindicated as treatment for bipolar disorder during pregnancy.

#### Teratogenicity and Developmental Effects

Valproate was shown to cross the placental barrier both in animal species and in humans (see Section 5.2 Pharmacokinetic Properties).

#### Animal data:

Teratogenic effects (malformation of multiple organ systems) have been demonstrated in mice, rats, and rabbits.

In published literature, behavioural abnormalities have been reported in first generation offspring of mice and rats after *in utero* exposure to clinically relevant doses/exposure of valproate. In mice, behavioural changes have also been observed in the 2<sup>nd</sup> and 3<sup>rd</sup> generations, albeit less pronounced in the 3<sup>rd</sup> generation, following an acute *in utero* exposure of the first generation. The relevance of these findings for humans is unknown.

#### Pregnancy Exposure Risk related to valproate

In females, both valproate monotherapy and valproate polytherapy including other antiepileptics, are frequently associated with abnormal pregnancy outcomes. Available data show an increased risk of major congenital malformations and neurodevelopmental disorders in both valproate monotherapy and polytherapy compared to the population not exposed to valproate.

#### Risk to children of fathers treated with valproate

A retrospective observational study on electronic medical records in 3 European Nordic countries indicates an increased risk of neuro-developmental disorders (NDDs) in children (from 0 to 11



years old) born to men treated with valproate at time of conception compared to those treated with lamotrigine or levetiracetam.

The adjusted cumulative risk of NDDs ranged between 5.6% to 6.3% in the valproate group versus between 2.5% to 3.6% in the composite lamotrigine/levetiracetam monotherapy exposure. The pooled adjusted hazard ratio (HR) for NDDs overall obtained from the meta-analysis of the datasets was 1.47 (95% CI: 1.10, 1.96).

Due to study limitations, it is not possible to determine which of the studied NDD subtypes (autism spectrum disorder, intellectual disability, communication disorder, attention deficit/hyperactivity disorder, movement disorders) contributes to the overall increased risk of NDDs. Further investigations are needed. Alternative therapeutic options and the need for effective contraception should be discussed with male patients of reproductive potential, at least annually (see section 4.4).

#### Congenital malformations from in utero exposure:

A meta-analysis (including registries and cohort studies) showed that about 11% of children of epileptic women exposed to valproate monotherapy during pregnancy had major congenital malformations. This is greater than the risk of major malformations in the general population (about 2-3%). The risk of major congenital malformations in children after *in utero* exposure to anti-epileptic polytherapy including valproate is higher than that of anti-epileptic drugs polytherapy not including valproate. This risk is dose-dependent in valproate monotherapy, and available data suggest it is dose-dependent in valproate polytherapy. However, a threshold dose below which no risk exists cannot be established.

Available data show an increased incidence of minor or major malformations. The most common include: neural tube defects, facial dysmorphism, cleft lip palate, craniostenosis, cardiac, renal and urogenital defects, limb defects (including bilateral aplasia of the radius), and multiple anomalies involving various body systems.

*In utero* exposure to valproate may also result in hearing impairment/loss due to ear and/or nose malformations (secondary effect) and/or to direct toxicity on the hearing function. Cases describe both unilateral and bilateral deafness or hearing impairment. Outcomes were not reported for all cases. When outcomes were reported the majority of the cases had not resolved. Monitoring of signs and symptoms of ototoxicity is recommended.

*In utero* exposure to valproate may result in eye malformations (including colobomas, microphthalmos). These have been reported in conjunction with other congenital malformations. These eye malformations may affect vision.

Data has shown an incidence of congenital malformations in children born to epileptic women exposed to valproate monotherapy during pregnancy. This is a greater risk of major malformations than for the general population. Women treated with Epilim IV have a potentially increased risk of giving birth to a baby with an abnormality due to the higher  $C_{max}$  of the

intravenous formulation compared with the oral formulation. Mothers taking more than one anticonvulsant medicine might have a higher risk of having a baby with a malformation than mothers taking one medicine.

Sodium valproate (valproic acid), if taken in the first trimester of pregnancy, is suspected of causing an increased risk of neural tube defects (especially spina bifida) in the exposed foetus. This has been estimated to be in the region of 1-2%.

This risk is dose dependent but a threshold dose below which no risk exists cannot be established.

#### Neurodevelopment disorders from in utero exposure:

Data has shown that exposure to valproate *in utero* can have adverse effects on mental and physical development of the exposed children. The risk of neurodevelopmental disorders (including that of autism) seems to be dose-dependent when valproate is used in monotherapy but a threshold dose below which no risk exists, cannot be established based on data. When valproate is administered in polytherapy with other anti-epileptic drugs during pregnancy, the risks of neurodevelopment disorders in the offspring were also significantly increased as compared with those in children from general population or born to untreated epileptic mothers. The exact gestational period of risk for these effects is uncertain and the possibility of a risk throughout the entire pregnancy cannot be excluded.

