

NEW ZEALAND DATA SHEET

1. ERLOTINIB 25 mg, 50 mg, 100 mg and 150 mg film coated tablets

Erlotinib 25 mg, 50 mg, 100 mg and 150 mg film coated tablets

The 25 mg and 50 mg strengths are currently not available in New Zealand.

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Erlotinib film coated tablets come in 4 dosage strengths containing erlotinib hydrochloride equivalent to 25 mg, 50 mg, 100 mg or 150 mg of erlotinib.

Excipients with known effect

Each 25 mg film-coated tablet contains 23.98 mg Lactose monohydrate.

Each 50 mg film-coated tablet contains 43.97 mg Lactose monohydrate.

Each 100 mg film-coated tablet contains 95.93 mg Lactose monohydrate.

Each 150 mg film-coated tablet contains 143.90 mg Lactose monohydrate.

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

Erlotinib 25 mg film-coated tablets are round, biconvex, white to yellowish tablets marked with “25” engraved on one side. The diameter of the tablet is 6.1 mm ± 5%.

Erlotinib 50 mg film-coated tablets are round, biconvex, white to yellowish tablets marked with “50” engraved on one side. The diameter of the tablet is 7.6 mm ± 5%.

Erlotinib 100 mg film-coated tablets are round, biconvex, white to yellowish tablets marked with “100” engraved on one side. The diameter of the tablet is 8.9 mm ± 5%.

Erlotinib 150 mg film-coated tablets are round, biconvex, white to yellowish tablets marked with “150” engraved on one side. The diameter of the tablet is 10.5 mm ± 5%.

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

Non-small cell lung cancer

Erlotinib is indicated for the first-line and maintenance treatment of patients with advanced (Stage IIIB) or metastatic (Stage IV) non-small cell lung cancer (NSCLC) with activating EGFR mutations.

Erlotinib is also indicated for the treatment of patients with locally advanced or metastatic NSCLC who have previously received chemotherapy.

Pancreatic cancer

Erlotinib in combination with gemcitabine is indicated for the treatment of patients with locally advanced, unresectable or metastatic pancreatic cancer.

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4.2 Dose and method of administration

Non-small cell lung cancer

It is recommended that EGFR mutation testing should be performed prior to initiation of erlotinib therapy in chemo-naïve patients with advanced or metastatic NSCLC. A well- validated and robust test for activating EGFR mutations should be used.

The recommended daily dose of erlotinib is 150 mg taken at least one hour before or two hours after the ingestion of food.

Pancreatic cancer

The recommended daily dose of erlotinib is 100 mg taken at least one hour before or two hours after the ingestion of food, in combination with gemcitabine (see the gemcitabine prescribing information for the correct dosage of gemcitabine in pancreatic cancer).

Special Dosage Instructions

Medicine interactions

Concomitant use of CYP 3A4 substrates and modulators may require dose adjustment (see section 4.5).

When dose adjustment is necessary, it is recommended to reduce the dose in 50 mg increments (see sections 4.5).

Hepatic impairment

Erlotinib is eliminated by hepatic metabolism and biliary excretion. Although erlotinib exposure was similar in patients with moderately impaired hepatic function (Child-Pugh score 7-9) compared with patients with adequate hepatic function, caution should be used when administering erlotinib to patients with hepatic impairment. Dose reduction or interruption of erlotinib should be considered if severe adverse reactions occur.

Safety and efficacy have not been studied in patients with severe hepatic impairment (see sections 4.4 and 5.2).

Renal impairment

The safety and efficacy of erlotinib has not been studied in patients with renal impairment (see section 5.2).

Paediatric use

The safety and efficacy of erlotinib in the approved indications has not been established in patients under the age of 18 years.

Smokers

Cigarette smoking has been shown to reduce erlotinib exposure by 50 - 60%. The maximum tolerated dose of erlotinib in NSCLC patients who currently smoke cigarettes was 300 mg. The 300 mg dose did not show improved efficacy in second line treatment after failure of chemotherapy compared to the recommended 150 mg dose in patients who continue to smoke cigarettes (See sections 4.5 and 5.2).

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4.3 Contraindications

Erlotinib is contraindicated in patients with severe hypersensitivity to erlotinib or to any of the excipients listed in section 6.1.

4.4 Special warnings and precautions for use

Interstitial lung disease

Cases of interstitial lung disease (ILD)-like events, including fatalities, have been reported uncommonly in patients receiving erlotinib for treatment of non-small cell lung cancer (NSCLC), pancreatic cancer or other advanced solid tumours. In the pivotal study BR.21 in NSCLC, the incidence of serious ILD-like events was 0.8% in each of the placebo and erlotinib arms.

In a meta-analysis of NSCLC randomized controlled clinical trials, the incidence of ILD-like events was 0.9% on erlotinib compared to 0.4% in patients in the control arms.

In the pancreatic cancer study in combination with gemcitabine, the incidence of ILD-like events was 2.5% in the erlotinib plus gemcitabine group versus 0.4% in the placebo plus gemcitabine treated group.

Some examples of reported diagnoses in patients suspected of having ILD-like events include pneumonitis, radiation pneumonitis, hypersensitivity pneumonitis, interstitial pneumonia, interstitial lung disease, obliterative bronchiolitis, pulmonary fibrosis, Acute Respiratory Distress Syndrome, lung infiltration and alveolitis. These ILD-like events started from a few days to several months after initiating erlotinib therapy. Most of the cases were associated with confounding or contributing factors such as concomitant or prior chemotherapy, prior radiotherapy, pre-existing parenchymal lung disease, metastatic lung disease or pulmonary infections.

In patients who develop acute onset of new and/or progressive unexplained pulmonary symptoms, such as dyspnoea, cough and fever, erlotinib therapy should be interrupted pending diagnostic evaluation. If ILD is diagnosed, erlotinib should be discontinued and appropriate treatment initiated as necessary (see section 4.8).

Diarrhoea, dehydration, electrolyte imbalance and renal failure

Diarrhoea has occurred in patients on erlotinib and moderate or severe diarrhoea should be treated with loperamide. In some cases, dose reduction may be necessary. In the event of severe or persistent diarrhoea, nausea, anorexia or vomiting associated with dehydration, erlotinib therapy should be interrupted and appropriate measures should be taken to treat the dehydration (see section 4.8).

