1. NAME OF THE MEDICINAL PRODUCT

Alimta 100mg Powder for Solution for Infusion

Alimta 500mg Powder for Solution for Infusion

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Each 100mg vial contains 100mg of pemetrexed (as pemetrexed disodium).

Each 500mg vial contains 500mg of pemetrexed (as pemetrexed disodium).

After reconstitution (see section 6.6), each vial contains 25 mg/ml of pemetrexed.

Excipient with known effect

Each 100mg vial contains approximately 11mg sodium.

Each 500mg vial contains approximately 54mg sodium.

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

Powder for solution for infusion.

White to either light yellow or green-yellow lyophilised powder.

4. CLINICAL PARTICULARS

4.1. Therapeutic indications

Malignant Pleural Mesothelioma (MPM):

Alimta in combination with cisplatin is indicated for the treatment of chemotherapy naïve patients with unresectable MPM or who are otherwise not candidates for curative surgery.

Non-Small Cell Lung Cancer (NSCLC) (see section 5.1):

Alimta in combination with cisplatin is indicated for the first line treatment of patients with locally advanced or metastatic non-squamous NSCLC.

Alimta in combination with pembrolizumab, and platinum chemotherapy, is indicated for the first-line treatment of patients with metastatic non-squamous NSCLC, with no EGFR or ALK genomic tumor aberrations.

Alimta is indicated as monotherapy for the maintenance treatment of locally advanced or metastatic non-squamous NSCLC in patients whose disease has not progressed immediately following first-line treatment with platinum-based chemotherapy.

Alimta is indicated as monotherapy for the second line treatment of patients with locally advanced or metastatic non-squamous NSCLC.

4.2. Posology and method of administration

Alimta must only be administered under the supervision of a physician qualified in the use of anti-cancer chemotherapy.

Alimta in combination with cisplatin:

The recommended dose of Alimta is 500 mg/m^2 of body surface area (BSA) administered as an intravenous infusion over 10 minutes on the first day of each 21-day cycle. The recommended dose of cisplatin is 75 mg/m^2 BSA infused over two hours approximately 30 minutes after completion of the Alimta infusion on the first day of each 21-day cycle. Patients must receive adequate anti-emetic treatment and appropriate hydration prior to and/or after receiving cisplatin (see cisplatin package insert for specific dosing advice).

Alimta in combination with pembrolizumab and platinum chemotherapy:

The recommended dose of Alimta when administered with pembrolizumab and platinum chemotherapy for the initial treatment of metastatic non-squamous NSCLC in patients with a creatinine clearance (calculated by Cockcroft-Gault equation) of 45 mL/min or greater is 500 mg/m^2 as an intravenous infusion over 10 minutes administered after pembrolizumab and prior to carboplatin or cisplatin on Day 1 of each 21-day cycle for 4 cycles. Following completion of platinum-based therapy, treatment with Alimta with or without pembrolizumab is administered until disease progression or unacceptable toxicity. Please refer to the full prescribing information for pembrolizumab and for carboplatin or cisplatin.

Alimta as single agent:

In patients treated for NSCLC after prior chemotherapy, the recommended dose of Alimta is 500 mg/m^2 BSA administered as an intravenous infusion over 10 minutes on the first day of each 21-day cycle.

Pre-medication Regimen:

To reduce the incidence and severity of skin reactions, a corticosteroid should be given the day prior to, on the day of, and the day after Alimta administration. The corticosteroid should be equivalent to 4mg of dexamethasone administered orally twice a day (see section 4.4).

To reduce toxicity, patients treated with Alimta must also receive vitamin supplementation (see section 4.4). Patients must take oral folic acid or a multivitamin containing folic acid (350-1000mcg) on a daily basis. The most commonly used dose of oral folic acid in clinical trials was 400mcg. At least five doses of folic acid must be taken during the seven days preceding the first dose of Alimta and dosing must continue during the full course of therapy and for 21 days after the last dose of Alimta. Patients must also receive an intramuscular injection of vitamin B_{12} (1000mcg) in the week preceding the first dose of Alimta and once every three cycles thereafter. Subsequent vitamin B_{12} injections may be given on the same day as Alimta.

Monitoring:

Patients receiving Alimta should be monitored before each dose with a complete blood count, including a differential white cell count (WCC) and platelet count. Prior to each chemotherapy administration blood chemistry tests should be collected to evaluate renal and hepatic function. Before the start of any cycle of chemotherapy, patients are required to have the following: Absolute Neutrophil Count (ANC) should be ≥ 1500 cells/mm^3 and platelets should be ≥ 100,000 cells/mm^3.

Creatinine clearance should be ≥ 45 ml/min.

The total bilirubin should be ≤ 1.5 times upper limit of normal. Alkaline phosphatase (AP), aspartate aminotransferase (AST or SGOT) and alanine aminotransferase (ALT or SGPT) should be ≤ 3 times upper limit of normal. Alkaline phosphatase, AST and ALT ≤ 5 times upper limit of normal is acceptable if liver has tumour involvement.

