

Alecensa[®] 150mg

Hard Capsules



Alectinib

1. DESCRIPTION

1.1 Therapeutic / Pharmacologic Class of Drug

Antineoplastic agent, Protein Kinase inhibitor

ATC code: L01XE36

1.2 Type of Dosage Form

White to yellowish white hard capsule of 19.2 mm, with “ALE” printed in black ink on the cap and “150 mg” printed in black ink on the body.

1.3 Route of administration

Oral

1.4 Sterile / Radioactive Statement

Not applicable

1.5 Qualitative and Quantitative Composition

Active ingredient: Alectinib

Each hard capsule contains: Alectinib 150 mg (equivalent to 161.3 mg alectinib hydrochloride).

Capsule fill mass: lactose monohydrate, hydroxypropylcellulose, sodium lauryl sulfate, carboxymethylcellulose calcium, magnesium stearate, purified water.

Capsule shell: carrageenan, potassium chloride, titanium dioxide (E171), carnauba wax, corn starch, hypromellose, printing ink (red iron oxide E172, yellow iron oxide E172, FD&C blue No. 2 aluminum lake E132, carnauba wax, white shellac, glyceryl monooleate, 1-butanol, dehydrated ethyl alcohol).

2. CLINICAL PARTICULARS

2.1 Therapeutic Indications

Alecensa as monotherapy is indicated for the first-line treatment of adult patients with anaplastic lymphoma kinase (ALK)-positive advanced non-small cell lung cancer (NSCLC).

Alecensa as monotherapy is indicated for the treatment of adult patients with ALK-positive advanced NSCLC previously treated with crizotinib.

2.2 Posology and method of administration

Treatment with Alecensa should be initiated and supervised by a physician experienced in the use of anticancer medicinal products.

A validated ALK assay is necessary for the selection of ALK-positive NSCLC patients. ALK-positive NSCLC status should be established prior to initiation of Alecensa therapy.

Posology

The recommended dose of Alecensa is 600 mg (four 150 mg capsules) taken twice daily with food (total daily dose of 1200 mg).

Patients with underlying severe hepatic impairment (Child-Pugh C) should receive a starting dose of 450 mg taken twice daily with food (total daily dose of 900 mg).

Duration of treatment

Treatment with Alecensa should be continued until disease progression or unacceptable toxicity.

Delayed or missed doses

If a planned dose of Alecensa is missed, patients can make up that dose unless the next dose is due within 6 hours. Patients should not take two doses at the same time to make up for a missed dose. If vomiting occurs after taking a dose of Alecensa, patients should take the next dose at the scheduled time.

Dose adjustments

Management of adverse events may require dose reduction, temporary interruption, or discontinuation of treatment with Alecensa. The dose of Alecensa should be reduced in steps of 150 mg twice daily based on tolerability. Alecensa treatment should be permanently discontinued if patients are unable to tolerate the 300 mg twice daily dose.

Dose modification advice is provided in Tables 1 and 2 below.

Table 1 Dose reduction schedule

Dose reduction schedule	Dose Level
Dose	600 mg twice daily
First dose reduction	450 mg twice daily
Second dose reduction	300 mg twice daily

Table 2 Dose modification advice for specified Adverse Drug Reactions (see sections 2.4 Special warnings and precautions for use and 2.8 Undesirable effects)

CTCAE grade	Alecensa treatment
ILD/pneumonitis of any severity grade	Immediately interrupt and permanently discontinue Alecensa if no other potential causes of ILD/pneumonitis have been identified.
ALT or AST elevation of Grade ≥ 3 (> 5 times ULN) with total bilirubin ≤ 2 times ULN	Temporarily withhold until recovery to baseline or \leq Grade 1 (≤ 3 times ULN), then resume at reduced dose (see Table 1).
ALT or AST elevation of Grade ≥ 2 (> 3 times ULN) with total bilirubin elevation > 2 times ULN in the absence of cholestasis or haemolysis	Permanently discontinue Alecensa.
Bradycardia ^a Grade 2 or Grade 3 (symptomatic, may be severe and medically significant, medical intervention indicated)	Temporarily withhold until recovery to \leq Grade 1 (asymptomatic) bradycardia or to a heart rate of ≥ 60 bpm. Evaluate concomitant medicinal products known to cause bradycardia, as well as anti-hypertensive medicinal products. If a contributing concomitant medicinal product is identified and discontinued, or its dose is adjusted, resume at previous dose upon recovery to \leq Grade 1 (asymptomatic) bradycardia or to a heart rate of ≥ 60 bpm. If no contributing concomitant medicinal product is identified, or if contributing concomitant medicinal products are not discontinued or dose modified, resume at reduced dose (see Table 1) upon recovery to \leq Grade 1 (asymptomatic) bradycardia or to a heart rate of ≥ 60 bpm.
Bradycardia ^a Grade 4 (life-threatening consequences, urgent intervention indicated)	Permanently discontinue if no contributing concomitant medicinal product is identified. If a contributing concomitant medicinal product is identified and discontinued, or its dose is adjusted, resume at reduced dose (see Table 1) upon recovery to \leq Grade 1 (asymptomatic) bradycardia or to a heart rate of ≥ 60 bpm, with frequent monitoring as clinically indicated. Permanently discontinue in case of recurrence.
CPK elevation > 5 times ULN	Temporarily withhold until recovery to baseline or to ≤ 2.5 times ULN, then resume at the same dose.
CPK elevation > 10 times ULN or second occurrence of CPK elevation of > 5 times ULN	Temporarily withhold until recovery to baseline or to ≤ 2.5 times ULN, then resume at reduced dose as per Table 1.

ALT = alanine aminotransferase; AST = aspartate aminotransferase; CPK = creatine phosphokinase; CTCAE = NCI Common Terminology Criteria for Adverse Events; ILD = interstitial lung disease; ULN = upper limit of normal

^aHeart rate less than 60 beats per minute (bpm).

Special populations

Hepatic impairment

No starting dose adjustment is required in patients with underlying mild (Child-Pugh A) or moderate (Child-Pugh B) hepatic impairment. Patients with underlying severe hepatic impairment (Child-Pugh C) should receive a starting dose of 450 mg taken twice daily (total dose of 900 mg) (see section 3.2 *Pharmacokinetic properties*). For all patients with hepatic impairment, appropriate monitoring (e.g. markers of liver function) is advised, see section 2.4 *Special warnings and precautions for use*.

