เอกสารกำกับยา

LORVIQUA™

1. Name of the Medicinal Product

1.1 Product name

LORVIQUA

1.2 Strength

25 mg and 100 mg

1.3 Pharmaceutical dosage form

Film-coated tablet

2. Quality and Quantitative Composition

2.1 Qualitative declaration

Active Ingredient: lorlatinib.

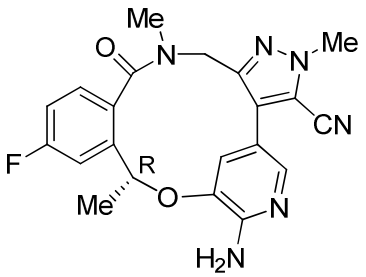
2.2 Quantitative declaration

Each 25 mg film-coated tablet contains 25 mg of lorlatinib.

Each 100 mg film-coated tablet contains 100 mg of lorlatinib.

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

Structure



3. Pharmaceutical Form

Film-coated tablet

25 mg: Round light pink immediate release film-coated tablet, debossed with “Pfizer” on one side and “25” and “LLN” on the other.

100 mg: Oval dark pink immediate release film-coated tablet, debossed with “Pfizer” on one side and “LLN 100” on the other.

4. Clinical Particulars

4.1 Therapeutic indications

Lorviqua as monotherapy is indicated for the treatment of adult patients with anaplastic lymphoma kinase (ALK)-positive advanced non-small cell lung cancer (NSCLC) whose disease has progressed after:

- alectinib or ceritinib as the first ALK tyrosine kinase inhibitor (TKI) therapy; or
- crizotinib and at least one other ALK TKI.

4.2 Posology and method of administration

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

<u>Posology</u>

The recommended dose is 100 mg lorlatinib taken orally once daily.

Duration of treatment

Treatment with lorlatinib is recommended as long as the patient is deriving clinical benefit from therapy without unacceptable toxicity.

Delayed or missed doses

If a dose of lorlatinib is missed, then it should be taken as soon as the patient remembers unless

it is less than 4 hours before the next dose, in which case the patient should not take the missed dose. Patients should not take 2 doses at the same time to make up for a missed dose.

Dose modifications

Dosing interruption or dose reduction may be required based on individual safety and tolerability. Lorlatinib dose reduction levels are summarised below.

- First dose reduction: 75 mg taken orally once daily
- Second dose reduction: 50 mg taken orally once daily

Lorlatinib should be permanently discontinued if the patient is unable to tolerate the 50 mg dose taken orally once daily.

Dose modification recommendations for toxicities and for patients who develop atrioventricular (AV) block are provided in Table 1.

Table 1. Recommended lorlatinib dose modifications for adverse reactions

Adverse Reaction[a]	**Lorlatinib dosing**
Hypercholesterolaemia or hypertriglyceridaemia	
Mild hypercholesterolaemia (cholesterol between ULN and 300 mg/dL or between ULN and 7.75 mmol/L) OR Moderate hypercholesterolaemia (cholesterol between 301 and 400 mg/dL or between 7.76 and 10.34 mmol/L) OR Mild hypertriglyceridaemia (triglycerides between 150 and 300 mg/dL or 1.71 and 3.42 mmol/L)	Introduce or modify lipid-lowering therapy[b] in accordance with respective prescribing information; continue lorlatinib at same dose.

Adverse Reaction[a]	**Lorlatinib dosing**
OR Moderate hypertriglyceridaemia (triglycerides between 301 and 500 mg/dL or 3.43 and 5.7 mmol/L)	
Severe hypercholesterolaemia (cholesterol between 401 and 500 mg/dL or between 10.35 and 12.92 mmol/L) OR Severe hypertriglyceridaemia (triglycerides between 501 and 1000 mg/dL or 5.71 and 11.4 mmol/L)	Introduce the use of lipid-lowering therapy;[b] if currently on lipid-lowering therapy, increase the dose of this therapy[b] in accordance with respective prescribing information; or change to a new lipid-lowering therapy[b]. Continue lorlatinib at the same dose without interruption.
Life-threatening hypercholesterolaemia (cholesterol over 500 mg/dL or over 12.92 mmol/L) OR Life-threatening hypertriglyceridaemia (triglycerides over 1,000 mg/dL or over 11.4 mmol/L)	Introduce the use of lipid-lowering therapy[b] or increase the dose of this therapy[b] in accordance with respective prescribing information or change to a new lipid-lowering therapy[b]. Withhold lorlatinib until recovery of hypercholesterolaemia and/or hypertriglyceridaemia to moderate or mild severity grade. Re-challenge at same lorlatinib dose while maximising lipid-lowering therapy[b] in accordance with respective prescribing information. If severe hypercholesterolaemia and/or hypertriglyceridaemia recur despite maximal lipid-lowering therapy[b] in accordance with respective prescribing information, reduce lorlatinib by 1 dose level.
Central nervous system effects (changes in cognition, mood or speech)	
Grade 2: Moderate	Withhold dose until toxicity is less than or equal to