There have been rare reports of hypokalaemia and renal failure (including fatalities). Some reports of renal failure were secondary to severe dehydration due to diarrhoea, vomiting and/or anorexia while others were confounded by concomitant chemotherapy. In more severe or persistent cases of diarrhoea, or cases leading to dehydration, particularly in groups of patients with aggravating risk factors (concomitant medications, symptoms or diseases or other predisposing conditions including advanced age), erlotinib therapy should be interrupted and appropriate measures should be taken to intensively rehydrate the patients intravenously. In addition, renal function and serum electrolytes including potassium should be monitored in patients at risk of dehydration.

Hepatitis, hepatic failure

Rare cases of hepatic failure (including fatalities) have been reported during use of erlotinib. Confounding factors have included pre-existing liver disease or concomitant hepatotoxic medications.

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Therefore in such patients, periodic liver function testing should be considered. Erlotinib dosing should be interrupted if changes in liver function are severe.

Gastrointestinal perforation

Patients receiving erlotinib are at increased risk of developing gastrointestinal perforation, which was observed uncommonly (including some cases with a fatal outcome). Patients receiving concomitant anti-angiogenic agents, corticosteroids, NSAIDs and/or taxane based chemotherapy, or who have prior history of peptic ulceration or diverticular disease are at increased risk. Erlotinib should be permanently discontinued in patients who develop gastrointestinal perforation (see section 4.8).

Bullous and exfoliative skin disorders

Bullous, blistering and exfoliative skin conditions have been reported, including very rare cases suggestive of Stevens-Johnson syndrome/toxic epidermal necrolysis, which in some cases were fatal (see section 4.8). Erlotinib treatment should be interrupted or discontinued if the patient develops severe bullous, blistering or exfoliating conditions.

Ocular disorders

Very rare cases of corneal perforation or ulceration have been reported during use of erlotinib. Other ocular disorders including abnormal eyelash growth, keratoconjunctivitis sicca or keratitis have been observed with erlotinib treatment which are also risk factors for corneal perforation/ulceration. Erlotinib therapy should be interrupted or discontinued if patients present with acute/worsening ocular disorders such as eye pain (see section 4.8).

Medicine interactions

Erlotinib has a potential for clinically significant medicine-medicine interactions (see section 4.5).

4.5 Interaction with other medicines and other forms of interaction

Erlotinib is metabolised in the liver by the hepatic cytochromes in humans, primarily CYP3A4 and to a lesser extent by CYP1A2 and the pulmonary isoform CYP1A1. Potential interactions may occur with medicines which are metabolised by, or are inhibitors or inducers of, these enzymes.

Potent inhibitors of CYP3A4 activity decrease erlotinib metabolism and increase erlotinib plasma concentrations. Inhibition of CYP3A4 metabolism by ketoconazole (200 mg orally bd for 5 days) resulted in increased exposure to erlotinib (86% in median erlotinib exposure [AUC]) and a 69% increase in maximum concentration (C_{max}) when compared to erlotinib alone. When erlotinib was co-administered with ciprofloxacin, an inhibitor of both CYP3A4 and CYP1A2, the erlotinib exposure [AUC] and C_{max} increased by 39% and 17%, respectively. Therefore caution should be used when administering erlotinib with potent CYP3A4 (or combined CYP3A4/CYP1A2) inhibitors. In these situations, the dose of erlotinib should be reduced if toxicity is observed.

Potent inducers of CYP3A4 activity increase erlotinib metabolism and significantly decrease erlotinib plasma concentrations. Induction of CYP3A4 metabolism by rifampicin (600 mg orally, daily for 7 days) resulted in a 69% decrease in the median erlotinib AUC, following a 150 mg dose of erlotinib as compared to erlotinib alone.

Pre-treatment and co-administration of rifampicin with a single 450 mg dose of erlotinib resulted in a decreased mean erlotinib exposure [AUC], which was 57.5% of a single 150 mg erlotinib dose in the absence of rifampicin treatment. Alternative treatments lacking potent CYP3A4 inducing activity should be considered when possible. For patients who require concomitant treatment with erlotinib and a potent CYP3A4 inducer such as rifampicin, an increase in dose to 300 mg should be considered

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while their safety is closely monitored and if well tolerated for more than 2 weeks, a further increase to 450 mg could be considered with close safety monitoring. Higher doses have not been studied in this setting.

Pre-treatment or co-administration of erlotinib did not alter the clearance of the prototypical CYP3A4 substrates midazolam and erythromycin. Significant interactions with the clearance of other CYP3A4 substrates are therefore unlikely. Oral availability of midazolam appeared to decrease by up to 24%, which was, however, not attributed to effects on CYP3A4 activity.

The solubility of erlotinib is pH dependent. Erlotinib solubility decreases as pH increases. Medicines that alter the pH of the upper gastrointestinal tract may alter the solubility of erlotinib and hence its bioavailability. Co-administration of erlotinib with omeprazole, a proton pump inhibitor, decreased the erlotinib exposure [AUC] and maximum concentration [C_{max}] by 46% and 61%, respectively. There was no change to T_{max} or half-life. Concomitant administration of erlotinib with 300 mg ranitidine, an H_2 -receptor antagonist, decreased erlotinib exposure [AUC] and C_{max} by 33% and 54%, respectively. Therefore, co-administration of medicines that reduce gastric acid production with erlotinib should be avoided where possible. Increasing the dose of erlotinib when co-administered with such agents is not likely to compensate for this loss of exposure. However, when erlotinib was dosed in a staggered manner 2 hours before or 10 hours after ranitidine 150 mg bd, erlotinib exposure [AUC] and C_{max} decreased only by 15% and 17%, respectively. If patients need to be treated with such medicines, then an H_2 -receptor antagonist such as ranitidine should be considered and used in a staggered manner. Erlotinib must be taken at least 2 hours before or 10 hours after the H_2 -receptor antagonist dosing.

Interaction with coumarin-derived anticoagulants, including warfarin, leading to increased International Normalised Ratio (INR) and bleeding events, which in some cases were fatal, have been reported in patients receiving erlotinib. Patients taking coumarin-derived anticoagulants should be monitored regularly for any changes in prothrombin time or INR.