When valproate is administered in monotherapy, studies in preschool children exposed *in utero* to valproate show that some children may experience delays in their early development such as talking and walking later, lower intellectual abilities, poor language skills (speaking and understanding) and memory problems.

Some data have suggested an association between *in utero* valproate exposure and the risk of impaired cognitive function, including developmental delay (frequently associated with craniofacial abnormalities), particularly of verbal IQ. IQ measured in school aged children with a history of valproate exposure *in utero*, was lower than those children exposed to other antiepileptics. Although the role of confounding factors cannot be excluded, there is evidence in children exposed to valproate that the risk of intellectual impairment may be independent from maternal IQ. There is limited data on the long term outcomes.

Developmental delay has been very rarely reported in children born to mothers with epilepsy. It is not possible to differentiate what may be due to genetic, social, environmental factors, maternal epilepsy or antiepileptic treatment.

Available data from a study conducted using registries in Denmark show that children exposed to valproate *in utero* are at increased risk of autistic spectrum disorder (approximately 3-fold) and childhood autism (approximately 5-fold) compared to the unexposed population in the study.

Available data from a study conducted using registries in Denmark show that children exposed to valproate *in utero* are at increased risk of developing symptoms of attention deficit/hyperactivity disorder (ADHD) (approximately 1.5-fold) compared to the unexposed population in the study.

## Valproate Therapy in Pregnancy

The enzyme inducing effect of valproate is appreciably less than that of certain other anticonvulsants and loss of efficacy of oral contraceptive agents does not appear to be a problem.

However, estrogen containing products, including estrogen containing hormonal contraceptives, may increase the clearance of valproate, which may result in decreased serum concentration of valproate and potentially decreased valproate efficacy. Prescribers should monitor clinical response (seizure control or mood control) when initiating, or discontinuing estrogen-containing products. Consider monitoring of valproate serum levels.

Women taking sodium valproate (valproic acid) who become or wish to become pregnant should be encouraged to consider routine ultrasound and amniocenteses for prenatal diagnosis of such abnormalities. As folic acid may have a role in the prevention of neural tube defects in infants of women taking antiepileptic therapy, such women are recommended to take folic acid supplementation (5mg daily) four weeks prior to and 12 weeks after conception.

Notwithstanding the potential risks, no sudden discontinuation of antiepileptic therapy should be undertaken, without reassessment of the risks and benefits, as this may lead to breakthrough seizures which could have serious consequences for both the mother and the foetus. If after careful evaluation of the risks and benefits, sodium valproate treatment is to be continued during pregnancy, it is recommended to use sodium valproate in divided doses over the day at the lowest effective dose. The use of a prolonged release formulation may be preferable to any other treatment form.

It is recommended that:

- in bipolar disorders indication, cessation of valproate therapy should be considered;
- women on antiepileptic drugs (AEDs) receive pre-pregnancy counselling with regard to the risk of foetal abnormalities;
- AEDs should be continued during pregnancy and monotherapy should be used if possible at the lowest effective dose as risk of abnormality is greater in women taking combined medication;
- If appropriate, folic acid supplementation (5mg) should be commenced four weeks prior to and continue for twelve weeks after conception as it may minimize the risk of neural tube defects;
- specialist prenatal diagnosis, including detailed mid-trimester ultrasound, should be offered in order to detect the possible occurrence of neural tube defects or other malformations.

Before Epilim is prescribed for use in women with epilepsy of any form, who could become pregnant, they should receive specialist advice. Due to the potential risks to the foetus, the benefits of its use should be weighed against the risks. When treatment with Epilim is deemed

necessary, precautions to minimise the potential teratogenic risk should be followed (see above recommendations).

### *If a woman plans a pregnancy*

For the epilepsy indication, if a woman is planning to become pregnant, a specialist experienced in the management of epilepsy must reassess the valproate therapy and consider alternative treatment options. Every effort should be made to switch to appropriate alternative treatment prior to conception, and before contraception is discontinued (see Section 4.4 Special Warnings and Precautions for Use). If switching is not possible, the woman should receive further counselling regarding the valproate risks for the unborn child to support her informed decision making regarding family planning.

For the bipolar disorder indication, if a woman is planning to become pregnant, a specialist experienced in the management of bipolar disorder must be consulted. Treatment with valproate should be discontinued prior to conception, and before contraception is discontinued. If needed, alternative treatment options should be considered.

Folate supplementation (5 mg daily) before the pregnancy may decrease the risk of neural tube defects which may occur in all pregnancies. However the available evidence does not suggest it prevents the birth defects or malformations due to valproate exposure.