Adverse Reaction[a]	**Lorlatinib dosing**
OR Grade 3: Severe	Grade 1. Then resume lorlatinib at 1 reduced dose level.
Grade 4: Life-threatening/Urgent intervention indicated	Permanently discontinue lorlatinib.
Lipase/Amylase increase	
Grade 3: Severe OR Grade 4: Life-threatening/Urgent intervention indicated	Withhold lorlatinib until lipase or amylase returns to baseline. Then resume lorlatinib at 1 reduced dose level.
Interstitial lung disease (ILD)/Pneumonitis	
Grade 1: Mild OR Grade 2: Moderate	Withhold lorlatinib until symptoms have returned to baseline and consider initiating corticosteroids. Resume lorlatinib at 1 reduced dose level. Permanently discontinue lorlatinib if ILD/pneumonitis recurs or fails to recover after 6 weeks of lorlatinib hold and steroid treatment.
Grade 3: Severe OR Grade 4: Life-threatening/Urgent intervention indicated	Permanently discontinue lorlatinib.
PR interval prolongation/Atrioventricular (AV) block	
First-degree AV block: Asymptomatic	Continue lorlatinib at the same dose without interruption. Consider effects of concomitant medicinal products, and assess and correct electrolyte imbalance that may prolong PR interval. Monitor ECG/symptoms potentially related

Adverse Reaction[a]	**Lorlatinib dosing**
	to AV block closely.
First-degree AV block: Symptomatic	Withhold lorlatinib. Consider effects of concomitant medicinal products, and assess and correct electrolyte imbalance that may prolong PR interval. Monitor ECG/symptoms potentially related to AV block closely. If symptoms resolve, resume lorlatinib at 1 reduced dose level.
Second-degree AV block: Asymptomatic	Withhold lorlatinib. Consider effects of concomitant medicinal products, and assess and correct electrolyte imbalance that may prolong PR interval. Monitor ECG/symptoms potentially related to AV block closely. If subsequent ECG does not show second-degree AV block, resume lorlatinib at 1 reduced dose level.
Second-degree AV block: Symptomatic	Withhold lorlatinib. Consider effects of concomitant medicinal products, and assess and correct electrolyte imbalance that may prolong PR interval. Refer for cardiac observation and monitoring. Consider pacemaker placement if symptomatic AV block persists. If symptoms and the second-degree AV block resolve or if patients revert to asymptomatic first-degree AV block, resume lorlatinib at 1 reduced dose level.
Complete AV block	Withhold lorlatinib. Consider effects of concomitant medicinal products, and assess and correct electrolyte imbalance that may prolong PR interval. Refer for cardiac observation and monitoring. Pacemaker placement may be indicated for severe symptoms associated with AV block. If AV block does not resolve, placement of a permanent pacemaker may be considered. If pacemaker placed, resume lorlatinib at full dose.

Adverse Reaction[a]	**Lorlatinib dosing**
	If no pacemaker placed, resume lorlatinib at 1 reduced dose level only when symptoms resolve and PR interval is less than 200 msec.
Other adverse reactions	
Grade 1: Mild OR Grade 2: Moderate	Consider no dose modification or reduce by 1 dose level, as clinically indicated.
Greater than or equal to Grade 3: Severe	Withhold lorlatinib until symptoms resolve to less than or equal to Grade 2 or baseline. Then resume lorlatinib at 1 reduced dose level.

Abbreviations: CTCAE=Common Terminology Criteria for Adverse Events; ECG=electrocardiogram; HMG CoA=3-hydroxy-3-methylglutaryl coenzyme A; NCI=National Cancer Institute; ULN=upper limit of normal.

[a] Grade categories are based on NCI CTCAE classifications.

[b] Lipid-lowering therapy may include: HMG CoA reductase inhibitor, nicotinic acid, fibric acid derivatives, or ethyl esters of omega-3 fatty acids.

Strong cytochrome P-450 (CYP) 3A4/5 inhibitors

Concurrent use of lorlatinib with medicinal products that are strong CYP3A4/5 inhibitors and grapefruit juice products may increase lorlatinib plasma concentrations. An alternative concomitant medicinal product with less potential to inhibit CYP3A4/5 should be considered (see section 4.5). If a strong CYP3A4/5 inhibitor must be co-administered, the starting lorlatinib dose of 100 mg once daily should be reduced to once daily 75 mg dose (see sections 4.5 and 5.2). If concurrent use of the strong CYP3A4/5 inhibitor is discontinued, lorlatinib should be resumed at the dose used prior to the initiation of the strong CYP3A4/5 inhibitor and after a washout period of 3 to 5 half-lives of the strong CYP3A4/5 inhibitor.

Special populations

Hepatic impairment

No dose adjustments are recommended for patients with mild hepatic impairment. No information is available for lorlatinib in patients with moderate or severe hepatic impairment. Therefore, lorlatinib is not recommended in patients with moderate to severe hepatic impairment (see section

5.2).

Renal impairment

No dose adjustment is needed for patients with normal renal function and mild or moderate (CL_{cr}: ≥30 mL/min) renal impairment based on a population pharmacokinetic analysis. Information for lorlatinib use in patients with severe (CL_{cr}: <30 mL/min) renal impairment is very limited. Therefore, lorlatinib is not recommended in patients with severe renal impairment (see section 5.2).

Elderly (≥65 years)

Due to the limited data on this population, no dose recommendation can be made for patients aged 65 years and older (see section 5.2).

Paediatric population

The safety and efficacy of lorlatinib in paediatric patients below 18 years have not been established. No data are available.

Method of administration

Lorviqua is for oral use.

Patients should be encouraged to take their dose of lorlatinib at approximately the same time each day with or without food (see section 5.2). The tablets should be swallowed whole (tablets should not be chewed, crushed or split prior to swallowing). No tablet should be ingested if it is broken, cracked, or otherwise not intact.

4.3 Contraindications

Hypersensitivity to lorlatinib or to any of the excipients listed in section 6.1.