Dose Adjustments:

Dose adjustments at the start of a subsequent cycle should be based on nadir haematologic counts or maximum non-haematologic toxicity from the preceding cycle of therapy. Treatment may be delayed to allow sufficient time for recovery. Upon recovery patients should be retreated using the guidelines in Tables 1, 2 and 3; which are applicable for Alimta used as a single agent or in combination with cisplatin.

Table 1: Dose modification for Alimta (single agent or in combination) and cisplatin – Haematologic toxicities	
Nadir ANC < 500/mm^3 and nadir platelets ≥ 50,000/mm^3	75% of previous dose (both Alimta and cisplatin)
Nadir platelets < 50,000/mm^3 without bleeding regardless of nadir ANC	75% of previous dose (both Alimta and cisplatin)
Nadir platelets < 50,000/mm^3 with bleeding[a], regardless of nadir ANC	50% of previous dose (both Alimta and cisplatin)

[a] These criteria meet the National Cancer Institute Common Toxicity Criteria (NCI CTC) (CTC v2.0; NCI 1998) definition of ≥ CTC Grade 2 bleeding

If patients develop non-haematologic toxicities ≥ Grade 3 (excluding neurotoxicity), Alimta should be withheld until resolution to less than or equal to the patient's pre-therapy value. Treatment should be resumed according to the guidelines in Table 2.

Table 2: Dose modification for Alimta (single agent or in combination) and cisplatin – Non-haematologic toxicities[a,b]		
	Dose of Alimta (mg/m^2)	**Dose of cisplatin (mg/m^2)**
Any Grade 3 or 4 toxicities except mucositis	75% of previous dose	75% of previous dose
Any diarrhoea requiring hospitalisation (irrespective of grade) or Grade 3 or 4 diarrhoea	75% of previous dose	75% of previous dose
Grade 3 or 4 mucositis	50% of previous dose	100% of previous dose

[a] NCI CTC (CTC v2.0; NCI 1998)

[b] Excluding neurotoxicity

In the event of neurotoxicity, the recommended dose adjustment for Alimta and cisplatin is documented in Table 3. Patients should discontinue therapy if Grade 3 or 4 neurotoxicity is observed.

Table 3: Dose modification for Alimta (single agent or in combination) and cisplatin – Neurotoxicity		
CTC[a] Grade	**Dose of Alimta (mg/m²)**	**Dose of cisplatin (mg/m²)**
0 – 1	100% of previous dose	100% of previous dose
2	100% of previous dose	50% of previous dose

[a] NCI CTC (CTC v2.0; NCI 1998)

Treatment with Alimta should be discontinued if a patient experiences any haematologic or non-haematologic Grade 3 or 4 toxicity after 2 dose reductions or immediately if Grade 3 or 4 neurotoxicity is observed.

Special populations

Elderly

In clinical studies, there has been no indication that patients 65 years of age or older are at increased risk of adverse reaction compared to patients younger than 65 years old. No dose reductions other than those recommended for all patients are necessary.

Paediatric population

Alimta is not recommended for use in children below 18 years of age, due to insufficient data on safety and efficacy.

Patients with renal impairment (Standard Cockcroft and Gault formula or Glomerular Filtration Rate measured Tc99m-DPTA serum clearance method)

Alimta is primarily eliminated unchanged by renal excretion. In clinical studies, patients with creatinine clearance of ≥ 45 ml/min required no dose adjustments other than those recommended for all patients. There are insufficient data on the use of Alimta in patients with creatinine clearance below 45 ml/min; therefore the use of Alimta is not recommended (see section 4.4).

Patients with hepatic impairment

No relationships between AST (SGOT), ALT (SGPT) or total bilirubin and Alimta pharmacokinetics were identified. However patients with hepatic impairment such as bilirubin > 1.5 times the upper limit of normal and/or aminotransferase > 3.0 times the upper limit of normal (hepatic metastases absent) or > 5.0 times the upper limit of normal (hepatic metastases present) have not been specifically studied.

Method of administration

ALIMTA is for intravenous use. ALIMTA should be administered as an intravenous infusion over 10 minutes on the first day of each 21-day cycle.

For precautions to be taken before handling or administering Alimta and for instructions on reconstitution and dilution of Alimta before administration, see section 6.6.

4.3. Contraindications

Hypersensitivity to the active substance or to any of the excipients listed in section 6.1.
Breastfeeding (see section 4.6).
Concomitant yellow fever vaccine (see section 4.5).