Renal impairment

No dose adjustment is required in patients with mild or moderate renal impairment. Alecensa has not been studied in patients with severe renal impairment. However, since alectinib elimination via the kidney is negligible, no dose adjustment is required in patients with severe renal impairment (see section 3.2 *Pharmacokinetic properties*).

Elderly (≥ 65 years)

The limited data on the safety and efficacy of Alecensa in patients aged 65 years and older do not suggest that a dose adjustment is required in elderly patients (see section 3.2 *Pharmacokinetic properties*). There are no available data on patients over 80 years of age.

Paediatric population

The safety and efficacy of Alecensa in children and adolescents below 18 years of age have not been established. No data are available.

Extreme body weight (>130 kg)

Although PK simulations for Alecensa do not indicate a low exposure in patients with extreme body weight (i.e. >130 kg), alectinib is widely distributed and clinical studies for alectinib enrolled patients within a range of body weights of 36.9–123 kg. There are no available data on patients with body weight above 130 kg.

Method of administration

Alecensa is for oral use. The hard capsules should be swallowed whole, and must not be opened or dissolved. They must be taken with food (see section 3.2 *Pharmacokinetic properties*).

2.3 Contraindications

Hypersensitivity to alectinib or to any of the excipients listed in section 1.5 *Qualitative and Quantitative Composition*.

2.4 Special warnings and precautions for use

Interstitial lung disease (ILD)/pneumonitis

Cases of ILD/pneumonitis have been reported in clinical trials with Alecensa (see section 2.8 *Undesirable effects*). Patients should be monitored for pulmonary symptoms indicative of pneumonitis. Alecensa should be immediately interrupted in patients diagnosed with ILD/pneumonitis and should be permanently discontinued if no other potential causes of ILD/pneumonitis have been identified (see section 2.2 *Posology and method of administration*).

Hepatotoxicity

Elevations in alanine aminotransferase (ALT) and aspartate aminotransferase (AST) greater than 5 times the ULN as well as bilirubin elevations of more than 3 times the ULN occurred in patients in pivotal clinical trials with Alecensa (see section 2.8 *Undesirable effects*). The majority of these events occurred during the first 3 months of treatment. In the pivotal Alecensa clinical trials it was reported that three patients with Grade 3-4 AST/ALT elevations had drug induced liver injury. Concurrent elevations in ALT or AST greater than or equal 3 times the ULN and total bilirubin greater than or equal 2 times the ULN, with normal alkaline phosphatase, occurred in one patient treated in Alecensa clinical trials.

Liver function, including ALT, AST, and total bilirubin should be monitored at baseline and then every 2 weeks during the first 3 months of treatment. Thereafter, monitoring should be performed periodically, since events may occur later than 3 months, with more frequent testing in patients who develop aminotransferase and bilirubin elevations. Based on the severity of the adverse drug reaction, Alecensa should be withheld and resumed at a reduced dose, or permanently discontinued as described in Table 2 (see section 2.2 *Posology and method of administration*).

Severe myalgia and creatine phosphokinase (CPK) elevation

Myalgia or musculoskeletal pain was reported in patients in pivotal trials with Alecensa, including Grade 3 events (see section 2.8 *Undesirable effects*).

Elevations of CPK occurred in pivotal trials with Alecensa, including Grade 3 events (see section 2.8 *Undesirable effects*). Median time to Grade 3 CPK elevation was 14 days across clinical trials (NP28761, NP28673, BO28984).

Patients should be advised to report any unexplained muscle pain, tenderness, or weakness. CPK levels should be assessed every two weeks for the first month of treatment and as clinically indicated in patients reporting symptoms. Based on the severity of the CPK elevation, Alecensa should be withheld, then resumed or dose reduced (see section 2.2 *Posology and method of administration*).

Bradycardia

Symptomatic bradycardia can occur with Alecensa (see section 2.8 *Undesirable effects*). Heart rate and blood pressure should be monitored as clinically indicated. Dose modification is not required in case of asymptomatic bradycardia (see section 2.2 *Posology and method of administration*). If patients experience symptomatic bradycardia or life-threatening events, concomitant medicinal products known to cause bradycardia, as well as anti-hypertensive medicinal products should be

evaluated and Alecensa treatment should be adjusted as described in Table 2 (see sections 2.2 *Posology and method of administration* and 2.5 *Interaction with other medicinal products and other forms of interaction*, 'P-gp substrates' and 'BCRP substrates').

Photosensitivity

Photosensitivity to sunlight has been reported with Alecensa administration (see section 2.8 *Undesirable effects*). Patients should be advised to avoid prolonged sun exposure while taking Alecensa, and for at least 7 days after discontinuation of treatment. Patients should also be advised to use a broad-spectrum Ultraviolet A (UVA)/ Ultraviolet B (UVB) sun screen and lip balm (SPF \geq 50) to help protect against potential sunburn.

Women of child-bearing potential

Alecensa may cause foetal harm when administered to a pregnant woman. Female patients of child-bearing potential receiving Alecensa, must use highly effective contraceptive methods during treatment and for at least 3 months following the last dose of Alecensa (see sections 2.6 *Fertility, pregnancy and lactation* and 3.3 *Preclinical safety data*).

Lactose intolerance

This medicinal product contains lactose. Patients with rare hereditary problems of galactose intolerance, a congenital lactase deficiency or glucose-galactose malabsorption should not take this medicinal product.

Sodium content

This medicinal product contains 48 mg sodium per daily dose (1200 mg), equivalent to 2.4% of the WHO recommended maximum daily intake of 2 g sodium for an adult.

2.5 Interaction with other medicinal products and other forms of interaction

Effects of other medicinal products on alectinib

Based on *in vitro* data, CYP3A4 is the primary enzyme mediating the metabolism of both alectinib and its major active metabolite M4, and CYP3A contributes to 40% – 50% of total hepatic metabolism. M4 has shown similar *in vitro* potency and activity against ALK.