Concomitant use of strong CYP3A4/5 inducers (see sections 4.4 and 4.5).

4.4 Special warnings and precautions for use

Hyperlipidaemia

The use of lorlatinib has been associated with increases in serum cholesterol and triglycerides

(see section 4.8). Median time of occurrence of severe increase in serum cholesterol and triglycerides is 201 days (range: 42 to 518 days) and 127 days (range: 15 to 358 days), respectively. Serum cholesterol and triglycerides should be monitored before initiation of lorlatinib; 2, 4, and 8 weeks after initiating lorlatinib; and regularly thereafter. Initiate or increase the dose of lipid-lowering medicinal products, if indicated (see section 4.2).

Central nervous system effects

Central nervous system (CNS) effects have been observed in patients receiving lorlatinib, including changes in cognitive function, mood or speech (see section 4.8). Dose modification or discontinuation may be required for those patients who develop CNS effects (see section 4.2).

Atrioventricular block

Lorlatinib was studied in a population of patients that excluded those with second degree or third-degree AV block (unless paced) or any AV block with PR interval >220 msec. PR interval prolongation and AV block have been reported in patients receiving lorlatinib (see section 5.2). Monitor electrocardiogram (ECG) prior to initiating lorlatinib and monthly thereafter, particularly in patients with predisposing conditions to the occurrence of clinically significant cardiac events. Dose modification may be required for those patients who develop AV block (see section 4.2).

Left ventricular ejection fraction decrease

Left ventricular ejection fraction (LVEF) decrease has been reported in patients receiving lorlatinib who had baseline and at least one follow-up LVEF assessment. Based on the available clinical study data, it is not possible to determine a causal relationship between effects on changes in cardiac contractility and lorlatinib. In patients with cardiac risk factors and those with conditions that can affect LVEF, cardiac monitoring, including LVEF assessment at baseline and during treatment, should be considered. In patients who develop relevant cardiac signs/symptoms during treatment, cardiac monitoring, including LVEF assessment, should be considered.

Lipase and amylase increase

Elevations of lipase and/or amylase have occurred in patients receiving lorlatinib (see section 4.8). Median time of occurrence of increase in serum lipase and amylase is 70 days (range: 7 to 696 days) and 41 days (range: 7 to 489 days), respectively. Risk of pancreatitis should be considered in patients receiving lorlatinib due to concomitant hypertriglyceridemia and/or a potential intrinsic mechanism. Patients should be monitored for lipase and amylase elevations prior to the start of lorlatinib treatment and regularly thereafter as clinically indicated (see section 4.2).

Interstitial lung disease/Pneumonitis

Severe or life-threatening pulmonary adverse reactions consistent with ILD/pneumonitis have occurred with lorlatinib (see section 4.8). Any patient who presents with worsening of respiratory symptoms indicative of ILD/pneumonitis (e.g., dyspnoea, cough, and fever) should be promptly evaluated for ILD/pneumonitis. Lorlatinib should be withheld and/or permanently discontinued based on severity (see section 4.2).

Drug-drug interactions

In a study conducted in healthy volunteers, the concomitant use of lorlatinib and rifampin, a strong CYP3A4/5 inducer, was associated with increases of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) with no increase of total bilirubin and alkaline phosphatase (see section 4.5). Concomitant use of a strong CYP3A4/5 inducer is contraindicated (see sections 4.3 and 4.5).

Concomitant use with moderate CYP3A4/5 inducers should be avoided, if possible, as they may also reduce lorlatinib plasma concentrations (see section 4.5).

Concurrent administration of lorlatinib with CYP3A4/5 substrates with narrow therapeutic indices, including but not limited to alfentanil, ciclosporin, dihydroergotamine, ergotamine, fentanyl, hormonal contraceptives, pimozide, quinidine, sirolimus and tacrolimus, should be avoided since the concentration of these medicinal products may be reduced by lorlatinib (see section 4.5).

Fertility and pregnancy

During treatment with lorlatinib and for at least 14 weeks after the final dose, male patients with female partners of childbearing potential must use effective contraception, including a condom, and male patients with pregnant partners must use condoms (see section 4.6). Male fertility may be compromised during treatment with lorlatinib (see section 5.3). Men should seek advice on effective fertility preservation before treatment. Women of childbearing potential should be advised to avoid becoming pregnant while receiving lorlatinib. A highly effective non-hormonal method of contraception is required for female patients during treatment with lorlatinib, because lorlatinib can render hormonal contraceptives ineffective (see sections 4.5 and 4.6). If a hormonal method of contraception is unavoidable, then a condom must be used in combination with the hormonal method. Effective contraception must be continued for at least 35 days after completing therapy (see section 4.6). It is not known whether lorlatinib affects female fertility.

Lactose intolerance

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

Dietary sodium

This medicinal product contains less than 1 mmol sodium (23 mg) per 25 mg or 100 mg tablet. Patients on low sodium diets should be informed that this product is essentially “sodium free”.

4.5 Interaction with other medicinal products and other forms of interaction

Pharmacokinetic interactions

In vitro data indicate that lorlatinib is primarily metabolised by CYP3A4 and uridine diphosphate-glucuronosyltransferase (UGT) 1A4, with minor contributions from CYP2C8, CYP2C19, CYP3A5 and UGT1A3.