4.4. Special warnings and precautions for use

Alimta can suppress bone marrow function as manifested by neutropenia, thrombocytopenia, anaemia or pancytopenia (see section 4.8). Myelosuppression is usually the dose-limiting toxicity. Patients should be monitored for myelosuppression during therapy and Alimta should not be given to patients until ANC returns to ≥ 1500 cells/mm^3 and platelet count returns to ≥ 100,000 cells/mm^3. Dose reductions for subsequent cycles are based on nadir ANC, platelet count and maximum non-haematologic toxicity seen from the previous cycle (see section 4.2).

Less toxicity and reduction in Grade 3/4 haematologic and non-haematologic toxicities such as neutropenia, febrile neutropenia and infection with Grade 3/4 neutropenia were reported when pre-treatment with folic acid and vitamin B_{12} was administered. Therefore, all patients treated with Alimta must be instructed to take folic acid and vitamin B_{12} as a prophylactic measure to reduce treatment-related toxicity (see section 4.2).

Skin reactions have been reported in patients not pre-treated with a corticosteroid. Pre-treatment with dexamethasone (or equivalent) can reduce the incidence and severity of skin reactions (see section 4.2).

An insufficient number of patients has been studied with creatinine clearance of below 45ml/min. Therefore, the use of Alimta in patients with creatinine clearance of < 45ml/min is not recommended (see section 4.2).

Patients with mild to moderate renal insufficiency (creatinine clearance from 45-79ml/min) should avoid taking non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and acetylsalicylic acid (> 1.3g daily) for 2 days before, on the day of, and at least 2 days following Alimta administration (see section 4.5).

In patients with mild to moderate renal insufficiency eligible for Alimta therapy, NSAIDs with long elimination half-lives should be interrupted for at least 5 days prior to, on the day of, and at least 2 days following Alimta administration (see section 4.5).

Serious renal events, including acute renal failure, have been reported with Alimta alone or in association with other chemotherapeutic agents. Many of the patients in whom these occurred had underlying risk factors for the development of renal events including dehydration or pre-existing hypertension or diabetes. Nephrogenic diabetes insipidus and renal tubular necrosis were also reported in post marketing setting with Alimta alone or with other chemotherapeutic agents. Most of these events resolved after Alimta withdrawal. Patients should be regularly monitored for acute tubular necrosis, decreased renal function and signs and symptoms of nephrogenic diabetes insipidus (e.g. hypernatraemia).

The effect of third space fluid, such as pleural effusion or ascites, on Alimta is not fully defined. A phase 2 study of Alimta in 31 solid tumour patients with stable third space fluid demonstrated no difference in Alimta dose-normalized plasma concentrations or clearance compared to patients without third space fluid collections. Thus, drainage of third space fluid collection prior to Alimta treatment should be considered, but may not be necessary.

Due to the gastrointestinal toxicity of Alimta given in combination with cisplatin, severe dehydration has been observed. Therefore, patients should receive adequate anti-emetic treatment and appropriate hydration prior to and/or after receiving treatment.

Serious cardiovascular events, including myocardial infarction and cerebrovascular events have been uncommonly reported during clinical studies with Alimta, usually when given in combination with another cytotoxic agent. Most of the patients in whom these events have been observed had pre-existing cardiovascular risk factors (see section 4.8).

Immunodepressed status is common in cancer patients. As a result, concomitant use of live attenuated vaccines is not recommended (see section 4.3 and 4.5).

Alimta can have genetically damaging effects. Sexually mature males are advised not to father a child during the treatment and up to 3 months thereafter. Contraceptive measures or abstinence are recommended. Owing to the possibility of Alimta treatment causing irreversible infertility, men are advised to seek counselling on sperm storage before starting treatment.

Women of childbearing potential must use effective contraception during treatment with Alimta and for 6 months following completion of treatment (see section 4.6).

Cases of radiation pneumonitis have been reported in patients treated with radiation either prior, during or subsequent to their Alimta therapy. Particular attention should be paid to these patients and caution exercised with use of other radiosensitising agents.

Cases of radiation recall have been reported in patients who received radiotherapy weeks or years previously.

Excipients

Alimta 100mg Powder for Solution for Infusion

This medicinal product contains less than 1 mmol sodium (23 mg) per vial, that is to say essentially 'sodium-free'.

Alimta 500mg Powder for Solution for Infusion

This medicinal product contains 54 mg sodium per vial, equivalent to 2.7 % of the WHO recommended maximum daily intake of 2 g sodium for an adult.

4.5. Interaction with other medicinal products and other forms of interaction

Alimta is mainly eliminated unchanged renally by tubular secretion and to a lesser extent by glomerular filtration. Concomitant administration of nephrotoxic drugs (e.g. aminoglycoside, loop diuretics, platinum compounds, cyclosporin) could potentially result in delayed clearance of Alimta. This combination should be used with caution. If necessary, creatinine clearance should be closely monitored.

Concomitant administration of substances that are also tubularly secreted (e.g. probenecid, penicillin) could potentially result in delayed clearance of Alimta. Caution should be made when these drugs are combined with Alimta. If necessary, creatinine clearance should be closely monitored.