### *Pregnant women*

Valproate as treatment for epilepsy is contraindicated in pregnancy unless there is no suitable alternative treatment (see Section 4.4 Special Warnings and Precautions for Use).

If a woman using valproate becomes pregnant, she must be immediately referred to a specialist to consider alternative treatment options. During pregnancy, maternal tonic clonic seizures and status epilepticus with hypoxia may carry a particular risk of death for mother and the unborn child

If, despite the known risks of valproate in pregnancy and after careful consideration of alternative treatment, in exceptional circumstances a pregnant woman must receive valproate for epilepsy, it is recommended to:

- Use the lowest effective dose and divide the daily dose of valproate into several small doses to be taken throughout the day

Valproate as treatment for bipolar disorder is contraindicated for use during pregnancy.

All patients with a valproate exposed pregnancy and their partners should be referred to a specialist experienced in pre-natal medicine for evaluation and counselling regarding the exposed pregnancy.

Specialised prenatal monitoring should take place to detect the possible occurrence of neural tube defects or other malformations.

Folate supplementation (5 mg daily) before the pregnancy may decrease the risk of neural tube defects which may occur in all pregnancies. However the available evidence does not suggest it prevents the birth defects or malformations due to valproate exposure.

### Risk in neonate

There have been rare reports of haemorrhagic syndrome in neonates whose mothers have taken sodium valproate during pregnancy. This syndrome is related to thrombocytopenia, hypofibrinaemia and/or to a decrease in other coagulation factors. Afibrinaemia has also been reported and may be fatal. Hypofibrinaemia is possibly associated with a decrease of coagulation factors. Phenobarbital and other enzyme inducers may also induce haemorrhagic syndrome as they decrease the vitamin-K factors. Platelet count, fibrinogen plasma level and coagulation status should be investigated in neonates.

Cases of hypoglycaemia have been reported in neonates whose mothers have taken valproate during the third trimester of the pregnancy.

Cases of hypothyroidism have been reported in neonates whose mothers have taken valproate during pregnancy.

Withdrawal syndrome (such as, in particular, agitation, irritability, hyperexcitability, jitteriness, hyperkinesia, tonic disorders, tremor, convulsions and feeding disorders) may occur in neonates whose mothers have taken valproate during the last trimester of pregnancy.

### ***Use in lactation***

Epilim is excreted in breast milk. Concentrations in breast milk have been reported to be 1 to 10% of serum concentration. It is not known what effect this would have on a breast-fed infant. As a general rule, breastfeeding should not be undertaken whilst a patient is receiving Epilim.

## **4.7 EFFECTS ON ABILITY TO DRIVE AND USE MACHINES**

Use of Epilim may provide seizure control such that the patient may be eligible to hold a driving licence. However, patients should be warned of the risk of drowsiness, especially in cases of anticonvulsant polytherapy, too high a starting dose, too rapid a dose escalation or when used in association with benzodiazepines.

## **4.8 UNDESIRABLE EFFECTS**

### ***In Bipolar Disorder***

No new or unexpected adverse events have been reported in clinical trials of Epilim in mania. The frequencies of adverse events (%) reported on valproate (as divalproex) in the largest controlled clinical trial described under Section 5.2 Pharmacokinetic Properties are summarised in [Table 1](#).

**Table 1 - Adverse events reported on divalproex in the Bowden et al. study (1994)**

Adverse event	Bowden <i>et al.</i> 1994		
	VPA* n = 69	Lithium n = 36	Placebo n = 74
Body as a whole			
Pain	19	3	20
Asthenia	13	19	9
Fever	1	14	4
Gastrointestinal			
Nausea	23	31	15
Diarrhoea	12	14	18
Vomiting	14	25	4
Constipation	10	17	7
Nervous system			
Headache	22	39	32
Somnolence/Sedation/ Fatigue	19	19	15
Twitching	3	8	0

Adverse events reported at a frequency: >15% or significantly different between treatment groups, or > 5% or common events to other study (no events significantly more frequent in this study).

\*VPA as divalproex

In this study, there were differences with placebo for vomiting only for divalproex (45% vs 14%), fever was more common for lithium (14%) than for divalproex (1%) and placebo (4%), pain was less common with lithium (3%) than with either divalproex (19%) or placebo (20%).

### **List of adverse effects by system organ class**

The following CIOMS frequency rating is used:

*very common* ≥ 1/10 (≥ 10%)  
*common* ≥ 1/100 and < 1/10 (≥ 1% and < 10%)  
*uncommon* ≥ 1/1000 and < 1/100 (≥ 0.1% and < 1.0%)  
*rare* ≥ 1/10,000 and < 1/1000 (≥ 0.01% and < 0.1%)  
*very rare* < 1/10,000 (< 0.01%)

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

Myelodysplastic syndrome is rare.