Effect of medicinal products on lorlatinib

CYP3A4/5 inducers

Rifampin, a strong inducer of CYP3A4/5, administered at oral doses of 600 mg once daily for 12 days, reduced the mean lorlatinib area under curve (AUC_{inf}) by 85% and C_{max} by 76% of a single 100 mg oral dose of lorlatinib in healthy volunteers; increases in AST and ALT were also observed. Concomitant administration of lorlatinib with strong CYP3A4/5 inducers (e.g., rifampicin, carbamazepine, enzalutamide, mitotane, phenytoin, and St. John’s wort) may decrease lorlatinib plasma concentrations. The use of a strong CYP3A4/5 inducer with lorlatinib is contraindicated (see sections 4.3 and 4.4). Concomitant use with moderate CYP3A4/5 inducers should be avoided, if possible, as they may also reduce lorlatinib plasma concentrations (see section 4.4).

CYP3A4/5 inhibitors

Itraconazole, a strong inhibitor of CYP3A4/5, administered at oral doses of 200 mg once daily for 5 days, increased the mean lorlatinib AUC_{inf} by 42% and C_{max} by 24% of a single 100 mg oral dose of lorlatinib in healthy volunteers. Concomitant administration of lorlatinib with strong CYP3A4/5 inhibitors (e.g., boceprevir, cobicistat, itraconazole, ketoconazole, posaconazole, troleandomycin, voriconazole, ritonavir, paritaprevir in combination with ritonavir and ombitasvir

and/or dasabuvir, and ritonavir in combination with either elvitegravir, indinavir, lopinavir or tipranavir) may increase lorlatinib plasma concentrations. Grapefruit products may also increase lorlatinib plasma concentrations and should be avoided. An alternative concomitant medicinal product with less potential to inhibit CYP3A4/5 should be considered. If a strong CYP3A4/5 inhibitor must be concomitantly administered, a dose reduction of lorlatinib is recommended (see section 4.2).

Effect of lorlatinib on other medicinal products

CYP3A4/5 substrates

In vitro studies indicated that lorlatinib is a time-dependent inhibitor as well as an inducer of CYP3A4/5. Lorlatinib 150 mg orally once daily for 15 days decreased AUC_{inf} and C_{max} of a single oral 2 mg dose of midazolam (a sensitive CYP3A substrate) by 61% by 50%, respectively; hence, lorlatinib is a moderate CYP3A inducer. Thus, concurrent administration of lorlatinib with CYP3A4/5 substrates with narrow therapeutic indices, including but not limited to alfentanil, ciclosporin, dihydroergotamine, ergotamine, fentanyl, hormonal contraceptives, pimozide, quinidine, sirolimus, and tacrolimus, should be avoided since the concentration of these medicinal products may be reduced by lorlatinib (see section 4.4).

CYP2B6 substrates

Lorlatinib 100 mg once daily for 15 days decreased AUC_{inf} and C_{max} of a single oral 100 mg dose of bupropion (a combined CYP2B6 and CYP3A4 substrate) by 49.5% and 53%, respectively. Thus, lorlatinib is a weak inducer of CYP2B6, and no dose adjustment is necessary when lorlatinib is used in combination with medicinal products that are mainly metabolised by CYP2B6.

CYP2C9 substrates

Lorlatinib 100 mg once daily for 15 days decreased AUC_{inf} and C_{max} of a single oral 500 mg dose of tolbutamide (a sensitive CYP2C9 substrate) by 43% and 15%, respectively. Thus, lorlatinib is a weak inducer of CYP2C9, and no dose adjustment is required for medicinal products that are mainly metabolised by CYP2C9. However, patients should be monitored in case of concomitant treatment with medicinal products with narrow therapeutic indices metabolised by CYP2C9 (e.g. coumarin anticoagulants).

UGT substrates

Lorlatinib 100 mg once daily for 15 days decreased AUC_{inf} and C_{max} of a single oral 500 mg dose

of acetaminophen (a UGT, SULT and CYP1A2, 2A6, 2D6, and 3A4 substrate) by 45% and 28%, respectively. Thus, lorlatinib is a weak inducer of UGT, and no dose adjustment is required for medicinal products that are mainly metabolised by UGT. However, patients should be monitored in case of concomitant treatment with medicinal products with narrow therapeutic indices metabolised by UGT.

P-glycoprotein substrates
Lorlatinib 100 mg once daily for 15 days decreased AUC_{inf} and C_{max} of a single oral dose of 60 mg fexofenadine [a sensitive P-glycoprotein (P-gp) substrate] by 67% and 63%, respectively. Thus, lorlatinib is a moderate inducer of P-gp. Medicinal products that are P- gp substrates with narrow therapeutic indices (e.g., digoxin, dabigatran etexilate) should be used with caution in combination with lorlatinib due to the likelihood of reduced plasma concentrations of these substrates.

In vitro inhibition and induction studies of other CYP enzymes
In vitro, lorlatinib has a low potential to cause drug-drug interactions by induction of CYP1A2.

In vitro studies with drug transporters other than P-gp
In vitro studies indicated that lorlatinib may have the potential to inhibit BCRP (gastrointestinal tract), OATP1B1, OATP1B3, OCT1, MATE1, and OAT3 at clinically relevant concentrations. Lorlatinib should be used with caution in combination with substrates of BCRP, OATP1B1, OATP1B3, OCT1, MATE1 and OAT3 as clinically relevant changes in the plasma exposure of these substrates cannot be ruled out.

4.6 Fertility, pregnancy and lactation

Women of childbearing potential/Contraception in males and females
Women of childbearing potential should be advised to avoid becoming pregnant while receiving lorlatinib. A highly effective non-hormonal method of contraception is required for female patients during treatment with lorlatinib, because lorlatinib can render hormonal contraceptives ineffective (see sections 4.4 and 4.5). If a hormonal method of contraception is unavoidable, then a condom must be used in combination with the hormonal method. Effective contraception must be continued for at least 35 days after completing therapy.