CYP3A inducers

Co-administration of multiple oral doses of 600 mg rifampicin once daily, a strong CYP3A inducer, with a single oral dose of 600 mg alectinib reduced alectinib C_{max} , and AUC_{inf} by 51% and 73% respectively and increased M4 C_{max} and AUC_{inf} 2.20 and 1.79-fold respectively. The effect on the combined exposure of alectinib and M4 was minor, reducing C_{max} and AUC_{inf} by 4% and 18%, respectively. Based on the effects on the combined exposure of alectinib and M4, no dose adjustments are required when Alecensa is co-administered with CYP3A inducers. Appropriate monitoring is recommended for patients taking concomitant strong CYP3A inducers (including, but not limited to, carbamazepine, phenobarbital, phenytoin, rifabutin, rifampicin and St. John's Wort (*Hypericum perforatum*)).

CYP3A inhibitors

Co-administration of multiple oral doses of 400 mg posaconazole twice daily, a strong CYP3A inhibitor, with a single oral dose of 300 mg alectinib increased alectinib exposure C_{max} and AUC_{inf} by 1.18 and 1.75-fold respectively, and reduced M4 C_{max} and AUC_{inf} by 71% and 25% respectively. The effect on the combined exposure of alectinib and M4 was minor, reducing C_{max} by 7% and increasing AUC_{inf} 1.36-fold. Based on the effects on the combined exposure of alectinib and M4, no dose adjustments are required when Alecensa is co-administered with CYP3A inhibitors. Appropriate monitoring is recommended for patients taking concomitant strong CYP3A inhibitors (including, but not limited to, ritonavir, saquinavir, telithromycin, ketoconazole, itraconazole, voriconazole, posaconazole nefazodone, grapefruit or Seville oranges).

Medicinal products that increase gastric pH

Multiple doses of esomeprazole, a proton pump inhibitor, 40 mg once daily, demonstrated no clinically relevant effect on the combined exposure of alectinib and M4. Therefore, no dose adjustments are required when Alecensa is co-administered with proton pump inhibitors or other medicinal products which raise gastric pH (e.g. H₂ receptor antagonists or antacids).

Effect of transporters on alectinib disposition

M4 is a substrate of P-gp. As alectinib inhibits P-gp, it is not expected that co-medication with P-gp inhibitors has a relevant effect on M4 exposure.

Effects of alectinib on other medicinal products

P-gp substrates

In vitro, alectinib and its major active metabolite M4 are inhibitors of the efflux transporter P-glycoprotein (P-gp). Therefore, alectinib and M4 may have the potential to increase plasma concentrations of co-administered substrates of P-gp. When Alecensa is co-administered with P-gp substrates (e.g., digoxin, dabigatran etexilate, topotecan, sirolimus, everolimus, nilotinib and lapatinib), appropriate monitoring is recommended.

BCRP substrates

In vitro, alectinib and M4 are inhibitors of the efflux transporter Breast Cancer Resistance Protein (BCRP). Therefore, alectinib and M4 may have the potential to increase plasma concentrations of co-administered substrates of BCRP. When Alecensa is co-administered with BCRP substrates (e.g., methotrexate, mitoxantrone, topotecan and lapatinib), appropriate monitoring is recommended.

CYP substrates

In vitro, alectinib and M4 show weak time-dependent inhibition of CYP3A4, and alectinib exhibits a weak induction potential of CYP3A4 and CYP2B6 at clinical concentrations.

Multiple doses of 600 mg alectinib had no influence on the exposure of midazolam (2 mg), a sensitive CYP3A substrate. Therefore, no dose adjustment is required for co-administered CYP3A substrates.

A risk for induction of CYP2B6 and PXR regulated enzymes apart from CYP3A4 cannot be completely excluded. The effectiveness of concomitant administration of oral contraceptives may be reduced.

2.6 Fertility, pregnancy and lactation

Women of childbearing potential/contraception

Women of childbearing potential must be advised to avoid pregnancy while on Alecensa. Female patients of child-bearing potential receiving Alecensa must use highly effective contraceptive methods during treatment and for at least 3 months following the last dose of Alecensa.

Pregnancy

There are no or limited amount of data from the use of Alecensa in pregnant women. Based on its mechanism of action, Alecensa may cause foetal harm when administered to a pregnant woman. Studies in animals have shown reproductive toxicity (see section 3.3 *Preclinical safety data*).

Female patients, who become pregnant while taking Alecensa or during the 3 months following the last dose of Alecensa must contact their doctor and should be advised of the potential harm to the foetus.

Breast-feeding

It is unknown whether alectinib and its metabolites are excreted in human milk. A risk to the newborn/infant cannot be excluded. Mothers should be advised against breast-feeding while receiving Alecensa.

Fertility

No fertility studies in animals have been performed to evaluate the effect of Alecensa. No adverse effects on male and female reproductive organs were observed in general toxicology studies (see section 3.3 *Preclinical safety data*).

2.7 Effects on ability to drive and use machines

Alecensa has minor influence on the ability to drive and use machines. Caution should be exercised when driving or operating machines as patients may experience symptomatic bradycardia (e.g., syncope, dizziness, hypotension) or vision disorders while taking Alecensa (see section 2.8 *Undesirable effects*).

2.8 Undesirable Effects

Summary of the safety profile

The data described below reflect exposure to Alecensa in 405 patients with ALK-positive advanced NSCLC who participated in one randomised Phase III clinical trial (BO28984) and in two single-arm phase II clinical trials (NP28761, NP28673). These patients were treated with the recommended dose of 600 mg twice daily. In the phase II clinical trials (NP28761, NP28673; N=253), the median duration of exposure to Alecensa was 11 months. In BO28984 (ALEX; N=152) the median duration of exposure to Alecensa was 17.9 months, whereas the median duration of exposure to crizotinib was 10.7 months.

The most common adverse drug reactions (ADRs) ($\geq 20\%$) were constipation (35%), oedema (30%, including oedema peripheral, oedema, generalised oedema, eyelid oedema, periorbital oedema, face oedema and localised oedema), and myalgia (28%, including myalgia and musculoskeletal pain).

Tabulated list of adverse drug reactions

Table 3 lists the ADRs occurring in patients who received Alecensa across two phase II clinical trials (NP28761, NP28673) and one phase III clinical trial (BO28984; ALEX), and during post-marketing.

The ADRs listed in Table 3 are presented by system organ class and frequency categories, defined using the following convention: very common ($\geq 1/10$), common ($\geq 1/100$ to $< 1/10$), uncommon ($\geq 1/1,000$ to $< 1/100$), rare ($\geq 1/10,000$ to $< 1/1000$), very rare ($< 1/10,000$). Within each system organ class, undesirable effects are presented in order of decreasing frequency.