The combination of erlotinib and a statin may increase the potential for statin-induced myopathy, including rhabdomyolysis, which was observed rarely.

Smokers should be advised to stop smoking, as cigarette smoking, which is known to induce CYP1A1 and CYP1A2, has been shown to reduce erlotinib exposure by 50 - 60% (see sections 4.2 and 5.2).

In a phase Ib study, there were no significant effects of gemcitabine on the pharmacokinetics of erlotinib nor were there significant effects of erlotinib on the pharmacokinetics of gemcitabine.

4.6 Fertility, pregnancy and lactation

Fertility

Impairment of fertility was not observed in studies with male and female rats at doses near the MTD levels. The potential risk for humans is unknown.

Pregnancy

There are no adequate or well controlled studies in pregnant women using erlotinib. Studies in animals have shown some reproductive toxicity (see section 5.3). The potential risk for humans is unknown.

Women of childbearing potential

Women of childbearing potential must be advised to avoid pregnancy while on erlotinib. Adequate

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contraceptive methods should be used during therapy and for at least 2 weeks after completing therapy. Treatment should only be continued in pregnant women if the potential benefit to the mother outweighs the risk to the foetus.

Breast-feeding

It is not known whether erlotinib is excreted in human milk. No studies have been conducted to assess the impact of erlotinib on milk production or its presence in breast milk. As the potential for harm to the nursing infant is unknown, mothers should be advised against breastfeeding while receiving erlotinib and for at least 2 weeks after the final dose.

4.7 Effects on ability to drive and use machines

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

4.8 Undesirable effects

Clinical trials

Safety evaluation of erlotinib is based on the data from more than 1500 patients treated with at least one 150 mg dose of erlotinib monotherapy, and more than 300 patients who received erlotinib 100 mg or 150 mg in combination with gemcitabine.

The incidence of adverse drug reactions (ADRs) reported with erlotinib alone, or in combination with chemotherapy are summarised in the tables below and are based on data from clinical trials. The listed ADRs were those reported in at least 10% (in the erlotinib group) of patients and occurred more frequently ($\geq 3\%$) in patients treated with erlotinib than in the comparator arm.

Adverse drug reactions from clinical trials (Table 1) are listed by MedDRA system organ class. The corresponding frequency category for each adverse drug reaction is based on the following convention: very common ($\geq 1/10$); common ($\geq 1/100 < 1/10$); uncommon ($\geq 1/1000 < 1/100$); rare ($\geq 1/10,000 < 1/1000$); very rare ($< 1/10,000$)

Non-small cell lung cancer - Erlotinib administered as monotherapy

First-Line Treatment of Patients with EGFR Mutations

In an open-label, randomised phase III study, ML20650 conducted in 154 patients, the safety of erlotinib for first-line treatment of NSCLC patients with EGFR activating mutations was assessed in 75 patients; no new safety signals were observed in these patients.

The most frequent ADRs seen in patients treated with erlotinib in study ML20650 were rash and diarrhoea (any Grade 80% and 57%, respectively), most were Grade 1 - 2 in severity and manageable without intervention. Grade 3 rash and diarrhoea occurred in 9% and 4% of patients, respectively. No Grade 4 rash or diarrhoea was observed. Both rash and diarrhoea resulted in discontinuation of erlotinib in 1% of patients. Dose modifications (interruptions or reductions) for rash and diarrhoea were needed in 11% and 7% of patients, respectively.

Maintenance treatment

In two other double-blind, randomised, placebo-controlled Phase III studies (BO18192 and BO25460) conducted in a total of 1532 patients with advanced, recurrent or metastatic NSCLC following first-line standard platinum-based chemotherapy, no new safety signals were identified.

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The most frequent ADRs seen in patients treated with erlotinib in studies BO18192 and BO25460 were rash (BO18192: all grades 49.2%, grade 3: 6.0%; BO25460: all grades 39.4%, grade 3: 5.0%) and diarrhoea (BO18192: all grades 20.3%, grade 3: 1.8%; BO25460: all grades 24.2%, grade 3: 2.5%).

No Grade 4 rash or diarrhoea was observed in either study. Rash and diarrhoea resulted in discontinuation of erlotinib in 1% and < 1% of patients, respectively, in Study BO18192, while no patient discontinued for rash or diarrhoea in BO25460. Dose modifications (interruptions or reductions) for rash and diarrhoea were needed in 8.3% and 3% of patients, respectively, in Study BO18192, and 5.6% and 2.8% of patients, respectively, in Study BO25460.

Second and Further Line Treatment

The ADRs in Table 1 are based on data from a randomised double-blind study (BR.21) conducted in 731 patients with locally advanced or metastatic NSCLC after failure of at least one prior chemotherapy regimen. Patients were randomised 2:1 to receive erlotinib 150 mg or placebo. Study medicine was taken orally once daily until disease progression or unacceptable toxicity.

The most frequent ADRs were rash and diarrhoea (any Grade 75% and 54% respectively), most were Grade 1/2 in severity and manageable without intervention. Grade 3 or Grade 4 rash and diarrhoea occurred in 9% and 6%, respectively in patients treated with erlotinib and each resulted in study discontinuation in 1% of patients. Dose reduction for rash and diarrhoea was needed in 6% and 1% of patients, respectively. In study BR.21 the median time to onset of rash was 8 days and the median time to onset of diarrhoea was 12 days.

Pancreatic cancer- Erlotinib administered concurrently with gemcitabine

The ADRs listed in Table 3 below are based on erlotinib-arm data from a controlled clinical trial (PA.3), 259 patients with pancreatic cancer received erlotinib 100 mg plus gemcitabine compared to 256 patients in the placebo plus gemcitabine-arm.

The most frequent ADRs in study PA.3, in pancreatic cancer patients receiving erlotinib 100 mg plus gemcitabine were fatigue, rash and diarrhoea. In the erlotinib plus gemcitabine arm, Grade 3/4 rash and diarrhoea were reported in 5% of patients. The median time to onset of rash and diarrhoea was 10 days and 15 days, respectively. Rash and diarrhoea each resulted in dose reductions in 2% of patients, and resulted in study discontinuation in up to 1% of patients receiving erlotinib plus gemcitabine.

The erlotinib 150 mg plus gemcitabine cohort (23 patients) was associated with a higher rate of certain class-specific adverse reactions including rash and required more frequent dose reduction or interruption.