During treatment with lorlatinib and for at least 14 weeks after the final dose, male patients with

female partners of childbearing potential must use effective contraception, including a condom, and male patients with pregnant partners must use condoms.

Pregnancy

Studies in animals have shown embryo-foetal toxicity (see section 5.3). There are no data from the use of lorlatinib in pregnant women. Lorlatinib may cause foetal harm when administered to a pregnant woman.

Lorlatinib is not recommended during pregnancy or for women of childbearing potential not using contraception.

Breast-feeding

It is unknown whether lorlatinib and its metabolites are excreted in human milk. A risk to the newborns/infants cannot be excluded.

Lorlatinib should not be used during breast-feeding. Breast-feeding should be discontinued during treatment with lorlatinib and for 7 days after the final dose.

Fertility

Based on non-clinical safety findings, male fertility may be compromised during treatment with lorlatinib (see section 5.3). It is not known whether lorlatinib affects female fertility. Men should seek advice on effective fertility preservation before treatment.

4.7 Effects on ability to drive and use machines

Lorlatinib has moderate influence on the ability to drive and use machines. Caution should be exercised when driving or operating machines as patients may experience CNS effects (see section 4.8).

4.8 Undesirable effects

Summary of the safety profile

The most frequently reported adverse reactions were hypercholesterolaemia (84.4%), hypertriglyceridaemia (67.1%), oedema (54.6%), peripheral neuropathy (47.8%), cognitive effects (28.8%), fatigue (28.1%), weight increased (26.4%), arthralgia (24.7%), mood effects (22.7%) and

diarrhoea (22.7%).

Dose reductions due to adverse reactions occurred in 23.4% of patients receiving lorlatinib. The most common adverse reactions that led to dose reductions were oedema and peripheral neuropathy. Permanent treatment discontinuation associated with adverse reactions occurred in 3.1% of patients receiving lorlatinib. The most frequent adverse reaction that led to permanent discontinuations was cognitive effects.

Tabulated list of adverse reactions

Table 2 presents adverse reactions occurring in 295 adult patients treated with lorlatinib 100 mg once daily with advanced NSCLC from Study A.

The adverse reactions listed in Table 2 are presented by system organ class and frequency categories, defined using the following convention: very common (≥1/10), common (≥1/100 to <1/10), uncommon (≥1/1,000 to <1/100), rare (≥1/10,000 to <1/1,000), very rare (<1/10,000). Within each frequency grouping, undesirable effects are presented in order of decreasing medical seriousness.

Table 2. Adverse reactions

System organ class and adverse reaction	Frequency category	All Grades %	Grades 3-4 %
Blood and lymphatic system disorders			
Anaemia	Very common	15.9	5.1
Metabolism and nutrition disorders			
Hypercholesterolaemia[a]	Very common	84.4	16.6
Hypertriglyceridaemia[b]	Very common	67.1	16.6
Psychiatric disorders			
Mood effects[c]	Very common	22.7	1.7
Hallucinations[d]	Common	7.8	1.0
Nervous system disorders			
Cognitive effects[e]	Very common	28.8	2.0
Peripheral neuropathy[f]	Very common	47.8	2.7
Headache	Very common	18.0	0.7
Speech effects[g]	Common	9.8	0.3

System organ class and adverse reaction	Frequency category	All Grades %	Grades 3-4 %
Eye disorders			
Vision disorder[h]	Very common	15.3	0.3
Respiratory, thoracic and mediastinal disorders			
Pneumonitis[i]	Common	1.4	1.0
Gastrointestinal disorders			
Diarrhoea	Very common	22.7	1.0
Nausea	Very common	18.3	0.7
Constipation	Very common	15.9	0
Skin and subcutaneous tissue disorders			
Rash[j]	Very common	14.2	0.3
Musculoskeletal and connective tissue disorders			
Arthralgia	Very common	24.7	0.7
Myalgia[k]	Very common	19.3	0
General disorders and administration site conditions			
Oedema[l]	Very common	54.6	2.4
Fatigue[m]	Very common	28.1	0.7
Investigations			
Weight increased	Very common	26.4	5.4
Lipase increased	Very common	13.9	8.8
Amylase increased	Very common	10.2	3.1
Electrocardiogram PR prolongation	Uncommon	0.7	0

Adverse reactions that represent the same medical concept or condition were grouped together and reported as a single adverse reaction in the table above. Terms actually reported in the studies and contributing to the relevant adverse reaction are indicated in parentheses, as listed below.

[a] Hypercholesterolaemia (including blood cholesterol increased, hypercholesterolaemia).

[b] Hypertriglyceridaemia (including blood triglycerides increased, hypertriglyceridaemia).

[c] Mood effects (including affective disorder, affect lability, aggression, agitation, anxiety, depressed mood, depression, euphoric mood, irritability, mania, mood altered, mood swings, personality change, stress).

[d] Hallucinations (including auditory hallucination, hallucination, visual hallucination).

[e] Cognitive effects (including events from SOC Nervous system disorders: amnesia, cognitive disorder, dementia, disturbance in attention, memory impairment, mental impairment; and also including events from SOC Psychiatric disorders: attention deficit/hyperactivity disorder, confusional state, delirium, disorientation, reading disorder). Within these effects, terms from SOC Nervous system disorders were more frequently reported than terms from SOC Psychiatric disorder.