Table 3 ADRs reported in Alecensa clinical trials (NP28761, NP28673, BO28984; N=405) and during post-marketing

System Organ Class ADR (MedDRA)	Alecensa (N=405)		
	All Grades (%)	Frequency category (all grades)	Grades 3-4 (%)
Blood and Lymphatic System Disorders			

System Organ Class ADR (MedDRA)	Alecensa (N=405)		
	All Grades (%)	Frequency category (all grades)	Grades 3-4 (%)
Anaemia ¹⁾	17	Very common	3.0
Nervous system disorders			
Dysgeusia ²⁾	5.2	Common	0.2
Eye disorders			
Vision disorders ³⁾	8.6	Common	0
Cardiac disorders			
Bradycardia ⁴⁾	8.9	Common	0
Respiratory, thoracic and mediastinal disorders			
Interstitial lung disease / pneumonitis	0.7	Uncommon	0.2
Gastrointestinal disorders			
Constipation	35	Very common	0
Nausea	19	Very common	0.5
Diarrhoea	16	Very common	0.7
Vomiting	11	Very common	0.2
Stomatitis ⁵⁾	3.0	Common	0
Hepatobiliary disorders			
Increased bilirubin ⁶⁾	18	Very common	3.2
Increased AST	15	Very common	3.7
Increased ALT	14	Very common	3.7
Increased alkaline phosphatase ^{**}	6.2	Common	0.2
Drug-induced liver injury ⁷⁾	0.7	Uncommon	0.7
Skin and subcutaneous tissue disorders			
Rash ⁸⁾	18	Very common	0.5
Photosensitivity	9.1	Common	0.2
Musculoskeletal and connective tissues disorders			
Myalgia ⁹⁾	28	Very common	0.7
Increased blood creatine phosphokinase	10	Very common	3.2
Renal and urinary disorders			
Blood creatinine increased	7.2	Common	0.7*
Acute kidney injury	1.0	Common	1.0*
General disorders and administration site conditions			
Oedema ¹⁰⁾	30	Very common	0.7
Investigations			
Weight increased	12	Very common	0.7

* Includes one Grade 5 event

** Increased alkaline phosphatase was reported in the post-marketing period and in pivotal phase II and phase III clinical trials.

1) includes cases of anaemia and haemoglobin decreased

2) includes cases of dysgeusia and hypogeusia

3) includes cases of blurred vision, visual impairment, vitreous floaters, reduced visual acuity, asthenopia, and diplopia

4) includes cases of bradycardia and sinus bradycardia

5) includes cases of stomatitis and mouth ulceration

6) includes cases of blood bilirubin increased, hyperbilirubinaemia and bilirubin conjugated increased

7) includes two patients with reported MedDRA term of drug-induced liver injury as well as one patient with reported Grade 4 increased AST and ALT who had documented drug-induced liver injury by liver biopsy

8) includes cases of rash, rash maculopapular, dermatitis acneiform, erythema, rash generalised, rash papular, rash pruritic, rash macular and exfoliative rash

9) includes cases of myalgia and musculoskeletal pain

10) includes cases of oedema peripheral, oedema, generalised oedema, eyelid oedema, periorbital oedema, face oedema and localised oedema

Description of selected adverse drug reactions

The safety profile of Alecensa was generally consistent across the pivotal phase III clinical trial BO28984 (ALEX) and phase II trials (NP28761, NP28673).

Interstitial lung disease (ILD) / pneumonitis

Severe ILD/pneumonitis occurred in patients treated with Alecensa. Across clinical trials (NP28761, NP28673, BO28984), 1 out of 405 patients treated with Alecensa (0.2%) had a Grade 3 ILD. This event led to withdrawal from Alecensa treatment. In the phase III clinical trial BO28984, Grade 3 or 4 ILD/pneumonitis was not observed in patients receiving Alecensa versus 2.0% of patients receiving crizotinib. There were no fatal cases of ILD in any of the clinical trials. Patients should be monitored for pulmonary symptoms indicative of pneumonitis (see sections 2.2 *Posology and method of administration* and 2.4 *Special warnings and precautions for use*).

Hepatotoxicity

Across clinical trials (NP28761, NP28673, BO28984) two patients with Grade 3-4 AST/ALT elevations had documented drug induced liver injury by liver biopsy. In addition, one patient experienced a Grade 4 adverse event of drug-induced liver injury. Two of these cases led to withdrawal from Alecensa treatment. Adverse reactions of increased AST and ALT levels (15% and 14% respectively) were reported in patients treated with Alecensa across clinical trials (NP28761, NP28673, BO28984). The majority of these events were of Grade 1 and 2 intensity, and events of Grade ≥ 3 were reported in 3.7% and 3.7% of the patients, respectively. The events generally occurred during the first 3 months of treatment, were usually transient and resolved upon temporary interruption of Alecensa treatment (reported for 1.5% and 3.0% of the patients, respectively) or dose reduction (2.2% and 1.2%, respectively). In 1.2% and 1.5% of the patients, AST and ALT elevations, respectively, led to withdrawal from Alecensa treatment. Grade 3 or 4 ALT or AST elevations were each observed in 5% of patients receiving Alecensa versus 15% and 11% of patients receiving crizotinib in the phase III clinical trial BO28984.

Adverse reactions of bilirubin elevations were reported in 18% of the patients treated with Alecensa across clinical trials (NP28761, NP28673, BO28984). The majority of the events were of Grade 1 and 2 intensity; Grade 3 events were reported in 3.2% of the patients. The events generally occurred during the first 3 months of treatment, were usually transient and the majority resolved upon dose modification. In 5.2% of patients, bilirubin elevations led to dose modifications and in 1.5% of patients, bilirubin elevations led to withdrawal from Alecensa treatment. In the phase III clinical trial BO28984, Grade 3 or 4 bilirubin elevations occurred in 3.3% of patients receiving Alecensa versus no patient receiving crizotinib.

Concurrent elevations in ALT or AST greater than or equal to three times the ULN and total bilirubin greater than or equal to two times the ULN, with normal alkaline phosphatase, occurred in one patient (0.2%) treated in Alecensa clinical trials.

Patients should be monitored for liver function including ALT, AST, and total bilirubin as outlined in section 2.4 *Special warnings and precautions for use* and managed as recommended in section 2.2 *Posology and method of administration*.