In patients with normal renal function (creatinine clearance ≥ 80ml/min), high doses of NSAIDs (such as ibuprofen > 1600 mg/day) and acetylsalicylic acid at higher dose (> 1.3g daily) may decrease Alimta elimination and, consequently increase the occurrence of Alimta adverse reactions. Therefore, caution should be made when administering higher doses of NSAIDs or acetylsalicylic acid, concurrently with Alimta to patients with normal function (creatinine clearance ≥ 80 ml/min).

In patients with mild to moderate renal insufficiency (creatinine clearance 45 to 79 ml/min), the concomitant administration of Alimta with NSAIDs (e.g. ibuprofen) or acetylsalicylic acid at higher dose should be avoided for 2 days before, on the day of, and 2 days following Alimta administration (see section 4.4).

In the absence of data regarding potential interaction with NSAIDs having longer half-lives, such as piroxicam, the concomitant administration with Alimta in patients with mild to moderate renal insufficiency should be interrupted for at least 5 days prior to, on the day of, and at least 2 days following Alimta administration (see section 4.4). If concomitant administration of NSAIDs is necessary, patients should be monitored closely for toxicity, especially myelosuppression and gastrointestinal toxicity.

Alimta undergoes limited hepatic metabolism. Results from *in vitro* studies with human liver microsomes indicated that Alimta would not be predicted to cause clinically significant inhibition of the metabolic clearance of drugs metabolised by CYP3A, CYP2D6, CYP2C9 and CYP1A2.

<u>Interactions common to all cytotoxics</u>

Due to the increased thrombotic risk in patients with cancer, the use of anti-coagulation treatment is frequent. The high intra-individual variability of the coagulation status during diseases and the possibility of interaction between oral anti-coagulants and anti-cancer chemotherapy require increased frequency of INR (International Normalised Ratio) monitoring, if it is decided to treat the patient with oral anti-coagulants.

Concomitant use contraindicated: Yellow fever vaccine: risk of fatal generalised vaccinale disease (see section 4.3).

Concomitant use not recommended: Live attenuated vaccines (except yellow fever, for which concomitant use is contraindicated): risk of systemic, possibly fatal, disease. The risk is increased in

subjects who are already immunosuppressed by their underlying disease. Use an inactivated vaccine where it exists (poliomyelitis) (see section 4.4).

4.6. Fertility, pregnancy and lactation

Women of childbearing potential / Contraception in males and females

Alimta can have genetically damaging effects. Women of childbearing potential must use effective contraception during treatment with Alimta and for 6 months following completion of treatment. Sexually mature males are advised to use effective contraceptive measures and not to father a child during the treatment and up to 3 months thereafter.

Pregnancy

There are no data from the use of Alimta in pregnant women but Alimta like other anti-metabolites is suspected to cause serious birth defects when administered during pregnancy. Animal studies have shown reproductive toxicity (see section 5.3). Alimta should not be used during pregnancy unless clearly necessary, after a careful consideration of the needs of the mother and the risk for the foetus (see section 4.4).

Lactation

It is unknown whether Alimta is excreted in human milk and adverse reactions on the breast-feeding child cannot be excluded. Breast-feeding must be discontinued during Alimta therapy (see section 4.3).

Fertility

Owing to the possibility of Alimta treatment causing irreversible infertility, men are advised to seek counselling on sperm storage before starting treatment.

4.7. Effects on ability to drive and use machines

No studies on the effects on the ability to drive and use machines have been performed. However, it has been reported that Alimta may cause fatigue. Therefore, patients should be cautioned against driving or operating machines if this event occurs.

4.8. Undesirable effects

The most commonly reported undesirable effects related to Alimta, whether used as monotherapy or in combination, are bone marrow suppression manifested as anaemia, neutropenia, leukopenia, thrombocytopenia; and gastrointestinal toxicities, manifested as anorexia, nausea, vomiting,

diarrhoea, constipation, pharyngitis, mucositis, and stomatitis. Other undesirable effects include renal toxicities, increased aminotransferases, alopecia, fatigue, dehydration, rash, infection/sepsis and neuropathy. Rarely seen events include Stevens-Johnson syndrome and Toxic epidermal necrolysis.

Tabulated list of adverse reactions

The table 4 lists the adverse drug events regardless of causality associated with pemetrexed used either as a monotherapy treatment or in combination with cisplatin from the pivotal registration studies (JMCH, JMEI, JMBD, JMEN and PARAMOUNT) and from the post marketing period.

ADRs are listed by MedDRA body system organ class. The following convention has been used for classification of frequency:
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) and not known (cannot be estimated from the available data).

Table 4. Frequencies of all grades adverse drug events regardless of causality from the pivotal registration studies: JMEI (ALIMTA vs Docetaxel), JMDB (ALIMTA and Cisplatin versus GEMZAR and Cisplatin, JMCH (ALIMTA plus Cisplatin versus Cisplatin), JMEN and PARAMOUNT (Pemetrexed plus Best Supportive Care versus Placebo plus Best Supportive Care) and from post-marketing period.