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Table 1 ADRs occurring in $\geq 10\%$ of patients in BR.21 (treated with erlotinib) and PA.3 (treated with erlotinib plus gemcitabine) studies and ADRs occurring more frequently ($\geq 3\%$) than placebo in BR.21 (treated with erlotinib) and PA.3 (treated with erlotinib plus gemcitabine) studies

NCI-CTC Grade	Erlotinib (BR.21) N=485			Erlotinib (PA.3) N=259			Frequency category of highest incidence
	Any Grade	3	4	Any Grade	3	4	
	%	%	%	%	%	%	
<i>Infections and infestations</i>							
Infection*	24	4	0	31	3	<1	very common
<i>Metabolism and nutrition disorders</i>							
Anorexia	52	8	1	--	--	--	very common
Weight decreased	--	--	--	39	2	0	very common
<i>Eye disorders</i>							
Conjunctivitis	12	<1	0	--	--	--	very common
Keratoconjunctivitis sicca	12	0	0	--	--	--	very common
<i>Psychiatric disorders</i>							
Depression	--	--	--	19	2	0	very common
<i>Nervous system disorders</i>							
Headache	--	--	--	15	<1	0	very common
Neuropathy	--	--	--	13	1	<1	very common
<i>Respiratory, thoracic and mediastinal disorders</i>							
Dyspnea	41	17	11	--	--	--	very common
Cough	33	4	0	16	0	0	very common
<i>Gastrointestinal disorders</i>							
Diarrhoea	54	6	<1	48	5	<1	very common
Nausea	33	3	0	--	--	--	very common
Vomiting	23	2	<1	--	--	--	very common
Stomatitis	17	<1	0	22	<1	0	very common
Abdominal pain	11	2	<1	--	--	--	very common
Dyspepsia	--	--	--	17	<1	0	very common
Flatulence	--	--	--	13	0	0	very common

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NCI-CTC Grade	Erlotinib (BR.21) N=485			Erlotinib (PA.3) N=259			Frequency category of highest incidence
	Any Grade	3	4	Any Grade	3	4	
MedDRA Preferred Term	%	%	%	%	%	%	
<i>Skin and subcutaneous tissue disorders</i>							
Rash	75	8	<1	69	5	0	very common
Pruritus	13	<1	0	--	--	--	very common
Dry skin	12	0	0	--	--	--	very common
Alopecia	--	--	--	14	0	0	very common
<i>General disorders and administration site conditions</i>							
Fatigue	52	14	4	73	14	2	very common
Pyrexia	--	--	--	36	3	0	very common
Rigors	--	--	--	12	0	0	very common

* Severe infections, with or without neutropenia, have included pneumonia, sepsis, and cellulitis.

-- corresponds to percentage below threshold

Further information on adverse reactions of special interest

The following ADRs have been observed in patients who received erlotinib 150 mg as monotherapy or 100 mg or 150 mg in combination with gemcitabine.

Very common ADRs are presented in Tables 1, ADRs in other frequency categories are summarised below.

Gastrointestinal disorders

Gastrointestinal perforations have been reported uncommonly (in less than 1% of patients) with erlotinib treatment, in some cases with a fatal outcome (see section 4.4).

Cases of gastrointestinal bleeding have been reported commonly (including some fatalities), some associated with concomitant warfarin administration (see section 4.5) and some with concomitant NSAIDs.

Hepatobiliary disorders

Liver function test abnormalities (including raised alanine aminotransferase (ALT), aspartate aminotransferase (AST), bilirubin) have been observed commonly in clinical trials of erlotinib. In study PA.3, these occurred very commonly. They were mainly mild or moderate in severity, transient in nature or associated with liver metastases. Rare cases of hepatic failure (including fatalities) have been reported during use of erlotinib. Confounding factors have included pre-existing liver disease or concomitant hepatotoxic medications (see section 4.4).

Eye disorders

Corneal ulcerations or perforations have been reported very rarely in patients receiving erlotinib treatment (see section 4.4). Keratitis and conjunctivitis have been reported commonly with erlotinib.

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Abnormal eyelash growth including: in-growing eyelashes, excessive growth and thickening of the eyelashes have been reported (see section 4.4).

Respiratory, thoracic and mediastinal disorders

There have been uncommon reports of serious interstitial lung disease (ILD)-like events (including fatalities) in patients receiving erlotinib for treatment of NSCLC and other advanced solid tumours (see section 4.4).

Cases of epistaxis have also been reported commonly in both the NSCLC clinical trials and the pancreatic cancer trials.

Skin and subcutaneous tissue disorders

Rash has been reported very commonly in patients receiving erlotinib and generally, manifests as a mild or moderate erythematous and papulopustular rash, which may occur or worsen in sun exposed areas. For patients who are exposed to sun, protective clothing, and/or use of sun screen (e.g. mineral-containing) may be advisable. Acne, dermatitis acneiform and folliculitis have been observed commonly, most of these events were mild or moderate and non-serious. Skin fissures, mostly non-serious, were reported commonly and in the majority of cases were associated with rash and dry skin. Other mild skin reactions such as hyperpigmentation have been observed uncommonly (in less than 1% of patients).

Bullous, blistering and exfoliative skin conditions have been reported, including very rare cases suggestive of Stevens-Johnson syndrome/Toxic epidermal necrolysis, which in some cases were fatal (see section 4.4).

Hair and nail changes, mostly non-serious, were reported in clinical trials, e.g. paronychia was reported commonly and hirsutism, eyelash/eyebrow changes and brittle and loose nails were reported uncommonly.

Post Marketing Experience

The following adverse drug reactions have been identified from post marketing experience with erlotinib based on spontaneous case reports and literature cases.

Table 2 Adverse drug reactions from post marketing experience

Adverse reactions	Frequency category
<i>Eye disorders</i>	
Uveitis	Unknown
<i>Skin and subcutaneous tissue disorders</i>	
Hair and nail changes, mostly non-serious, e.g. hirsutism, eyelash/eyebrow changes, paronychia and brittle and loose nails	Uncommon

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/>

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4.9 Overdose

Single oral doses of erlotinib up to 1000 mg in healthy subjects and up to 1600 mg given as a single dose once weekly in cancer patients have been tolerated. Repeated twice daily doses of 200 mg in healthy subjects were poorly tolerated after only a few days of dosing. Based on the data from these studies, severe adverse events such as diarrhoea, rash and possibly liver transaminase elevation may occur above the recommended dose. In case of suspected overdose erlotinib should be withheld and symptomatic treatment administered.