[f] Peripheral neuropathy (including burning sensation, carpal tunnel syndrome, dysaesthesia, formication, gait disturbance, hypoaesthesia, muscular weakness, neuralgia, neuropathy peripheral, neurotoxicity, paraesthesia, peripheral sensory neuropathy, peroneal nerve palsy, sensory disturbance).

[g] Speech effects (dysarthria, slow speech, speech disorder).

[h] Vision disorder (including diplopia, photophobia, photopsia, vision blurred, visual acuity reduced, visual impairment, vitreous floaters).

i Pneumonitis (including interstitial lung disease, pneumonitis).

[j] Rash (including dermatitis acneiform, maculopapular rash, pruritic rash, rash).

[k] Myalgia (including musculoskeletal pain, myalgia).

[l] Oedema (including generalised oedema, oedema, oedema peripheral, peripheral swelling, swelling).

[m] Fatigue (including asthenia, fatigue).

Description of selected adverse reactions

Hypercholesterolaemia/hypertriglyceridaemia

Adverse reactions of increase in serum cholesterol or triglycerides were reported in 84.4% and 67.1% of patients, respectively. Of those, mild or moderate adverse reactions of hypercholesterolaemia or hypertriglyceridaemia occurred in 67.8% and 50.5% of patients, respectively (see section 4.4). The median time to onset for both hypercholesterolaemia and hypertriglyceridaemia was 15 days (range: 1 to 399 days). The median duration of hypercholesterolaemia and hypertriglyceridaemia was 381 and 405 days, respectively.

Central nervous system effects

CNS adverse reactions were primarily cognitive effects (28.8%), mood effects (22.7%), and speech effects (9.8%), and were generally mild, transient, and reversible spontaneously upon dose delay and/or dose reduction (see sections 4.2 and 4.4). The most common cognitive effect of any grade was memory impairment (11.5%), and the most common Grade 3 or 4 reactions were cognitive effect and confusional state (0.7% each). The most common mood effect of any grade was irritability (6.1%), which was also the most common Grade 3 or 4 reaction (1.0%). The most common speech effect of any grade was dysarthria (4.1%), and the most common Grade 3

or 4 reaction was slow speech (0.3%). Median time to onset for cognitive, mood, and speech effects was 92, 44, and 42 days, respectively. Median duration of cognitive, mood, and speech effects was 224, 83, and 106 days, respectively.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product.

4.9 Overdose

Treatment of overdose with the medicinal product consists of general supportive measures. Given the dose-dependent effect on PR interval, ECG monitoring is recommended. There is no antidote for lorlatinib.

5. Pharmacological Properties

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: anti neoplastic agents, protein kinase inhibitors, ATC code: L01XE44

Mechanism of action

Lorlatinib is a selective, adenosine triphosphate (ATP)-competitive inhibitor of ALK and c-ros oncogene 1 (ROS1) tyrosine kinases.

In non-clinical studies, lorlatinib inhibited catalytic activities of non-mutated ALK and clinically relevant ALK mutant kinases in recombinant enzyme and cell-based assays.

Lorlatinib demonstrated marked antitumour activity in mice bearing tumour xenografts that express echinoderm microtubule-associated protein-like 4 (EML4) fusions with ALK variant 1 (v1), including ALK mutations L1196M, G1269A, G1202R, and I1171T. Two of these ALK mutants, G1202R and I1171T, are known to confer resistance to alectinib, brigatinib, ceritinib, and crizotinib. Lorlatinib was also capable of penetrating the blood-brain barrier. Lorlatinib demonstrated activity in mice bearing orthotopic EML4-ALK or EML4-ALK^{L1196M} brain tumour implants.

Clinical efficacy

The use of lorlatinib in the treatment of ALK-positive advanced NSCLC after treatment with at least one second-generation ALK TKI was investigated in Study A, a single-arm, multicentre Phase 1/2 study. A total of 139 patients with ALK-positive advanced NSCLC after treatment with at least one second-generation ALK TKI were enrolled in the Phase 2 portion of the study. Patients received lorlatinib orally at the recommended dose of 100 mg once daily, continuously.

The primary efficacy endpoint in the Phase 2 portion of the study was objective response rate (ORR), including intracranial (IC)-ORR, as per Independent Central Review (ICR) according to modified response evaluation criteria in solid tumours (modified RECIST version 1.1). Secondary endpoints included duration of response (DOR), IC-DOR, time-to-tumour response (TTR), and progression-free survival (PFS).

Patient demographics of the 139 ALK-positive advanced NSCLC patients after treatment with at least one second-generation ALK TKI, were 56% female, 48% White, 38% Asian and the median age was 53 years (range: 29 to 83 years) with 16% of patients ≥65 years of age. The Eastern Cooperative Oncology Group (ECOG) performance status at baseline was 0 or 1 in 96% patients. Brain metastases were present at baseline in 67% of patients. Of the 139 patients, 20% received 1 prior ALK TKI, excluding crizotinib, 47% received 2 prior ALK TKIs, and 33% received 3 or more prior ALK TKIs.

The main efficacy results for Study A are included in Tables 3 and 4.