System Organ Class (MedDRA)	Very common	Common	Uncommon	Rare	Very rare	Not known
Infections and infestations	Infection[a] Pharyngitis	Sepsis[b]			Dermo-hypodermitis	
Blood and lymphatic system disorders	Neutropenia Leukopenia Haemoglobin decreased	Febrile neutropenia Platelet count decreased	Pancytopenia	Autoimmune haemolytic anaemia		
Immune System disorders		Hypersensitivity		Anaphylactic shock		
Metabolism and nutrition disorders		Dehydration				
Nervous system disorders		Taste disorder	Cerebrovascular accident			

System Organ Class (MedDRA)	Very common	Common	Uncommon	Rare	Very rare	Not known
		Peripheral motor neuropathy Peripheral sensory neuropathy Dizziness	Ischaemic stroke Haemorrhage intracranial			
Eye disorders		Conjunctivitis Dry eye Lacrimation increased Keratoconjunctivitis sicca Eyelid oedema Ocular surface disease				
Cardiac disorders		Cardiac failure Arrhythmia	Angina Myocardial infarction Coronary artery disease Arrhythmia supraventricular			
Vascular disorders			Peripheral ischaemia[c]			
Respiratory, thoracic and mediastinal disorders			Pulmonary embolism Interstitial pneumonitis[b,d]			

System Organ Class (MedDRA)	Very common	Common	Uncommon	Rare	Very rare	Not known
Gastrointestinal disorders	Stomatitis Anorexia Vomiting Diarrhoea Nausea	Dyspepsia Constipation Abdominal pain	Rectal haemorrhage Gastrointestinal haemorrhage Intestinal perforation Oesophagitis Colitis [e]			
Hepatobiliary disorders		Alanine aminotransferase increased Aspartate aminotransferase increased		Hepatitis		
Skin and subcutaneous tissue disorders	Rash Skin exfoliation	Hyperpigmentation Pruritus Erythema multiforme Alopecia Urticaria		Erythema	Stevens-Johnson syndrome[b] Toxic epidermal necrolysis[b] Pemphigoid Dermatitis bullous Acquired epidermolysis bullosa Erythema-tous oedema[f] Pseudocellu-litis Dermatitis Eczema	

System Organ Class (MedDRA)	Very common	Common	Uncommon	Rare	Very rare	Not known
					Prurigo	
Renal and urinary disorders	Creatinine clearance decreased Blood creatinine increased[e]	Renal failure Glomerular filtration rate decreased				Nephrogenic diabetes insipidus Renal tubular necrosis
General disorders and administration site conditions	Fatigue	Pyrexia Pain Oedema Chest pain Mucosal inflammation				
Investigations		Gamma-glutamyltransferase increased				
Injury, poisoning and procedural complications			Radiation oesophagitis Radiation pneumonitis	Recall phenomenon		

[a] with and without neutropenia

[b] in some cases fatal

[c] sometimes leading to extremity necrosis

[d] with respiratory insufficiency

[e] seen only in combination with cisplatin

[f] mainly of the lower limbs

Combination with pembrolizumab and platinum chemotherapy (NSCLC):

The safety of pembrolizumab in combination with Alimta and platinum chemotherapy has been evaluated in 488 patients with non-squamous NSCLC receiving 200mg, 2 mg/Kg or 10 mg/Kg pembrolizumab every 3 weeks, in two clinical trials. In this patient population, the most frequent

adverse reactions were nausea (47%), anaemia (37%), fatigue (38%), neutropenia (22%), decreased appetite (21%), diarrhoea (20%) and vomiting (19%). Incidences of Grade 3-5 adverse reactions were 47% for pembrolizumab combination therapy and 37% for chemotherapy alone.

4.9. Overdose

Reported symptoms of overdose include neutropenia, anaemia, thrombocytopenia, mucositis, sensory polyneuropathy and rash. Anticipated complications of overdose include bone marrow suppression as manifested by neutropenia, thrombocytopenia and anaemia. In addition, infection with or without fever, diarrhoea and/or mucositis may be seen. In the event of suspected overdose, patients should be monitored with blood counts and should receive supportive therapy as necessary. The use of calcium folinate/ folinic acid in the management of Alimta overdose should be considered.

5. PHARMACOLOGICAL PROPERTIES

5.1. Pharmacodynamic properties

Pharmacotherapeutic group: Folic acid analogues, ATC code: L01BA04

Alimta is a multi-targeted anti-cancer anti-folate agent that exerts its action by disrupting crucial folate-dependent metabolic processes essential for cell replication.