Bradycardia

Cases of bradycardia (8.9%) of Grade 1 or 2 have been reported in patients treated with Alecensa across clinical trials (NP28761, NP28673, BO28984). No patients had events of Grade ≥ 3 severity. There were 66 of 365 patients (18%) treated with Alecensa who had post-dose heart rate values below 50 beats per minutes (bpm). In the phase III clinical trial BO28984 15% of patients treated with Alecensa had post-dose heart rate values below 50 bpm versus 20% of patients treated with crizotinib. Patients who develop symptomatic bradycardia should be managed as recommended in sections 2.2 *Posology and method of administration* and 2.4 *Special warnings and precautions for use*. No case of bradycardia led to withdrawal from Alecensa treatment.

Severe myalgia and CPK elevations

Cases of myalgia (28%) including myalgia events (22%) and musculoskeletal pain (7.4%) have been reported in patients treated with Alecensa across clinical trials (NP28761, NP28673, BO28984). The majority of events were Grades 1 or 2 and three patients (0.7%) had a Grade 3 event. Dose modifications of Alecensa treatment due to these adverse events were only required for two patients (0.5%); Alecensa treatment was not withdrawn due to these events of myalgia. Elevations of CPK occurred in 43% of 362 patients with CPK laboratory data available across clinical trials (NP28761, NP28673, BO28984) with Alecensa. The incidence of Grade 3 elevations of CPK was 3.7%. Median time to Grade 3 CPK elevation was 14 days across trials (NP28761, NP28673, BO28984). Dose modifications for elevation of CPK occurred in 3.2% of patients; withdrawal from Alecensa treatment did not occur due to CPK elevations. Severe myalgia has not been reported in the clinical trial BO28984. Grade 3 elevation of CPK was reported for 2.6% of patients receiving Alecensa and 1.3% of patients receiving crizotinib; and median time to Grade 3 CPK elevation was 27.5 days and 369 days, respectively, in the pivotal phase III clinical trial BO28984 (ALEX).

Gastrointestinal effects

Constipation (35%), nausea (19%), diarrhoea (16%) and vomiting (11%) were the most commonly reported gastrointestinal (GI) reactions. Most of these events were of mild or moderate severity; Grade 3 events were reported for diarrhea (0.7%), nausea (0.5%), and vomiting (0.2%). These events did not lead to withdrawal from Alecensa treatment. Median time to onset for constipation, nausea, diarrhea, and/or vomiting events across clinical trials (NP28761, NP28673, BO28984) was 21 days. The events declined in frequency after the first month of treatment. In the phase III clinical trial BO28984, one patient (0.2%) experienced a Grade 4 event of nausea in the Alecensa arm and the incidence of Grade 3 and 4 events for nausea, vomiting, and diarrhoea was 3.3%, 3.3%, and 2.0%, respectively, in the crizotinib arm.

2.9 Overdose

Patients who experience overdose should be closely supervised and general supportive care instituted. There is no specific antidote for overdose with Alecensa.

3. CLINICAL PARTICULARS

3.1 Pharmacodynamic Properties

Pharmacotherapeutic group: anti-neoplastic agents, protein kinase inhibitor; ATC code: L01XE36.

Mechanism of action

Alectinib is a highly selective and potent ALK and RET tyrosine kinase inhibitor. In preclinical studies, inhibition of ALK tyrosine kinase activity led to blockage of downstream signalling pathways including STAT 3 and PI3K/AKT and induction of tumour cell death (apoptosis).

Alectinib demonstrated *in vitro* and *in vivo* activity against mutant forms of the ALK enzyme, including mutations responsible for resistance to crizotinib. The major metabolite of alectinib (M4) has shown similar *in vitro* potency and activity.

Based on preclinical data, alectinib is not a substrate of p-glycoprotein or BCRP, which are both efflux transporters in the blood brain barrier, and is therefore able to distribute into and be retained within the central nervous system.

Clinical efficacy and safety

ALK positive non-small cell lung cancer

Treatment-naïve patients

The safety and efficacy of Alecensa were studied in a global randomised Phase III open label clinical trial (BO28984, ALEX) in ALK-positive NSCLC patients who were treatment naïve. Central testing for ALK protein expression positivity of tissue samples from all patients by Ventana anti-ALK (D5F3) immunohistochemistry (IHC) was required before randomisation into the study.

A total of 303 patients were included in the Phase III trial, 151 patients randomised to the crizotinib arm and 152 patients randomised to the Alecensa arm receiving Alecensa orally, at the recommended dose of 600 mg twice daily.

ECOG PS (0/1 vs. 2), race (Asian vs. non-Asian), and CNS metastases at baseline (yes vs. no) were stratification factors for randomisation. The primary endpoint of the trial was to demonstrate superiority of Alecensa versus crizotinib based on Progression Free survival (PFS) as per investigator assessment using RECIST 1.1. Baseline demographic and disease characteristics for Alecensa were median age 58 years (54 years for crizotinib), 55% female (58% for crizotinib), 55% non-Asian (54% for crizotinib), 61% with no smoking history (65% for crizotinib), 93% ECOG PS of 0 or 1 (93% for crizotinib), 97% Stage IV disease (96% for crizotinib), 90% adenocarcinoma histology (94% for crizotinib), 40% CNS metastases at baseline (38% for crizotinib) and 17% having received prior CNS radiation (14% for crizotinib).

The trial met its primary endpoint at the primary analysis, demonstrating a statistically significant improvement in PFS by investigator. Efficacy data are summarised in Table 4 and the Kaplan-Meier curve for investigator assessed PFS is shown in Figure 1.