Table 3. Overall efficacy results in Study A by prior treatment

Efficacy parameter	One prior ALK TKI[a] with or without prior chemotherapy (N=28)	Two or more prior ALK TKIs with or without prior chemotherapy (N=111)
Objective response rate[b]	42.9%	39.6%
(95% CI)	(24.5, 62.8)	(30.5, 49.4)
Complete response, n	1	2
Partial response, n	11	42
Duration of response		
Median, months	5.6	9.9
(95% CI)	(4.2, NR)	(5.7, 24.4)
Progression-free survival		
Median, months	5.5	6.9
(95% CI)	(2.9, 8.2)	(5.4, 9.5)

Abbreviations: ALK=anaplastic lymphoma kinase; CI=confidence interval; ICR=Independent Central Review; N/n=number of patients; NR=not reached; TKI=tyrosine kinase inhibitor.

[a] Alectinib, brigatinib, or ceritinib.

[b] Per ICR.

Table 4. Intracranial* efficacy results in Study A by prior treatment

Efficacy parameter	One prior ALK TKI[a] with or without prior chemotherapy (N=9)	Two or more prior ALK TKIs with or without prior chemotherapy (N=48)
Objective response rate[b]	66.7%	52.1%
(95% CI)	(29.9, 92.5)	(37.2, 66.7)
Complete response, n	2	10
Partial response, n	4	15
Duration of intra-cranial response		
Median, months	NR	12.4
(95% CI)	(4.1, NR)	(6.0, NR)

Abbreviations: ALK=anaplastic lymphoma kinase; CI=confidence interval; ICR=Independent Central Review; N/n=number of patients; NR=not reached; TKI= tyrosine kinase inhibitor.

* In patients with at least one measurable brain metastasis at baseline.

[a] Alectinib, brigatinib, or ceritinib.

[b] Per ICR.

In the overall efficacy population of 139 patients, 56 patients had a confirmed objective response by ICR with a median TTR of 1.4 months (range: 1.2 to 16.6 months). The ORR for Asians was 49.1% (95% CI: 35.1, 63.2) and 31.5% for non-Asians (95% CI: 21.1, 43.4). Among the 31 patients with a confirmed IC objective tumour response and at least one measurable brain metastasis at baseline by ICR, the median IC-TTR was 1.4 months (range: 1.2 to 16.2 months). The IC ORR was 54.5% for Asians (95% CI: 32.2, 75.6) and 46.4% for non-Asians (95% CI: 27.5, 66.1).

5.2 Pharmacokinetic properties

Absorption

Peak lorlatinib concentrations in plasma are rapidly reached with the median T_{max} of 1.2 hours following a single 100 mg dose and 2.0 hours following multiple dosing of 100 mg once daily.

After oral administration of lorlatinib tablets, the mean absolute bioavailability is 80.8% (90% CI: 75.7, 86.2) compared to intravenous administration.

Administration of lorlatinib with a high fat, high calorie meal resulted in 5% higher exposure compared to fasted conditions. Lorlatinib may be administered with or without food. .

At 100 mg once daily, the geometric mean (% coefficient of variation [CV]) peak plasma concentration was 577 (42) ng/mL and the AUC_{24} was 5,650 (39) ng•h/mL in patients with cancer. The geometric mean (% CV) oral clearance was 17.7 (39) L/h.

Distribution

In vitro binding of lorlatinib to human plasma proteins is 66% with moderate binding to albumin or to α_1-acid glycoprotein.

Biotransformation

In humans, lorlatinib undergoes oxidation and glucuronidation as the primary metabolic pathways. *In vitro* data indicate that lorlatinib is metabolised primarily by CYP3A4 and UGT1A4, with minor contribution from CYP2C8, CYP2C19, CYP3A5, and UGT1A3.

In plasma, a benzoic acid metabolite of lorlatinib resulting from the oxidative cleavage of the amide and aromatic ether bonds of lorlatinib was observed as a major metabolite, accounting for 21% of the circulating radioactivity. The oxidative cleavage metabolite is pharmacologically inactive.

Elimination

The plasma half-life of lorlatinib after a single 100 mg dose was 23.6 hours. Following oral administration of a 100 mg radiolabelled dose of lorlatinib, a mean 47.7% of the radioactivity was recovered in urine and 40.9% of the radioactivity was recovered in faeces, with overall mean total recovery of 88.6%.

Unchanged lorlatinib was the major component of human plasma and faeces, accounting for 44% and 9.1% of total radioactivity, respectively. Less than 1% of unchanged lorlatinib was detected in urine.

Furthermore, lorlatinib is an inducer via human pregnane-X-receptor (PXR) and the human constitutive androstane receptor (CAR).

Linearity/non-linearity

At single dose, lorlatinib systemic exposure (AUC_{inf} and C_{max}) increased in a dose-related manner over the 10 to 200 mg dose range. Few data are available over the 10 to 200 mg dose range; however, no deviation from linearity was observed for AUC_{inf} and C_{max} after single dose.

After multiple once daily dose administration, lorlatinib C_{max} increased dose proportionally and AUC_{tau} increased slightly less than proportionally over the dose range of 10 to 200 mg once daily.

Also, at steady-state lorlatinib plasma exposures are lower than those expected from single dose pharmacokinetics, indicative of a net time-dependent auto-induction effect.

Cardiac electrophysiology

In Study A, 2 patients (0.7%) had absolute Fridericia's correction QTc (QTcF) values >500 msec and 5 patients (1.8%) had a change in QTcF from baseline >60 msec.

In addition, the effect of a single oral dose of lorlatinib (50 mg, 75 mg, and 100 mg) with and

without 200 mg once daily itraconazole was evaluated in a 2-way crossover study in 16 healthy volunteers. No increases in the mean QTc were observed at the mean observed lorlatinib concentrations in this study.