In vitro studies have shown that Alimta behaves as a multitargeted anti-folate by inhibiting thymidylate synthase (TS), dihydrofolate reductase (DHFR) and glycinamide ribonucleotide formyltransferase (GARFT); which are key folate-dependent enzymes for the *de novo* biosynthesis of thymidine and purine nucleotides. Alimta is transported into cells by both the reduced folate carrier and membrane folate binding protein transport systems. Once in the cell, Alimta is rapidly and efficiently converted to polyglutamate forms by the enzyme folylpolyglutamate synthetase. The polyglutamate forms are retained in cells and are even more potent inhibitors of TS and GARFT. Polyglutamation is a time- and concentration-dependent process that occurs in tumour cells and, to a lesser extent, in normal tissues. Polyglutamated metabolites have an increased intracellular half-life resulting in prolonged drug action in malignant cells.

Clinical Efficacy:

Mesothelioma:

EMPHACIS, a multicentre, randomised, single-blind phase 3 study of Alimta plus cisplatin versus cisplatin in chemonaive patients with MPM, has shown that patients treated with Alimta and cisplatin

had a clinically meaningful 2.8-month median survival advantage over patients receiving cisplatin alone.

During the study, low-dose folic acid and vitamin B_{12} supplementation was introduced to patients' therapy to reduce toxicity. The primary analysis of this study was performed on the population of all patients randomly assigned to a treatment arm who received study drug (randomised and treated). A subgroup analysis was performed on patients who received folic acid and vitamin B_{12} supplementation during the entire course of study therapy (fully supplemented). The results of these analyses of efficacy are summarised in the following table:

Table 5. Efficacy of Alimta plus cisplatin vs cisplatin in malignant pleural mesothelioma

	Randomised and Treated Patients		**Fully Supplemented Patients**	
Efficacy Parameter	**Alimta/ Cisplatin (n=226)**	**Cisplatin (n=222)**	**Alimta/ Cisplatin (n=168)**	**Cisplatin (n=163)**
Median Overall Survival (months) (95% CI)	12.1 (10.0-4.4)	9.3 (7.8-10.7)	13.3 (11.4-14.9)	10.0 (8.4-11.9)
Log Rank p-value[a]	0.020		0.051	
Median Time to tumour progression (months) (95% CI)	5.7 (4.9-6.5)	3.9 (2.8-4.4)	6.1 (5.3-7.0)	3.9 (2.8-4.5)
Log Rank p-value[a]	0.001		0.008	
Time to Treatment Failure (months) (95% CI)	4.5 (3.9-4.9)	2.7 (2.1-2.9)	4.7 (4.3-5.6)	2.7 (2.2-3.1)
Log Rank p-value[a]	0.001		0.001	
Overall response rate[b] (%) (95% CI)	41.3 (34.8-48.1)	16.7 (12.0-22.2)	45.5 (37.8-53.4)	19.6 (13.8-26.6)
Fisher's exact p-value[a]	< 0.001		< 0.001	

[a] p-value refers to comparison between arms.

[b] In the Alimta/cisplatin arm, randomised and treated (n=225) and fully supplemented (n=167)

A statistically significant improvement of the clinically relevant symptoms (pain and dyspnoea) associated with MPM in the Alimta/cisplatin arm (212 patients) versus the cisplatin arm alone (218

patients) was demonstrated using the Lung Cancer Symptom Scale. Statistically significant differences in pulmonary function tests were also observed. The separation between the treatment arms was achieved by improvement in lung function in the Alimta/cisplatin arm and deterioration of lung function over time in the control arm.

There are limited data in patients with MPM treated with Alimta alone or in combination with carboplatin. Alimta at a dose of 500 mg/m^2 was studied as a single-agent in 64 chemonaive patients with MPM. The overall response rate was 14.1%.

NSCLC, Second-Line Treatment:

A multicentre, randomised, open label phase 3 study of Alimta versus docetaxel in patients with locally advanced or metastatic NSCLC after prior chemotherapy has shown median survival times of 8.3 months for patients treated with Alimta (ITT population n=283) and 7.9 months for patients treated with docetaxel (ITT n=288). Prior chemotherapy did not include Alimta. An analysis of the impact of NSCLC histology on the treatment effect on overall survival (OS) was in favour of Alimta versus docetaxel for other than predominantly squamous histologies (n=399, 9.3 versus 8.0 months, adjusted HR=0.78; 95% CI=0.61-1.00, p=0.047) and was in favour of docetaxel for squamous cell carcinoma histology (n=172, 6.2 versus 7.4 months, adjusted HR=1.56; 95% CI=1.08-2.26, p=0.018). There were no clinically relevant differences observed for the safety profile of Alimta within the histology subgroups.