### Blood and lymphatic system disorders

Valproic acid inhibits the second stage of platelet aggregation. Reversible prolongation of bleeding time, as well as thrombocytopenia, have been reported but have usually been associated with doses above those recommended (see Section 4.4 Special Warnings and Precautions for Use).

Common cases of thrombocytopaenia and anaemia have been reported.

Uncommon cases of leucopenia and pancytopenia with or without bone marrow depression have been reported.

Bone marrow failure, including pure red cell aplasia, agranulocytosis, anaemia macrocytic and macrocytosis have rarely been reported.

Isolated cases of decreased blood fibrinogen and prolonged prothrombin time have been reported.

Spontaneous bruising or bleeding is an indication for withdrawal of medication pending investigation (see Section 4.4 Special Warnings and Precautions for Use).

Red cell hypoplasia, neutropenia and leucopenia have also been reported. In most cases the blood picture returned to normal when the medicine was discontinued.

### Immune system disorders

Angioedema, Drug Rash with Eosinophilia and Systemic Symptoms (DRESS) syndrome and allergic reactions have been observed.

### Endocrine disorders

Hyperandrogenism (hirsutism, virilism, acne, male pattern alopecia, and/or androgen increased) and Syndrome of Inappropriate Secretion of ADH (SIADH) is uncommon.

Hypothyroidism is rare.

### Metabolism and nutrition disorders

Common cases of hyponatremia have been reported.

Increased weight is common and since this is a risk factor for polycystic ovary syndrome, it should be carefully monitored.

Obesity has been reported rarely. Hyperammonaemia is rare. This has been reported in association with valproate therapy and may be present despite normal liver function tests. Isolated and moderate hyperammonaemia may occur frequently and should not cause treatment discontinuation.

Hyperammonaemia associated with neurological symptoms has been reported. In patients who develop unexplained lethargy and vomiting or changes in mental status, further investigations and hyperammonaemic encephalopathy should be considered. In these patients, EEG and ammonia level should be checked and, if ammonia is increased, valproate therapy should be discontinued. Appropriate interventions for treatment of hyperammonaemia should be initiated, and such patients should undergo investigation for underlying urea cycle disorders (see Section 4.4 Special Warnings and Precautions for Use).

Not known: hypocarnitinemia (see Sections 4.3 Contraindications and 4.4 Special Warnings and Precautions for Use).

Asymptomatic elevations of ammonia are more common and, when present, require close monitoring of plasma ammonia levels. If the elevation is significant (above 3N) and persists, discontinuation of valproate therapy should be considered.

#### Psychiatric disorders

Confusional state, hallucinations, aggression, agitation and disturbance in attention are common.

Abnormal behaviour, psychomotor hyperactivity and learning disorder are rare.

#### Paediatric population

The safety profile of valproate in the paediatric population is comparable to adults, but some adverse reactions are more severe or principally observed in the paediatric population. There is a particular risk of severe liver damage in infants and young children especially under the age of 3 years. Young children are also at particular risk of pancreatitis. These risks decrease with increasing age (see Section 4.4 Special Warnings and Precautions for Use). Psychiatric disorders such as aggression, agitation, disturbance in attention, abnormal behaviour, psychomotor hyperactivity and learning disorder are principally observed in the paediatric population.

#### Nervous system disorders

The true incidence of drowsiness and sedation with Epilim is difficult to assess, as mostly it was administered in combination with other medicines. Epilim, however, may have an intrinsic sedative action in addition to potentiating sedative effects of other anticonvulsants (e.g. barbiturates, clonazepam) and CNS depressants, including alcohol. In monotherapy, sedation occurred early in treatment on rare occasions and is usually transient.

Very common cases of tremor have been reported.

Common cases of stupor, somnolence, convulsion, memory impairment, headache, nystagmus and dizziness have been reported.

When using Epilim intravenously, dizziness may occur within a few minutes after injection; it disappears spontaneously within a few minutes.



Common cases of extrapyramidal disorder which may not be reversible, including reversible parkinsonism has been reported.

Uncommon cases of ataxia, coma, encephalopathy, aggravated convulsions (see Section 4.4 Special Warnings and Precautions for Use), lethargy and paresthesia have been reported.

Diplopia and depression have occurred rarely and usually in association with other anticonvulsants. Excitement, alertness, hyperactivity and behavioural disorders have been rarely reported, usually in children at the start of treatment.

Rare cases of reversible dementia associated with reversible cerebral atrophy and cognitive disorder have been reported.