Table 4 Summary of efficacy results from study BO28984 (ALEX)

	Crizotinib N=151	Alecensa N=152
Median duration of follow-up (months)	17.6 (range 0.3 – 27.0)	18.6 (range 0.5 – 29.0)
Primary efficacy parameter PFS (INV) Number of patients with event n (%) Median (months) [95% CI] HR [95% CI] Stratified log-rank p-value	102 (68%) 11.1 [9.1; 13.1] 0.47 [0.34, 0.65] p <0.0001	62 (41%) NE [17.7; NE] 0.47 [0.34, 0.65] p <0.0001
Secondary efficacy parameter PFS (IRC)* Number of patients with event n (%) Median (months) [95% CI] HR [95% CI] Stratified log-rank p-value	92 (61%) 10.4 [7.7; 14.6] 0.50 [0.36; 0.70] p <0.0001	63 (41%) 25.7 [19.9; NE] 0.50 [0.36; 0.70] p <0.0001
Time to CNS progression (IRC)*, ** Number of patients with event n (%) Cause-specific HR [95% CI] Stratified log-rank p-value	68 (45%) 0.16 [0.10; 0.28] p < 0.0001	18 (12%) 0.16 [0.10; 0.28] p < 0.0001

	Crizotinib N=151	Alecensa N=152
12-month cumulative incidence of CNS progression (IRC) [95% CI]	41.4% [33.2; 49.4]	9.4% [5.4; 14.7]
ORR (INV) ^{*,***} Responders n (%) [95% CI]	114 (75.5%) [67.8; 82.1]	126 (82.9%) [76.0; 88.5]
Overall survival [*] Number of patients with event n (%) Median (months) [95% CI] HR [95% CI]	40 (27%) NE [NE; NE]	35 (23%) NE [NE; NE]
	0.76 [0.48; 1.20]	
Duration of response (INV) Median (months) [95% CI]	N=114 11.1 [7.9; 13.0]	N=126 NE [NE; NE]
CNS-ORR in patients with measurable CNS metastases at baseline CNS responders n (%) [95% CI] CNS-CR n (%) CNS-DOR, median (months) [95% CI]	N=22 11 (50.0%) [28.2; 71.8] 1 (5%) 5.5 [2.1, 17.3]	N=21 17 (81.0%) [58.1; 94.6] 8 (38%) 17.3 [14.8, NE]
CNS-ORR in patients with measurable and non-measurable CNS metastases at baseline (IRC) CNS responders n (%) [95% CI] CNS-CR n (%) CNS-DOR, median (months) [95% CI]	N=58 15 (25.9%) [15.3; 39.0] 5 (9%) 3.7 [3.2, 6.8]	N=64 38 (59.4%) [46.4; 71.5] 29 (45%) NE [17.3, NE]

* Key secondary endpoints part of the hierarchical testing

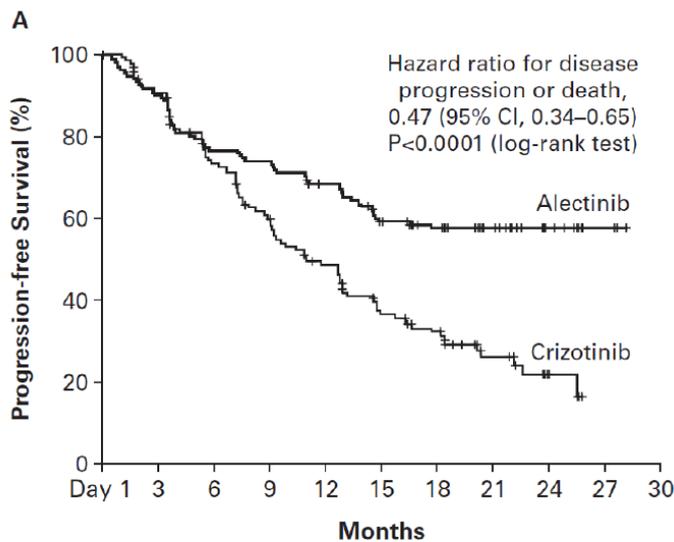
** Competing risk analysis of CNS progression, systemic progression and death as competing events

*** 2 patients in the crizotinib arm and 6 patients in the alectinib arm had CR

CI = confidence interval; CNS = central nervous system; CR = complete response; DOR = duration of response; HR = hazard ratio; IRC = Independent Review Committee; INV = investigator; NE = not estimable; ORR = objective response rate; PFS = progression free survival

The PFS benefit was consistent for patients with CNS metastases at baseline (HR = 0.40, 95% CI: 0.25-0.64, median PFS for Alecensa = NE, 95% CI: 9.2-NE, median PFS for crizotinib = 7.4 months, 95% CI: 6.6-9.6) and without CNS metastases at baseline (HR = 0.51, 95% CI: 0.33-0.80, median PFS for Alecensa = NE, 95% CI: NE, NE, median PFS for crizotinib = 14.8 months, 95% CI: 10.8-20.3), indicating benefit of Alecensa over crizotinib in both subgroups.

Figure 1: Kaplan Meier Plot of INV Assessed PFS in BO28984 (ALEX)



No. at Risk

Crizotinib	151	132	104	84	65	46	35	16	5	
Alectinib	152	135	113	109	97	81	67	35	15	3

Crizotinib pre-treated patients

The safety and efficacy of Alecensa in ALK-positive NSCLC patients pre-treated with crizotinib were studied in two Phase I/II clinical trials (NP28673 and NP28761).

NP28673

Study NP28673 was a Phase I/II single arm, multicentre study conducted in patients with ALK-positive advanced NSCLC who have previously progressed on crizotinib treatment. In addition to crizotinib, patients may have received previous treatment with chemotherapy. A total of 138 patients were included in the phase II part of the study and received Alecensa orally, at the recommended dose of 600 mg twice daily.

The primary endpoint was to evaluate the efficacy of Alecensa by Objective Response Rate (ORR) as per central Independent Review Committee (IRC) assessment using Response Evaluation Criteria in Solid Tumors (RECIST) version 1.1 in the overall population (with and without prior exposure of cytotoxic chemotherapy treatments). The co-primary endpoint was to evaluate the ORR as per central IRC assessment using RECIST 1.1 in patients with prior exposure of cytotoxic chemotherapy treatments. A lower confidence limit for the estimated ORR above the pre-specified threshold of 35% would achieve a statistically significant result.

Patient demographics were consistent with that of a NSCLC ALK positive population. The demographic characteristics of the overall study population were 67% Caucasian, 26% Asian, 56% females, and the median age was 52 years. The majority of patients had no history of smoking (70%). The ECOG (Eastern Cooperative Oncology Group) performance status at baseline was 0 or 1 in 90.6% of patients and 2 in 9.4% of patients. At the time of entry in the study, 99% of patients had stage IV disease, 61% had brain metastases and in 96% of patients tumours were classified as adenocarcinoma. Among patients included in the study, 20% of the patients had previously progressed on crizotinib treatment only, and 80% had previously progressed on crizotinib and at least one chemotherapy treatment.