Table 6. Efficacy of Alimta vs docetaxel in NSCLC - ITT Population

	Alimta	**Docetaxel**
Survival Time (months)	n=283	n=288
Median (m)	8.3	7.9
95% CI for median	7.0-9.4	6.3-9.2
HR	0.99	
95% CI for HR	0.82-1.20	
Non-inferiority p-value (HR)	0.226	
% of docetaxel's survival benefit retained	102%	
95% CI for % retention	52-157%	
Non-inferiority p-value (% retention)	0.047	
Progression-free survival (months)	n=283	n=288
Median	2.9	2.9
HR (95% CI)	0.97 (0.82-1.16)	

	Alimta	Docetaxel
Time to treatment failure (months)	n=283	n=288
Median	2.3	2.1
HR (95% CI)	0.84 (0.71-0.997)	
Responses (n: qualified for responses)	n=264	n=274
Response rate (%) (95% CI)	9.1 (5.9–13.2)	8.8 (5.7–12.8)
Stable Disease (%)	45.8	46.4

NSCLC, First-Line Treatment:

Alimta combined with cisplatin for the treatment of locally advanced or metastatic non-squamous NSCLC:

A multicentre, randomised, open-label, Phase 3 study of Alimta plus cisplatin versus gemcitabine plus cisplatin in chemonaive patients with locally advanced or metastatic (Stage IIIb or IV) NSCLC showed that Alimta plus cisplatin (ITT population n=862) met its primary endpoint and showed similar clinical efficacy as gemcitabine plus cisplatin (ITT n=863) in OS (adjusted HR 0.94; 95% CI=0.84-1.05). All patients included in this study had an ECOG performance status 0 or 1.

The primary efficacy analysis was based on the ITT population. Sensitivity analyses of main efficacy endpoints were also assessed on the Protocol Qualified (PQ) population. The efficacy analyses using PQ population are consistent with the analyses for the ITT population and support the non-inferiority of AC versus GC.

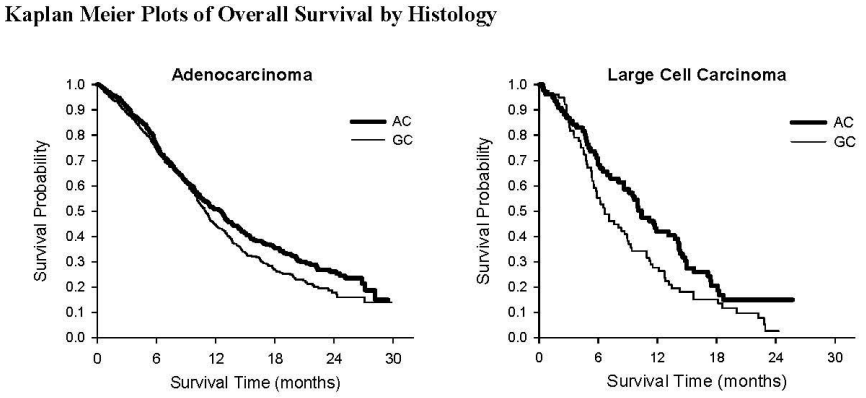
Progression-free survival (PFS) and overall response rate were similar between treatment arms: median PFS was 4.8 months for Alimta plus cisplatin versus 5.1 months for gemcitabine plus cisplatin (adjusted HR 1.04; 95% CI=0.94-1.15), and overall response rate was 30.6% (95% CI=27.3- 33.9) for Alimta plus cisplatin versus 28.2% (95% CI=25.0-31.4) for gemcitabine plus cisplatin. PFS data were partially confirmed by an independent review (400/1725 patients were randomly selected for review).

The analysis of the impact of NSCLC histology on OS demonstrated clinically relevant differences in survival according to histology, see table below.

Table 7. Efficacy of Alimta + cisplatin vs gemcitabine + cisplatin in first-line NSCLC – ITT Population and Histology Subgroups.

ITT Population and Histology Subgroups	Median Overall Survival in Months (95% CI)				Adjusted HR (95% CI)	Superiority p-value
	Alimta + cisplatin		Gemcitabine + cisplatin			
ITT Population (n=1725)	10.3 (9.8-11.2)	n=862	10.3 (9.6-10.9)	n=863	0.94[a] (0.84-1.05)	0.259
Non-squamous NSCLC (n=1252)	11.0 (10.1-12.5)	n=618	10.1 (9.3-10.9)	n=634	0.84 (0.74-0.96)	0.011
Adenocarcinoma (n=847)	12.6 (10.7-13.6)	n=436	10.9 (10.2-11.9)	n=411	0.84 (0.71-0.99)	0.033
Large Cell (n=153)	10.4 (8.6-14.1)	n=76	6.7 (5.5-9.0)	n=77	0.67 (0.48-0.96)	0.027
Other (n=252)	8.6 (6.8-10.2)	n=106	9.2 (8.1-10.6)	n=146	1.08 (0.81-1.45)	0.586
Squamous Cell (n=473)	9.4 (8.4-10.2)	n=244	10.8 (9.5-12.1)	n=229	1.23 (1.00-1.51)	0.050

[a] Statistically significant for non-inferiority, with the entire confidence interval for HR well below the 1.17645 non-inferiority margin (p<0.001).