A few cases of stupor and lethargy sometimes leading to transient coma (encephalopathy) have been reported. They were isolated or associated with an increase in the occurrence of convulsions whilst on therapy, and they decreased on withdrawal of treatment or reduction of dosage. These cases mostly occurred during combined therapy (in particular with phenobarbital or topiramate) or after a sudden increase in valproate doses.

#### Eye Disorders

Not known: diplopia

#### Ear and labyrinth disorders

Deafness, either reversible or irreversible, has been reported commonly.

#### Vascular disorders

Haemorrhage is common and the occurrence of vasculitis is uncommon.

#### Respiratory, thoracic and mediastinal disorders

Pleural effusion has uncommonly been reported.

#### Gastrointestinal disorders

Nausea is very common.

Upper abdominal pain, vomiting, diarrhoea, gingival disorder (mainly gingival hyperplasia) and stomatitis are common and frequently occur at the start of treatment and usually disappear after a few days without discontinuing treatment.

Vomiting, abdominal cramp, upper abdominal pain, anorexia, increased appetite and diarrhoea are usually transient and rarely require discontinuation of therapy or limitation of dose.

The overall incidence of adverse GI effects are reported to be 9 to 16% in adults and over 22% in children when plain tablets are prescribed. GI side effects may be minimised by taking the tablets with or after food or by substituting the enteric-coated tablets. As some of these symptoms may also indicate early stage hepatic dysfunction, patients should be monitored closely for the appearance of these symptoms. Patients should be instructed to report such signs to the clinician for investigation should they occur (see Section 4.4 Special Warnings and Precautions for Use).

There have been uncommon reports of pancreatitis, sometimes lethal, occurring in patients receiving valproic acid or sodium valproate, usually within the first 6 months of therapy. Patients experiencing acute abdominal pain should have their serum amylase estimated promptly; if these levels are elevated the medicine should be withdrawn (see Section 4.4 Special Warnings and Precautions for Use).

### Hepatobiliary disorders

Liver injury is common.

Hepatic dysfunction, including hepatic failure resulting in fatalities, has occurred in patients whose treatment included valproic acid or sodium valproate/valproic acid (see Section 4.4 Special Warnings and Precautions for Use).

Concomitant valproate and cannabidiol can cause elevations of ALT and AST greater than 3 times the upper limit of normal (see section 4.4 Special Warnings and Precautions for Use and section 4.5 Interactions with Other Medicines and Other Forms of Interactions).

### Skin and subcutaneous tissue disorders

Hypersensitivity and transient and/or dose related alopecia has been observed commonly. Nail and nail bed disorders have been commonly reported.

Angioedema, rash and hair disorder (such as hair texture abnormal, hair colour changes, hair growth abnormal) are uncommon.

Hirsutism, acne and male pattern alopecia are uncommon (see Section 4.8 Undesirable Effects - List of adverse effects by system organ class - Endocrine disorders).

Toxic epidermal necrolysis, Stevens-Johnson syndrome, Drug Rash with Eosinophilia and Systemic Symptoms (DRESS) syndrome and erythema multiforme have been reported rarely.

Caution should be observed when using the medicine in patients with systemic lupus erythematosus.

### Musculoskeletal and connective tissue disorders

Decreased bone mineral density, osteopenia, osteoporosis and fractures in patients on long-term therapy with valproate have been uncommon. The mechanism by which valproate affects bone metabolism has not been identified.

Systemic lupus erythematosus and rhabdomyolysis are rare.

#### Renal and urinary disorders

Urinary incontinence is common.

Renal failure is uncommon.

Rare cases of enuresis and tubulointerstitial nephritis have been reported.

Rare cases of reversible Fanconi's syndrome associated with valproate therapy have been reported but the mode of action is as yet unclear.

#### Reproductive system and breast disorders

Dysmenorrhoea is common and amenorrhoea is uncommon.

There have been rare reports of male infertility and polycystic ovaries.

There have been reports of irregular menses and secondary amenorrhoea and rare cases of breast enlargement and galactorrhoea.

#### General disorders and administration site conditions

Non-severe peripheral oedema and hypothermia are uncommon.

Oedema has been reported. Increase in appetite may occur.

#### Investigations

Coagulation factors decreased, abnormal coagulation tests (such as prolonged prothrombin time, activated partial thromboplastin time, thrombin time and INR) and biotin deficiency/biotinidase deficiency have rarely been reported.

#### ***Reporting of suspected adverse reactions***

Reporting suspected adverse reactions after authorisation of the medicine is important. It allows continued monitoring of the benefit/risk balance of the medicine. Healthcare professionals are asked to report any suspected adverse reactions <https://nzphvc.otago.ac.nz/reporting/>.

## **4.9 OVERDOSE**

Cases of accidental and suicidal overdosage have been reported. Fatalities are rare.