Study NP28761

Study NP28761 was a Phase I/II single arm multicentre study conducted in patients with ALK positive advanced NSCLC who have previously progressed on crizotinib treatment. In addition to crizotinib, patients may have received previous treatment with chemotherapy. A total of 87 patients were included in the phase II part of the study and received Alecensa orally, at the recommended dose of 600 mg twice daily.

The primary endpoint was to evaluate the efficacy of Alecensa by ORR as per central IRC assessment using RECIST version 1.1. A lower confidence limit for the estimated ORR above the pre-specified threshold of 35% would achieve a statistically significant result.

Patient demographics were consistent with that of a NSCLC ALK positive population. The demographic characteristics of the overall study population were 84% Caucasian, 8% Asian, 55% females. The median age was 54 years. The majority of patients had no history of smoking (62%). The ECOG performance status at baseline was 0 or 1 in 89.7% of patients and 2 in 10.3% of patients. At the time of entry in the study, 99% of patients had stage IV disease, 60% had brain metastases and in 94% of patients tumours were classified as adenocarcinoma. Among the patients included in the study, 26% of the patients had previously progressed on crizotinib treatment only, and 74% had previously progressed on crizotinib and at least one chemotherapy treatment.

The main efficacy results from studies NP28673 and NP28761 are summarised in Table 5. A summary of pooled analysis of CNS endpoints is presented in Table 6.

Table 5 Efficacy results from studies NP28673 and NP28761

	NP28673 Alecensa 600 mg twice daily	NP28761 Alecensa 600 mg twice daily
Median duration of follow-up (months)	21 (range 1 – 30)	17 (range 1 – 29)
Primary efficacy parameter		
ORR (IRC) in RE population Responders N (%) [95% CI]	N=122 ^a 62 (50.8%) [41.6%, 60.0%]	N = 67 ^b 35 (52.2%) [39.7%, 64.6%]
ORR (IRC) in patients pre-treated with chemotherapy Responders N (%) [95% CI]	N = 96 43 (44.8%) [34.6%, 55.3%]	
Secondary efficacy parameter		
DOR (IRC) Number of patients with event N (%) Median (months) [95% CI]	N = 62 36 (58.1%) 15.2 [11.2, 24.9]	N = 35 20 (57.1%) 14.9 [6.9, NE]
PFS (IRC) Number of patients with event N (%) Median (months) [95% CI]	N = 138 98 (71.0%) 8.9 [5.6, 12.8]	N = 87 58 (66.7%) 8.2 [6.3, 12.6]

CI = confidence interval; DOR = duration of response; IRC = independent review committee; NE = not estimable; ORR = objective response rate; PFS= progression free survival; RE = response evaluable

^a 16 patients did not have measurable disease at baseline according to the IRC and were not included in the IRC response evaluable population.

^b 20 patients did not have measurable disease at baseline according to the IRC and were not included in the IRC response evaluable population

ORR results for studies NP28673 and NP28761 were consistent across subgroups of baseline patient characteristics such as age, gender, race, ECOG performance status, Central Nervous System (CNS) metastasis and prior chemotherapy use, especially when considering the small number of patients in some subgroups.

Table 6 Summary of the pooled analysis of CNS endpoints from studies NP28673 and NP28761

CNS Parameters (NP28673 and NP28761)	Alecensa 600 mg twice daily
Patients with measurable CNS lesions at baseline	N = 50
CNS ORR (IRC) Responders (%) [95% CI] Complete response Partial response	32 (64.0%) [49.2%, 77.1%] 11 (22.0%) 21 (42.0%)
CNS DOR (IRC) Number of patients with events (%) Median (months) [95% CI]	N=32 18 (56.3%) 11.1 [7.6, NE]

CI = confidence interval; DOR = duration of response; IRC = independent review committee; ORR = objective response rate; NE = not estimable

3.2 Pharmacokinetic properties

The pharmacokinetic parameters for alectinib and its major active metabolite (M4) have been characterised in ALK-positive NSCLC patients and healthy subjects. Based on population pharmacokinetic analysis, the geometric mean (coefficient of variation %) steady-state C_{max} , C_{min} and AUC_{0-12hr} for alectinib were approximately 665 ng/mL (44.3%), 572 ng/mL (47.8%) and 7430 ng*h/mL (45.7%), respectively. The geometric mean steady-state C_{max} , C_{min} and AUC_{0-12hr} for M4 were approximately 246 ng/mL (45.4%), 222 ng/mL (46.6%) and 2810 ng*h/mL (45.9%), respectively.

Absorption

Following oral administration of 600 mg twice daily under fed conditions in ALK-positive NSCLC patients, alectinib was absorbed reaching T_{max} after approximately 4 to 6 hours.

Alectinib steady-state is reached within 7 days with continuous 600 mg twice daily dosing. The accumulation ratio for the twice-daily 600 mg regimen was approximately 6-fold. Population PK analysis supports dose proportionality for alectinib across the dose range of 300 to 900 mg under fed conditions.

The absolute bioavailability of alectinib capsules was 36.9% (90% CI: 33.9%, 40.3%) under fed conditions in healthy subjects.

Following a single oral administration of 600 mg with a high-fat, high-calorie meal, alectinib and M4 exposure was increased by around 3-fold relative to fasted conditions (see section 2.2 *Posology and method of administration*).

Distribution

Alectinib and its major metabolite M4 are highly bound to human plasma proteins (>99%), independent of active substance concentration. The mean *in vitro* human blood-to-plasma concentration ratios of alectinib and M4 are 2.64 and 2.50, respectively, at clinically relevant concentrations.

The geometric mean volume of distribution at steady state (V_{ss}) of alectinib following IV administration was 475 L, indicating extensive distribution into tissues.

Based on *in vitro* data, alectinib is not a substrate of P-gp. Alectinib and M4 are not substrates of BCRP or organic anion-transporting polypeptide (OATP) 1B1/B3.

Biotransformation

In vitro metabolism studies showed that CYP3A4 is the main CYP isozyme mediating alectinib and its major metabolite M4 metabolism, and is estimated to contribute 40-50% of alectinib metabolism. Results from the human mass balance study demonstrated that alectinib and M4 were the main circulating moieties in plasma with 76% of the total radioactivity in plasma. The geometric mean Metabolite/Parent ratio at steady state is 0.399.