For advice on the management of overdose please contact the National Poisons Centre on 0800 POISON (0800 764766).

5. PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: antineoplastic agent protein kinase inhibitor, ATC code: L01EB02

Mechanism of Action

Erlotinib potently inhibits the intracellular phosphorylation of HER1/EGFR receptor. HER1/EGFR receptor is expressed on the cell surface of normal cells and cancer cells. In non-clinical models, inhibition of EGFR phosphotyrosine results in cell stasis and/or death.

Clinical trials

Non-Small Cell Lung Cancer (NSCLC) (erlotinib administered as monotherapy)

First-line therapy for patients with Epidermal Growth Factor Receptor (EGFR) activating mutations
The efficacy of erlotinib in first-line treatment of patients with EGFR activating mutations in NSCLC was demonstrated in a phase III, randomised, open-label trial (ML20650, EURTAC). This study was conducted in Caucasian patients with metastatic or locally advanced NSCLC (stage IIIB and IV) who have not received previous chemotherapy or any systemic antitumour therapy for their advanced disease and who present mutations in the tyrosine kinase domain of the EGFR (exon 19 deletion or exon 21 mutation). Patients were randomised 1:1 to receive erlotinib 150 mg orally once daily or platinum based doublet chemotherapy.

The primary endpoint of investigator assessed progression free survival (PFS), was determined at a pre-planned interim analysis (n=153, hazard ratio (HR) = 0.42, 95% CI, 0.27 to 0.64; p<0.0001 for the erlotinib group (n=77) relative to the chemotherapy group (n=76)). A 58% reduction in the risk of disease progression or death was observed. In the erlotinib versus chemotherapy arms, median PFS was 9.4 and 5.2 months, respectively. The median duration of follow-up was 14.3 months for erlotinib patients and 10.7 months for chemotherapy patients. Objective response rate (ORR) was 54.5% and 10.5%, respectively. PFS results were confirmed by an independent review of the scans, median PFS was 10.4 months in the erlotinib group compared with 5.4 months in the chemotherapy group (HR=0.47, 95% CI, 0.27 to 0.78; p=0.003). The overall survival (OS) data were immature at the time of interim analysis (HR=0.80, 95% CI, 0.47 to 1.37, p=0.4170).

At an updated analysis with 62% of OS maturity, OS HR was 0.93 (95 % CI, 0.64 to 1.36, p=0.7149). A high crossover was observed with 82% of the patients in the chemotherapy arm receiving subsequent therapy with an EGFR tyrosine kinase inhibitor and all but 2 of those patients had subsequent erlotinib. In the updated analysis, PFS results remained consistent with the interim analysis results. Median PFS assessed by the investigators was 10.4 and 5.1 months in the erlotinib and chemotherapy arms respectively (HR = 0.34, 95 % CI, 0.23 to 0.49, p<0.0001).

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In a prospective analysis of patients with advanced NSCLC having tumours with activating mutations in the EGFR tyrosine kinase domain, the median PFS for the 113 patients treated with first-line erlotinib was 14 months (95% CI, 9.7 to 18.3 months) and the median OS was 28.0 months (95% CI, 22.7 to 33 months).

A pooled analysis of published data from NSCLC patients showed that patients having tumours with EGFR activating mutations and receiving erlotinib as predominantly first-line therapy (n=70, 12.5 months, 95% CI [10.6-16.0]) had a longer median PFS compared to those receiving chemotherapy (n=359, 6.0 months, 95% CI [5.4-6.7]).

First line maintenance therapy

The efficacy and safety of erlotinib as first-line maintenance therapy of NSCLC was demonstrated in a randomised, double-blind, placebo-controlled trial BO18192 (SATURN). This study was conducted in 889 patients with locally advanced or metastatic NSCLC who did not progress during 4 cycles of platinum-based doublet chemotherapy. Patients were randomised 1:1 to receive erlotinib 150 mg or placebo orally once daily. The primary end-point of the study was progression free survival (PFS) in all patients and in patients with an EGFR IHC positive tumour. Baseline demographic and disease characteristics were well balanced between the two treatment arms.

In this study BO18192 (SATURN), the overall population showed a benefit for the primary PFS end-point (HR= 0.71 p<0.0001) and the secondary OS end-point (HR=0.81 p=0.0088). However the largest benefit was observed in a predefined exploratory analysis in patients with EGFR activating mutations (n=49) demonstrating a substantial PFS benefit (HR=0.10, 95% CI, 0.04 to 0.25; p<0.0001) and an overall survival HR of 0.83 (95% CI, 0.34 to 2.02). 67% of placebo patients in the EGFR mutation positive subgroup received second or further line treatment with EGFR-TKIs. In patients with EGFR wild type tumours (n=388), the PFS HR was 0.78 (95% CI, 0.63 to 0.96; p=0.0185) and the overall survival HR was 0.77 (95% CI, 0.61 to 0.97; p=0.0243).

The BO25460 (IUNO) study was conducted in 643 patients with advanced NSCLC whose tumours did not harbour an EGFR-activating mutation (exon 19 deletion or exon 21 L858R mutation) and who had not experienced disease progression after four cycles of platinum-based chemotherapy.

The objective of the study was to compare the overall survival of first line maintenance therapy with erlotinib versus erlotinib administered at the time of disease progression. The study did not meet its primary endpoint. OS of erlotinib in first line maintenance was not superior to erlotinib as second line treatment in patients whose tumour did not harbour an EGFR-activating mutation (HR=1.02, 95% CI, 0.85 to 1.22, p=0.82). The secondary endpoint of PFS showed no difference between erlotinib and placebo in maintenance treatment (HR=0.94, 95% CI, 0.80 to 1.11; p=0.48).

Based on the data from the BO25460 (IUNO) study, erlotinib is not recommended for first-line maintenance treatment in patients without an EGFR activating mutation.