## **Symptoms**

At plasma concentrations of up to 5 or 6 times the maximum therapeutic levels, there are unlikely to be any symptoms other than nausea, vomiting and dizziness.

Symptoms of overdose may include serious CNS depression and impairment of respiration. In cases of overdose, long half-lives up to 30 hours have been reported. Signs of an acute massive overdose usually include coma, with muscular hypotonia, hyporeflexia and miosis, impaired respiratory functions and metabolic acidosis, hypotension and circulatory collapse/shock. Symptoms may however be variable and seizures have been reported in the presence of very high plasma levels. Cases of intracranial hypertension related to cerebral oedema have been reported. Deaths have occurred following massive overdose. Hospital management of overdose including assisted ventilation and other supportive measures are recommended. The presence of sodium content in the valproate formulations may lead to hypernatraemia when taken in overdose.

## **Treatment**

Provided that adequate supportive treatment is given, full recovery usually occurs. Particular attention should be given to the maintenance of an adequate urinary output. Hepatic and pancreatic function should be monitored.

Contact the Poisons Information Centre on 0800 POISON or 0800 764 766 for advice on management of overdose.

# **5 PHARMACOLOGICAL PROPERTIES**

## **5.1 PHARMACODYNAMIC PROPERTIES**

Pharmacotherapeutic group: Antiepileptics, ATC Code: N03AG01

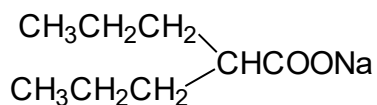
### **Chemical Name**

Sodium Valproate

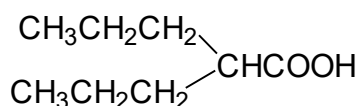
Sodium di-n-propylacetic acid

## **Chemical structure**

### Sodium di-n-propylacetic acid



### Valproic acid



## **CAS Registry Number**

Sodium valproate: 1069-66-5

Valproic acid: 99-66-1

## **Description**

Sodium valproate is a white, odourless, crystalline powder with a saline taste. It is highly soluble in water and alcohol. Its molecular weight is 166. It is quite dissimilar to other established anticonvulsants such as barbiturates, hydantoins, succinamides, oxazolidinediones and acetylureas in that it has no nitrogen or aromatic moiety.

Valproic acid is a colourless to pale yellow, viscous liquid. It is slightly soluble in water (1.2 mg/mL); fully soluble in acetone, chloroform, ether and methyl alcohol. Its molecular weight is 144.

## **Mechanism of Action**

The mode of action of Epilim has not been fully established. Its anticonvulsant effect is attributed to the blockade of voltage dependent Na<sup>+</sup> channels and increased brain levels of  $\gamma$ -aminobutyric acid (GABA). The GABA-ergic effect is also believed to possibly contribute towards the antimanic properties of sodium valproate/valproic acid.

In animals, Epilim raises cerebral and cerebellar levels of the inhibitory synaptic transmitter, GABA, possibly by inhibiting GABA degradative enzymes, such as GABA transaminase and/or succinic semialdehyde dehydrogenase and/or by inhibiting the reuptake of GABA by neuronal cells.

Epilim exhibits marked anticonvulsant activity in animals, demonstrated by the various tests used to detect antiepileptic activity.

Epilim appears to have no significant hypnotic effect (an incidence of about 0.2% was noted for drowsiness in a survey of unwanted effects), nor does it have any significant action on the autonomic nervous system, respiration, blood pressure, renal function or body temperature. It does have a spasmolytic action on the isolated ileum preparation but no effect on the nictitating membrane.

### ***Pharmacodynamic effects***

#### In epilepsy

Epilim has been shown to be effective in the treatment of absence seizures (petit mal), tonic-clonic seizures (grand mal) and myoclonic seizures. It has also been shown to be effective in patients with partial (focal) seizures. Epilim appears to have less sedative effect than conventional antiepileptic drugs and this, together with the reduction in fit frequency in children, has often led to improvements in alertness and performance in school.

#### In bipolar disorder

In one study valproate has been shown to be significantly more effective than placebo in the treatment of acute mania and has been reported to be comparable to lithium. Potential medicine interactions likely to be relevant to valproate in the management of patients with mania are outlined under Interactions with other medicines. Although the dosage of sodium valproate/valproic acid varied considerably among the controlled studies, a fixed initial dose was used after which dosage was determined by serum levels.

### ***Clinical Trials***

#### In epilepsy

Epilim's efficacy in this therapeutic indication is widely known and recognised.