In 295 patients who received lorlatinib at the recommended dose of 100 mg once daily and had a ECG measurement in Study A, lorlatinib was studied in a population of patients that excluded those with QTc interval >470 msec. In the study population, the maximum mean change from baseline for PR interval was 16.4 msec (2-sided 90% upper CI 19.4 msec) (see sections 4.2, 4.4 and 4.8). Of these, 7 patients had a baseline PR >200 msec. Among the 284 patients with PR interval <200 msec, 14% had PR interval prolongation ≥200 msec after starting lorlatinib. The prolongation of PR interval occurred in a concentration-dependent manner. Atrioventricular block occurred in 1.0% of patients.

For those patients who develop PR prolongation, dose modification may be required (see section 4.2).

Special populations

Hepatic impairment

As lorlatinib is metabolised in the liver, hepatic impairment is likely to increase lorlatinib plasma concentrations. Clinical studies that were conducted excluded patients with AST or ALT >2.5 × ULN, or if due to underlying malignancy, >5.0 × ULN or with total bilirubin >1.5 × ULN. Population pharmacokinetic analyses have shown that lorlatinib exposure was not clinically meaningfully altered in patients with mild hepatic impairment (n=50). No dose adjustments are recommended for patients with mild hepatic impairment. No information is available for patients with moderate or severe hepatic impairment.

Renal impairment

Less than 1% of the administered dose is detected as unchanged lorlatinib in urine. Population pharmacokinetic analyses have shown that lorlatinib exposure was not clinically meaningfully altered in patients with mild (n=103) or moderate (n=41) renal impairment (CL_{cr}>30 mL/min). No starting dose adjustments are recommended for patients with mild or moderate renal impairment. Information for lorlatinib use in patients with severe renal impairment (CL_{cr}<30 mL/min) is limited (n=1).

Age, gender, race, body weight, and phenotype

Population pharmacokinetic analyses in patients with advanced NSCLC and healthy volunteers indicate that there are no clinically relevant effects of age, gender, race, body weight, and phenotypes for CYP3A5 and CYP2C19.

5.3 Preclinical Safety Data

Repeat-dose toxicity

The main toxicities observed were inflammation across multiple tissues (skin and cervix of rats and lung, trachea, skin, lymph nodes and/or the oral cavity including mandibular bone of dogs; associated with increases in white blood cells, fibrinogen, and/or globulin and decreases in albumin), and changes in the pancreas (with increases in amylase and lipase), hepatobiliary system (with increases in liver enzymes), male reproductive system, cardiovascular system, kidneys and gastrointestinal tract, peripheral nerves and the CNS (potential for cognitive functional impairment) at dose equivalent to human clinical exposure at the recommended posology. Changes in blood pressure and heart rate, and QRS complex and PR interval were also observed in animals after acute dosing (approximately 2.6 times the human clinical exposure at 100 mg after a single dose based on C_{max}). All target organ findings with the exception of hepatic bile duct hyperplasia were partially to fully reversible.

Genotoxicity

Lorlatinib is not mutagenic but is aneugenic *in vitro* and *in vivo* with a no observed effect level for aneugenicity approximately 16.5 times human clinical exposure at 100 mg based on AUC.

Carcinogenicity

Carcinogenicity studies have not been conducted with lorlatinib.

Reproductive toxicity

Seminiferous tubular degeneration and/or atrophy in the testes, and epididymal changes (inflammation and/or vacuolation) were observed in the rat and dog. In the prostate, minimal to mild glandular atrophy was observed in dogs at dose equivalent to human clinical exposure at the recommended posology). The effects on male reproductive organs were partially to fully reversible.

In embryo-foetal toxicity studies, conducted in rats and rabbits, respectively, increased

embryolethality, and lower foetal body weights and malformations were observed. Foetal morphologic abnormalities included rotated limbs, supernumerary digits, gastroschisis, malformed kidneys, domed head, high arched palate, and dilation of ventricles of the brain. The exposure at the lowest doses with embryo-foetal effects in animals was equivalent to the human clinical exposure at 100 mg, based on AUC.

6. Pharmaceutical Particulars

6.1 List of excipients

Tablet core contains:
Microcrystalline cellulose
Calcium hydrogen phosphate
Sodium starch glycolate
Magnesium stearate

Film-coating contains:
Hypromellose
Lactose monohydrate
Macrogol
Triacetin
Titanium dioxide (E171)
Iron oxide black (E172)
Iron oxide red (E172)

6.2 Incompatibilities

Not applicable

6.3 Shelf life

2 years

6.4 Special precautions for storage

The medicinal product does not require any special storage conditions.

6.5 Nature and contents of container

OPA/Al/PVC blisters with aluminum foil backing containing 10 film-coated tablets.

LORVIQUA 25 mg film-coated tablets

Each pack contains 120 film-coated tablets in 12 blisters

LORVIQUA 100 mg film-coated tablets

Each pack contains 30 film-coated tablets in 3 blisters

Not all pack sizes may be marketed.

7. Marketing Authorization Holder

Pfizer (Thailand) Limited

8. Marketing Authorization Numbers

9. Date of Authorization

10. Date of Revision of the Text

June 23, 2020

Warning (based on the Ministry of Public Health's Announcement)

This drug may cause serious harm, should be used under the supervision of a physician.

LPD Title: Lorlatinib

LPD rev no.: 1.2

LPD Date: June 23, 2020

Country: Thailand

Reference EU SmPC; date: May 25, 2020

LPD Date: June 23, 2020

Country: Thailand