Second or third line therapy

The efficacy and safety of erlotinib in second or third line therapy of NSCLC was demonstrated in a randomised, double-blind, placebo-controlled trial (BR.21). This study was conducted in 17 countries, in 731 patients with locally advanced or metastatic NSCLC after failure of at least one chemotherapy regimen. Patients were randomised 2:1 to receive erlotinib 150 mg or placebo orally once daily. Study end points included overall survival, time to deterioration of lung cancer-related symptoms (cough, dyspnoea and pain), response rate, duration of response, progression-free survival (PFS) and safety. The primary end-point was survival.

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Due to the 2:1 randomisation, 488 patients were randomised to erlotinib and 243 patients to placebo. Patients were not selected for HER1/EGFR status, gender, race, smoking history and histologic classification.

Demographic characteristics were well balanced between the two treatment arms. About two-thirds of the patients were male and approximately one-third had a baseline ECOG performance status (PS) of 2 and 9% had a baseline ECOG of 3. Ninety-three percent and 92% of all patients in the erlotinib and placebo groups, respectively, had received a prior platinum-containing regimen and 36% and 37% of all patients, respectively, had received a prior taxane therapy. Fifty percent of the patients had received only one prior regimen of chemotherapy.

Survival was evaluated in the intent-to-treat population. The median overall survival improved by 42.5% and was 6.7 months in the erlotinib group (95% CI, 5.5 to 7.8 months) compared with 4.7 months in the placebo group (95% CI, 4.1 to 6.3 months). The primary survival analysis was adjusted for the stratification factors as reported at the time of randomisation (ECOG PS, best response to prior therapy, number of prior regimens and exposure to prior platinum) and HER1/EGFR status. In this primary analysis, the adjusted hazard ratio (HR) for death in the erlotinib group relative to the placebo group was 0.73 (95% CI, 0.60 to 0.87) ($p = 0.001$). The percentage of patients alive at 12 months was 31.2% and 21.5%, respectively.

The survival benefit with erlotinib treatment was seen across most subsets. A series of subsets of patients formed by the values of the stratification factors at randomisation and at baseline, HER1/EGFR status, prior exposure to taxanes, smoking history, gender, age, histology, prior weight loss, time between initial diagnosis and randomisation and geographic location were examined in exploratory univariate analyses to assess the robustness of the overall survival result. Nearly all of the hazard ratios (HR) in the erlotinib group relative to the placebo group were less than 1.0, suggesting that the survival benefit from erlotinib was robust across subsets. Of note, the survival benefit of erlotinib was comparable in patients with a baseline ECOG PS of 2-3 (HR = 0.77) or a PS of 0-1 (HR = 0.73) and patients who had received one chemotherapy regimen (HR = 0.76) or two or more regimens (HR = 0.76).

A survival benefit of erlotinib was also observed in patients who did not achieve an objective tumour response (by RECIST). This was evidenced by a HR for death of 0.83 among patients whose best response was stable disease and 0.85 among patients whose best response was progressive disease.

Table 3 summarises the results for the study, including survival, time to deterioration of lung cancer-related symptoms and progression free survival (PFS).

Table 3: Study BR.21 Efficacy Results

	Erlotinib (n = 488)	Placebo (n = 243)	p-value
Median Survival 95 % CI	6.7 months (5.5 to 7.8)	4.7 months (4.1 to 6.3)	
Difference between Survival Curves			0.001
Hazard Ratio*, Mortality (Erlotinib: Placebo) 95 % CI (Risk Ratio)	0.73 0.60 to 0.87		
Median Time to Deterioration in Cough*** 95 % CI	28.1 weeks (16.1 to 40.0)	15.7 weeks (9.3 to 24.3)	0.041
Median Time to Deterioration in Dyspnoea*** 95 % CI	20.4 weeks (16.3 to 28.3)	12.1 weeks (9.3 to 20.9)	0.031 **

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Median Time to Deterioration in Pain*** 95 % CI	12.1 weeks (10.1 to 14.1)	8.1 weeks (7.7 to 12.3)	0.040**
Median Progression-free Survival 95 % CI	9.7 weeks (8.4 to 12.4)	8.0 weeks (7.9 to 8.0)	<0.001

* Adjusted for stratification factors and HER1/EGFR status; a value less than 1.00 favours erlotinib (primary analysis)

** p-value adjusted for multiple testing

*** From the EORTC QLQ-C30 and QLQ-LC13 Quality of Life Questionnaire

Symptom deterioration was measured using the EORTC QLQ-C30 and QLQ-LC13 quality of life questionnaires. Baseline scores of cough, dyspnoea and pain were similar in the two treatment groups. Erlotinib resulted in symptom benefits by significantly prolonging time to deterioration in cough (HR = 0.75), dyspnoea (HR = 0.72) and pain (HR = 0.77) versus placebo. These symptom benefits were not due to an increased use of palliative radiotherapy or concomitant medication in the erlotinib group.

The median PFS was 9.7 weeks in the erlotinib group (95% CI, 8.4 to 12.4 weeks) compared with 8.0 weeks in the placebo group (95% CI, 7.9 to 8.1 weeks). The HR for progression, adjusted for stratification factors and HER1/EGFR status, was 0.61 (95% CI, 0.51 to 0.73) ($p < 0.001$). The percent of PFS at 6-months was 24.5% and 9.3%, respectively, for the erlotinib and placebo arms.

The objective response rate by RECIST in the erlotinib group was 8.9% (95% CI, 6.4 to 12.0%). The median duration of response was 34.3 weeks, ranging from 9.7 to 57.6+ weeks. Two responses (0.9%, 95% CI, 0.1 to 3.4) were reported in the placebo group. The proportion of patients who experienced complete response, partial response or stable disease was 44.0% and 27.5%, respectively, for the erlotinib and placebo groups ($p = 0.004$).

In a double-blind, randomized phase III study (MO22162, CURRENTS) comparing two doses of erlotinib (300 mg vs 150 mg) in current smokers (mean of 38 pack years) with locally advanced or metastatic NSCLC in the second-line setting after failure on chemotherapy, the 300 mg dose of erlotinib demonstrated no PFS benefit over the recommended dose (7.00 vs 6.86 weeks, respectively). Patients in this study were not selected based on EGFR mutation status.