#### In bipolar disorder

There have been at least five double-blind trials comparing sodium valproate or the bioequivalent active, divalproex sodium with either placebo and/or lithium in the treatment of mania. Only one of these trials was of adequate size. Bowden et al (1994) demonstrated most convincingly the superior effectiveness of valproate as compared to placebo in the treatment of acute mania. Marked improvement, defined as at least 50% improvement on the Manic Syndrome Subscale of the Mania Rating Scale occurred in 48% of valproate-treated patients and 25% of placebo-treated patients respectively (p=0.0040). Comparable efficacy to lithium in this study was reported. Marked improvement, defined as at least 50% improvement on the Manic Syndrome Subscale of the Mania Rating Scale, occurred in a similar number of patients receiving sodium valproate and lithium, 48% and 49% respectively.

## 5.2 PHARMACOKINETIC PROPERTIES

### **Absorption**

#### IV

The pharmacokinetic profile of Epilim IV powder for injection with diluent differs from that of oral Epilim preparations. As expected, after intravenous and oral dosage (enteric-coated tablets) of Epilim (400 mg), T<sub>max</sub> is reached sooner following intravenous administration ( $7.3 \pm 2.6$  min) than after oral administration ( $227.7 \pm 59.2$  min) and C<sub>max</sub> is higher after intravenous dosage ( $55.4 \pm 9.38$  microgram/mL) than after oral administration ( $39.1 \pm 3.51$  microgram/mL). The bioavailability of Epilim enteric-coated (EC) tablets is only slightly less than that of intravenous Epilim with a mean AUC ratio of 100:87 for intravenous to oral forms respectively. The distribution, metabolism, excretion and elimination of intravenous Epilim are not different to orally administered Epilim.

In most adult patients, daily doses of 1,200 to 1,500 mg result in therapeutic plasma levels of 50 to 100 microgram/mL (0.35 to 0.69 mmol/L). However, correlation between the daily dose per bodyweight and plasma levels of drug has been poor.

### **Distribution**

Distribution of sodium valproate/valproic acid is rapid and most likely restricted to the circulation and rapidly exchangeable extracellular water. CSF and breast milk levels were found to be 5 to 15% and about 1 to 10% of plasma levels, respectively.

Valproic acid shows non-linear kinetics, due to concentration-dependent plasma protein binding as well as a relatively short half-life. The half-life of sodium valproate/valproic acid is usually reported to be within the range 8-20 hours. It is usually shorter in children.

Epilim is approximately 90% bound to plasma proteins but only 60% to albumin. However, if the plasma level of valproic acid rises above 120 microgram/mL or if the serum albumin concentration is lowered, the binding sites may become saturated, causing the amount of free drug to rise rapidly, out of proportion to any increase in dosage. Epilim may displace phenobarbital or phenytoin from plasma protein binding sites.

Saliva levels of Epilim are poorly correlated with those in plasma in contrast to the good correlation found for other antiepileptics.

Placental transfer (see Section 4.6 Fertility, Pregnancy and Lactation)

Valproate crosses the placental barrier in animal species and in humans:

- In animal species, valproate crosses the placenta, to a similar extent as in humans.
- In humans, several publications assessed the concentration of valproate in the umbilical cord of neonates at delivery. Valproate serum concentration in the umbilical cord, representing that in the fetuses, was similar to or slightly higher than that in the mothers.

## **Metabolism**

Its metabolism is complex; the major elimination pathway is via glucuronidation (40-60%). The remainder is largely metabolised via oxidation pathways,  $\beta$ -oxidation accounting for 30-40% and  $\omega$ -oxidation (cytochrome P450 dependent), the remaining fraction. Only 1 to 3% of the ingested dose is found to be excreted unchanged in the urine.

## **Excretion**

Sodium valproate and valproic acid are almost completely metabolised prior to excretion. Plasma half-life is variable but generally appears to be 8 to 12 hours (range 3.84 to 15.77 hours) in adults. It may be shorter in patients receiving other anticonvulsants and patients receiving the medicine for long periods. In cases of overdose, long half-lives up to 30 hours have been reported. Antipsychotic agents or antidepressants including MAOIs, tricyclics and SSRIs co-administered with sodium valproate/valproic acid may result in competitive metabolism or enzyme inhibition, thereby increasing valproate levels (see Section 4.5 Interaction with Other Medicines and Other Forms of Interaction).

## **Children and adolescents**

In paediatric patients below the age of 10 years, the systemic clearance of valproate varies with age. In neonates and infants up to 2 months of age, valproate clearance is decreased when compared to adults and is lowest directly after birth. In a review of the scientific literature, valproate half-life in infants under two months showed considerable variability ranging from 10 to 67 hours. In children aged 2-10 years, valproate clearance is 50% higher than in adults. Above the age of 10 years, children and adolescents have valproate clearances similar to those reported in adults.