Metabolite M1b was detected as a minor metabolite from *in vitro* and in human plasma in healthy subjects. Formation of metabolite M1b and its minor isomer M1a is likely to be catalyzed by a combination of CYP isozymes (including isozymes other than CYP3A) and aldehyde dehydrogenase (ALDH) enzymes.

In vitro studies indicate that neither alectinib nor its major active metabolite (M4) inhibits CYP1A2, CYP2B6, CYP2C9, CYP2C19, or CYP2D6 at clinically relevant concentrations. Alectinib did not inhibit OATP1B1/OATP1B3, OAT1, OAT3 or OCT2 at clinically relevant concentrations *in vitro*.

Elimination

Following administration of a single dose of ^{14}C -labeled alectinib administered orally to healthy subjects the majority of radioactivity was excreted in faeces (mean recovery 97.8%) with minimal excretion in urine (mean recovery 0.46%). In faeces, 84% and 5.8% of the dose was excreted as unchanged alectinib or M4, respectively.

Based on a population PK analysis, the apparent clearance (CL/F) of alectinib was 81.9 L/hour. The geometric mean of the individual elimination half-life estimates for alectinib was 32.5 hours. The corresponding values for M4 were 217 L/hour and 30.7 hours, respectively.

Pharmacokinetics in special populations

Renal impairment

Negligible amounts of alectinib and the active metabolite M4 are excreted unchanged in urine (< 0.2% of the dose). Based on a population pharmacokinetic analysis alectinib and M4 exposures were similar in patients with mild and moderate renal impairment and normal renal function. The pharmacokinetics of alectinib has not been studied in patients with severe renal impairment.

Hepatic impairment

As elimination of alectinib is predominantly through metabolism in the liver, hepatic impairment may increase the plasma concentration of alectinib and/or its major metabolite M4. Based on a population pharmacokinetic analysis, alectinib and M4 exposures were similar in patients with mild hepatic impairment and normal hepatic function.

Following administration of a single oral dose of 300 mg alectinib in subjects with severe (Child-Pugh C) hepatic impairment, alectinib C_{max} was the same and AUC_{inf} was 2.2-fold higher compared with the same parameters in matched healthy subjects. M4 C_{max} and AUC_{inf} was 39% and 34% lower respectively, resulting in a combined exposure of alectinib and M4 (AUC_{inf}) 1.8-fold higher in patients with severe hepatic impairment compared with matched healthy subjects.

The hepatic impairment study also included a group with moderate (Child-Pugh B) hepatic impairment, and a modestly higher alectinib exposure was observed in this group compared with matched healthy subjects. The subjects in the Child Pugh B group however did in general not suffer from abnormal bilirubin, albumin or prothrombin time, indicating that they may not be fully representative of moderately hepatically impaired subjects with decreased metabolic capacity.

Effects of age, body weight, race and gender

Age, body weight, race and gender had no clinically meaningful effect on the systemic exposure of alectinib and M4. The range of body weights for patients enrolled in clinical studies is 36.9-123 kg. There are no available data on patients with extreme body weight (>130 kg) (see section 2.2 *Posology and method of administration*).

3.3 Preclinical safety data

Carcinogenicity

Carcinogenicity studies have not been performed to establish the carcinogenic potential of Alecensa.

Mutagenicity

Alectinib was not mutagenic *in vitro* in the bacterial reverse mutation (Ames) assay but induced a slight increase in numerical aberrations in the *in vitro* cytogenetic assay using Chinese Hamster Lung (CHL) cells with metabolic activation, and micronuclei in a rat bone marrow micronucleus test. The mechanism of micronucleus induction was abnormal chromosome segregation (aneugenicity), and not a clastogenic effect on chromosomes.

Impairment of fertility

No fertility studies in animals have been performed to evaluate the effect of Alecensa. No adverse effects on male and female reproductive organs were observed in general toxicology studies. These studies were conducted in rats and monkeys at exposures equal to or greater than 2.6- and 0.5-fold, respectively, of the human exposure, measured by AUC, at the recommended dose of 600 mg twice daily.

Teratogenicity

Alectinib caused embryo-foetal toxicity in pregnant rats and rabbits. In pregnant rats, alectinib caused total embryo-foetal loss (miscarriage) at exposures 4.5-fold of the human AUC exposure and small fetuses with retarded ossification and minor abnormalities of the organs at exposures 2.7-fold of the human AUC exposure. In pregnant rabbits, alectinib caused embryo-foetal loss, small fetuses and increased incidence of skeletal variations at exposures 2.9-fold of the human AUC exposure at the recommended dose.

Other

Alectinib absorbs UV light between 200 and 400 nm and demonstrated a phototoxic potential in an *in vitro* photosafety test in cultured murine fibroblasts after UVA irradiation.

Target organs in both rat and monkey at clinically relevant exposures in the repeat-dose toxicology studies included, but were not limited to the erythroid system, gastrointestinal tract, and hepatobiliary system.

Abnormal erythrocyte morphology was observed at exposures equal or greater than 10-60% the human exposure by AUC at the recommended dose. Proliferative zone extension in GI mucosa in both species was observed at exposures equal to or greater than 20-120% of the human AUC exposure at the recommended dose. Increased hepatic alkaline phosphatase (ALP) and direct bilirubin as well as vacuolation/degeneration/necrosis of bile duct epithelium and enlargement/focal necrosis of hepatocytes was observed in rats and/or monkeys at exposures equal to or greater than 20-30% of the human exposure by AUC at the recommended dose.

A mild hypotensive effect has been observed in monkeys at around clinically relevant exposures.

4. PHARMACEUTICAL PARTICULARS

4.1 Storage

Blisters

Do not store above 30°C. Store in the original package to protect from light and moisture.

Shelf life

36 months.

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

4.2 Special Instructions for Use, Handling and Disposal

Incompatibilities

Not applicable

Disposal of unused/expired medicines

The release of pharmaceuticals in the environment should be minimized. Medicines should not be disposed of via wastewater

and disposal through household waste should be avoided. Use established “collection systems”, if available in your location.

4.3 Packs

Multipack of 224 (4 packs of 56) hard capsules

Medicine: keep out of reach of children

MYAlecensa20200108CDS6.1



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Made for F. Hoffmann-La Roche Ltd, Basel, Switzerland
by Excella GmbH, Feucht, Germany

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