Pancreatic cancer (erlotinib administered concurrently with gemcitabine)

The efficacy and safety of erlotinib in combination with gemcitabine as a first-line treatment was assessed in a randomised, double blind, placebo-controlled trial in 569 patients with locally advanced, unresectable or metastatic pancreatic cancer. Patients were randomised 1:1 to receive erlotinib (100 mg or 150 mg) or placebo once daily on a continuous schedule plus gemcitabine IV (100 mg/m², Cycle 1 - Days 1, 8, 15, 22, 29, 36 and 43 of an 8 week cycle; Cycle 2 and subsequent cycles - Days 1, 8 and 15 of a 4 week cycle) (approved dose and schedule for pancreatic cancer, see the gemcitabine prescribing information). Erlotinib or placebo was taken orally once daily until disease progression or unacceptable toxicity. Study end points included overall survival, response rate and progression-free survival (PFS). Duration of response was also examined. The primary endpoint was survival. A total of 285 patients were randomised to receive gemcitabine plus erlotinib (261 patients in the 100 mg cohort and 24 patients in the 150 mg cohort) and 284 patients were randomised to receive gemcitabine plus placebo (260 patients in the 100 mg cohort and 24 patients in the 150 mg cohort). Too few observations were made for the 150 mg cohort to draw conclusions.

Baseline demographic and disease characteristics of the patients were similar between the 2 treatment groups, 100 mg erlotinib plus gemcitabine or placebo plus gemcitabine, except for a slightly larger

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proportion of females in the erlotinib arm (51%) compared with the placebo arm (44%). The median time from initial diagnosis to randomisation was approximately 1.0 month. Approximately half of the patients had a baseline ECOG performance status (PS) of 1, and 17 % had a baseline ECOG PS of 2. Most patients presented with metastatic disease at study entry as the initial manifestation of pancreatic cancer (77% in the erlotinib arm, 76% in the placebo arm).

Survival was evaluated in the intent-to-treat population based on follow-up survival data including 551 deaths. Results are presented for the 100 mg dose cohort (504 deaths). The adjusted hazard ratio for death in the erlotinib group relative to the placebo group was 0.82 (95 % CI, 0.69 to 0.98) (p = 0.028). The percent of patients alive at 12 months was 23.8 % in the erlotinib group compared to 19.4% in the placebo group. The median overall survival was 6.4 months in the erlotinib group compared with 6 months in the placebo group.

Table 4 summarises the results of the study.

Table 4: Study PA.3 Efficacy Results

	Erlotinib 100mg plus gemcitabine (N = 261)	Placebo plus gemcitabine (N=260)	p-value
Median survival	6.4 months	6 months	
Hazard ratio, mortality (erlotinib:placebo) (95% CI)	0.82 (0.69 to 0.98)		p = 0.028
% Patients alive at 12 months	23.8	19.4	

The median PFS was 3.81 months (16.5 weeks) in the erlotinib group (95 % CI, 3.58 to 4.93 months) compared with 3.55 months (15.2 weeks) in the placebo group (95 % CI, 3.29 to 3.75 months) (p = 0.006).

The median duration of response was 23.9 weeks, ranging from 3.71 to 56+ weeks. The objective response rate (complete response and partial response) was 8.6 % in the erlotinib group and 7.9 % in the placebo group. The proportion of patients who experienced complete response, partial response or stable disease was 59 % and 49.4 %, respectively, for the erlotinib and placebo groups (p = 0.036).

5.2 Pharmacokinetic properties

Exposure

Following a 150 mg oral dose of erlotinib, at steady state, the median time to reach maximum plasma concentrations is approximately 4 hours with median maximum plasma concentrations achieved of 1,995 ng/mL. Prior to the next dose at 24 hours, the median minimum plasma concentrations are 1,238 ng/mL. Median AUC achieved during the dosing interval at steady state are 41.3 mcg*h/mL.

Absorption

Oral erlotinib is well absorbed and has an extended absorption phase, with mean peak plasma levels occurring at 4 hours after oral dosing. A study in normal healthy volunteers provided an estimate of bioavailability of 59%. The exposure after an oral dose may be increased by food.

Following absorption, erlotinib is highly bound in blood, with approximately 95% bound to blood components, primarily to plasma proteins (i.e. albumin and alpha-1 acid glycoprotein [AAG]), with a free fraction of approximately 5%.

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Distribution

Erlotinib has a mean apparent volume of distribution of 232 L and distributes into tumour tissue of humans. In a study of 4 patients (3 with NSCLC and 1 with laryngeal cancer) receiving 150 mg daily oral doses of erlotinib, tumour samples from surgical excisions on Day 9 of treatment revealed tumour concentrations of erlotinib that averaged 1,185 ng/g of tissue. This corresponded to an overall average of 63% of the steady state observed peak plasma concentrations. The primary active metabolites were present in tumours at concentrations averaging 160 ng/g tissue, which corresponded to an overall average of 113% of the observed steady state peak plasma concentrations. Tissue distribution studies using whole body autoradiography following oral administration with [¹⁴C] labelled erlotinib in athymic nude mice with HN5 tumour xenografts have shown rapid and extensive tissue distribution with maximum concentrations of radiolabelled erlotinib (approximately 73% of that in plasma) observed at 1 hour.

Biotransformation

Erlotinib is metabolised in humans by hepatic cytochrome P450 enzymes, primarily by CYP3A4 and to a lesser extent by CYP1A2. Extrahepatic metabolism by CYP3A4 in intestine, CYP1A1 in lung and CYP1B1 in tumour tissue potentially contribute to the metabolic clearance of erlotinib. *In vitro* studies indicate approximately 80 - 95% of erlotinib metabolism is by the CYP3A4 enzyme. There are three main metabolic pathways identified: 1) O-demethylation of either side chain or both, followed by oxidation to the carboxylic acids; 2) oxidation of the acetylene moiety followed by hydrolysis to the aryl carboxylic acid; and 3) aromatic hydroxylation of the phenyl-acetylene moiety. The primary metabolites of erlotinib produced by O-demethylation of either side chain have comparable potency to erlotinib in preclinical *in vitro* assays and *in vivo* tumour models. They are present in plasma at levels that are < 10% of erlotinib and display similar pharmacokinetics as erlotinib.

Elimination

The metabolites and trace amounts of erlotinib are excreted predominantly via the faeces (> 90%), with renal elimination accounting for only a small amount of an oral dose.