## **5.3 PRECLINICAL SAFETY DATA**

### **Genotoxicity**

Valproate was not mutagenic in bacteria (Ames test), or mouse lymphoma L5178Y cells at thymidine kinase locus (mouse lymphoma assay), and did not induce DNA repair activity in primary culture of rat hepatocytes. After oral administration, valproate did not induce either chromosome aberrations in rat bone marrow, or dominant lethal effects in mice.

Statistically significant higher incidences of sister-chromatid exchange (SCE) have been observed in patients exposed to valproate as compared to healthy subjects not exposed to valproate. However, these data may have been impacted by confounding factors. Two published studies examining SCE frequency in epileptic patients treated with valproate versus untreated epileptic patients, provided contradictory results. The biological significance of an increase in SCE frequency is not known.



## ***Carcinogenicity***

Sodium valproate/valproic acid was administered in the diet to Sprague-Dawley rats and ICR (HA/ICR) mice at approximate dosage levels of 0, 80 and 160 mg/kg/day for up to 2 years. There was equivocal evidence of an increased incidence of subcutaneous fibrosarcomas in male rats and of bronchoalveolar adenomas in male mice. The presence of these tumours was not considered to be biologically significant because of the published variable incidence of spontaneously occurring fibrosarcomas and pulmonary adenomas in rats and mice respectively and the fact that statistical significance of tumour incidence was only attained in males. The significance of these findings for humans is unknown at present.

## ***Toxicology***

No significant toxic effects were seen in rats receiving 270 mg/kg/day for 3 months or in dogs receiving 90 mg/kg/day for 12 months. At higher doses sedation, ataxia and various histopathological effects (testicular atrophy and reduction in lymphoid tissue) were observed at levels of 256 to 568 microgram/mL (1.78 to 3.94 mmol/L).

## ***Testicular Function***

In sub-chronic/chronic toxicity studies, testicular degeneration/atrophy or spermatogenesis abnormalities and a decrease in testes weight were reported in adult rats and dogs after oral administration of valproate starting at doses of 400 mg/kg/day and 150 mg/kg/day, respectively with associated NOAELs for testis findings of 270 mg/kg/day in adult rats and 90 mg/kg/day in adult dogs.

In a fertility study in rats, valproate at doses up to 350 mg/kg/day did not alter male reproductive performance.

In juvenile rats, a decrease in testes weight and testicular degeneration were observed at doses that also elicited substantial general systemic toxicity. The relevance of the testicular findings to the paediatric population is unknown because the fertility of animals exposed to valproate as pre-pubertal juveniles has not been investigated.

# **6 PHARMACEUTICAL PARTICULARS**

## **6.1 LIST OF EXCIPIENTS**

### ***Intravenous***

Diluent: water for injection.

## **6.2 INCOMPATIBILITIES**

Epilim IV should not be administered via the same line as other IV additives.

## **6.3 SHELF LIFE**

Intravenous: 36 months

## **6.4 SPECIAL PRECAUTIONS FOR STORAGE**

### ***Intravenous***

Store in a dry place below 30°C.

For intravenous use, the reconstituted solution should be used as soon as practicable after reconstitution, to reduce microbiological hazard. If storage is necessary hold at 2 to 8°C for not more than 24 hours and discard any remaining solution.

When stored under 30°C, after product reconstitution, the solution may be clear to slightly opalescent.

## **6.5 NATURE AND CONTENTS OF CONTAINER**

### ***Intravenous Solution for Injection***

Epilim IV powder for injection is presented in single packs. Each pack contains one glass vial of 400 mg sodium valproate freeze-dried powder and one glass ampoule containing 4 mL of solvent (water for injections).

## **6.6 SPECIAL PRECAUTIONS FOR DISPOSAL**

No special requirements. Any unused medicine or waste material should be disposed of in accordance with local requirements.

## **7 MEDICINE SCHEDULE**

Prescription Medicine

## 8 SPONSOR

### NEW ZEALAND

Pharmacy Retailing (NZ) Ltd t/a Healthcare Logistics

PO Box 62027

Sylvia Park Auckland 1644

Freecall: 0800 283 684

Email: [medinfo.australia@sanofi.com](mailto:medinfo.australia@sanofi.com)

## 9 DATE OF FIRST APPROVAL

11 October 1977

## 10 DATE OF REVISION OF THE TEXT

22 May 2023

### **SUMMARY TABLE OF CHANGES**

Section	Change
4.4	To add risk of neurodevelopmental disorders (NDD) including autism spectrum disorders (ASD) after paternal exposure to valproate
4.6	To add risk of neurodevelopmental disorders (NDD) including autism spectrum disorders (ASD) after paternal exposure to valproate
5.3	To amend nonclinical testicular findings.