Clearance

A population pharmacokinetic analysis in 591 patients receiving single agent erlotinib showed a mean apparent clearance of 4.47 L/hour with a median half-life of 36.2 hours. Therefore, the time to reach steady state plasma concentration would be expected to occur in approximately 7 - 8 days. No significant relationships between predicted apparent clearance and patient age, body weight, gender and ethnicity were observed.

Patient factors, which correlate with erlotinib pharmacokinetics, are serum total bilirubin, AAG concentrations and current smoking. Elevated serum concentrations of total bilirubin and AAG were associated with a slower rate of erlotinib clearance. Smokers had a higher rate of erlotinib clearance (see Interactions with other Medicinal Products and other Forms of Interaction).

A second population pharmacokinetic analysis was conducted to incorporate erlotinib data from 204 pancreatic cancer patients who received erlotinib plus gemcitabine. This analysis demonstrated that covariates affecting erlotinib clearance in patients from the pancreatic study were very similar to those seen in the prior single-agent pharmacokinetic analysis. No new covariate effects were identified. Co-administration of gemcitabine had no effect on erlotinib plasma clearance.

Pharmacokinetics in Special Populations

There have been no specific studies in paediatric or elderly patients.

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Hepatic impairment

Erlotinib is mainly cleared by the liver. Erlotinib exposure was similar in patients with moderately impaired hepatic function (Child-Pugh score 7 - 9) compared with patients with adequate hepatic function including patients with primary liver cancer or hepatic metastases.

Renal impairment

Erlotinib and its metabolites are not significantly excreted by the kidneys as less than 9% of a single dose is excreted in the urine. No clinical studies have been conducted in patients with compromised renal function.

Smokers

A pharmacokinetic study in non-smoking subjects and healthy subjects who currently smoke has shown that cigarette smoking leads to increased clearance of, and decreased exposure to, erlotinib. The $AUC_{0-\infty}$ in smokers was about 1/3 of that in never/former smokers ($n = 16$ in each of the smoker and never/former smoker arms). This reduced exposure in smokers is presumably due to induction of CYP1A1 in the lungs and CYP1A2 in the liver.

In the pivotal Phase III NSCLC trial, smokers achieved an erlotinib steady state trough plasma concentration of 0.65 mcg/mL ($n = 16$) which was approximately 2-fold less than the former smokers or patients who had never smoked (1.28 mcg/mL, $n = 108$). This effect was accompanied by a 24% increase in apparent erlotinib plasma clearance.

In a phase I dose escalation study in NSCLC patients who were current smokers, pharmacokinetic analyses at steady state indicated a dose proportional increase in erlotinib exposure when the erlotinib dose was increased from 150 mg to the maximum tolerated dose of 300 mg. Steady state trough plasma concentrations at a 300 mg dose in smokers in this study was 1.22 mcg/mL ($n = 17$) (see Special Dosage Instructions, Interactions with other Medicinal Products and other Forms of Interaction).

5.3 Preclinical safety data

Carcinogenicity

Evidence for a carcinogenic potential was not seen in preclinical studies. Erlotinib was neither genotoxic nor clastogenic in genetic toxicity studies. Two year carcinogenicity studies with erlotinib conducted in rats and mice at exposures exceeding human therapeutic exposure were negative.

Genotoxicity

Erlotinib was negative in the standard battery of genotoxicity assays.

Impairment of fertility

Impairment of fertility was not observed in studies with male and female rats at doses near the MTD levels.

Teratogenicity

Data from reproductive toxicology tests in rats and rabbits indicate that, following exposure to erlotinib at doses near the MTD and/or doses that were maternally toxic, there was embryotoxicity, but there was no evidence of teratogenicity or abnormal pre- or postnatal physical or behavioural development. Maternal toxicity in both rats and rabbits in these studies occurred at plasma exposure levels that were similar to those in humans following a 150 mg dose of erlotinib.

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Other

Chronic dosing effects observed in at least 1 animal species or study included effects on the cornea (atrophy, ulceration), skin (follicular degeneration and inflammation, redness and alopecia), ovary (atrophy), liver (liver necrosis), kidney (renal papillary necrosis and tubular dilatation) and gastrointestinal tract (delayed gastric emptying and diarrhoea). Red blood cell (RBC) counts, haematocrit and haemoglobin were decreased and reticulocytes were increased. White blood cells (WBCs), primarily neutrophils, were increased. There were treatment-related increases in alanine aminotransferase (ALT), aspartate aminotransferase (AST) and bilirubin.

In vitro studies of erlotinib showed inhibition of hERG channels at concentrations at least 20 times higher than the free drug concentration in humans at therapeutic doses. Studies in dogs did not show QT-prolongation. A systematic centralised review of ECG data from 152 individuals from seven studies with healthy volunteers found no evidence of QT prolongation and clinical studies have found no evidence of arrhythmias, associated with QT prolongation.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Lactose monohydrate
Microcrystalline cellulose
Sodium starch glycolate
Magnesium stearate

The tablets have a film-coating which contains:

Poly(vinyl alcohol) (E1203)
Macrogol 3350 (E1521)
Titanium dioxide (E171)
Talc (E553b)
Methacrylic acid
Sodium hydrogen carbonate

6.2 Incompatibilities

Not applicable.

6.3 Shelf life

4 years.

6.4 Special precautions for storage

Store below 30°C.

Erlotinib film-coated tablets should be stored in the original container.

This medicine should not be used after the expiry date shown on the pack.

6.5 Nature and contents of container

Erlotinib 25 mg, 50 mg, 100 mg and 150 mg film-coated tablets come in blister packs containing 30 tablets.

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The 25 mg and 50 mg strengths are currently not available in New Zealand.

6.6 Special precautions for disposal and other handling

The release of medicines into the environment should be minimised. Medicines should not be disposed of via wastewater and disposal through household waste should be avoided. Unused or expired medicine should be returned to a pharmacy for disposal.

7. MEDICINE SCHEDULE

Prescription Medicine

8. SPONSOR

Alchemy Health Limited
1629 Ponga Road
Hunua
Auckland 2584
NEW ZEALAND

Medical enquiries: 0508 ALCHEMY (0508 252436)

9. DATE OF FIRST APPROVAL

12 May 2022

10. DATE OF REVISION OF THE TEXT

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