There were no clinically relevant differences observed for the safety profile of Alimta plus cisplatin within the histology subgroups.

Patients treated with Alimta and cisplatin required fewer transfusions (16.4% versus 28.9%, p<0.001), red blood cell transfusions (16.1% versus 27.3%, p<0.001) and platelet transfusions (1.8% versus 4.5%, p=0.002). Patients also required lower administration of erythropoietin/darbopoietin (10.4% versus 18.1%, p<0.001), G-CSF/GM-CSF (3.1% versus 6.1%, p=0.004) and iron preparations (4.3% versus 7.0%, p=0.021).

Alimta combined with pembrolizumab and platinum chemotherapy for the treatment of metastatic non-squamous NSCLC patients naïve to treatment:

The efficacy of pembrolizumab in combination with Alimta and platinum chemotherapy was investigated in a multicentre, randomized, active-controlled, double-blind trial, KEYNOTE-189. Key eligibility criteria were metastatic non-squamous NSCLC, with no prior systemic treatment for metastatic NSCLC, and no EGFR or ALK genomic tumour aberrations. Patients with autoimmune disease that required systemic therapy within 2 years of treatment; a medical condition that required immunosuppression; or who had received more than 30 Gy of thoracic radiation within the prior 26 weeks were ineligible. Patients were randomized (2:1) to receive one of the following treatment regimens:

- Pembrolizumab 200mg with Alimta 500 mg/m^2 and investigator's choice of cisplatin 75 mg/m^2 or carboplatin AUC 5 mg/mL/min intravenously every 3 weeks for 4 cycles followed by pembrolizumab 200mg and Alimta 500 mg/m^2 intravenously every 3 weeks.
- Placebo with Alimta 500 mg/m^2 and investigator's choice of cisplatin 75 mg/m^2 or carboplatin AUC 5 mg/mL/min intravenously every 3 weeks for 4 cycles followed by placebo and Alimta 500 mg/m^2 intravenously every 3 weeks.

Treatment with pembrolizumab continued until Response Evaluation Criteria in Solid Tumors (RECIST 1.1) defined progression of disease as determined by the investigator, unacceptable toxicity, or a maximum of 24 months. Administration of pembrolizumab was permitted beyond RECIST-defined disease progression by blinded independent central review (BICR) or beyond discontinuation of Alimta if the patient was clinically stable and deriving clinical benefit as determined by the investigator. For patients who completed 24 months of therapy or had a complete response, treatment with pembrolizumab could be reinitiated for disease progression and administered for up to 1 additional year. Assessment of tumor status was performed at Week 6 and Week 12, followed by every 9 weeks thereafter. Patients receiving placebo plus chemotherapy who experienced independently verified progression of disease were offered pembrolizumab as monotherapy.

Among the 616 patients in KEYNOTE-189 (410 patients in the pembrolizumab combination arm and 206 in the placebo plus chemotherapy arm), baseline characteristics were: median age of 64 years (49% age 65 or older); 59% male; 94% White and 3% Asian; 43% and 56% ECOG performance status of 0 or 1 respectively; 31% with PD-L1 tumor proportion score (TPS) <1%; and 18% with treated or untreated brain metastases at baseline. A total of 67 patients in the placebo plus chemotherapy arm crossed over to receive monotherapy pembrolizumab at the time of disease progression and 18 additional patients received a checkpoint inhibitor as subsequent therapy.

The primary efficacy outcome measures were OS and PFS (as assessed by BICR using RECIST 1.1). Secondary efficacy outcome measures were ORR and response duration, as assessed by BICR using RECIST 1.1. The median follow-up time was 10.5 months (range: 0.2 – 20.4 months). The table below summarizes key efficacy measures.

Table 8. Response to pembrolizumab, Alimta, and platinum chemotherapy in patients with non-squamous NSCLC in KEYNOTE-189

Endpoint	Alimta + Pembrolizumab + Platinum Chemotherapy n=410	Placebo + Alimta + Platinum Chemotherapy n=206
OS		
Number (%) of patients with	127 (31%)	108 (52%)
Hazard ratio* (95% CI)	0.49 (0.38, 0.64)	
p-Value†	<0.00001	
Median in months (95% CI)	Not reached (NA, NA)	11.3 (8.7, 15.1)
PFS		
Number (%) of patients with	244 (60%)	166 (81%)
Hazard ratio* (95% CI)	0.52 (0.43, 0.64)	
p-Value†	<0.00001	
Median in months (95% CI)	8.8 (7.6, 9.2)	4.9 (4.7, 5.5)
Objective Response Rate		
ORR‡ % (95% CI)	48% (43, 53)	19% (14, 25)
Complete response %	0.5%	0.5%
Partial response %	47%	18%

Endpoint	Alimta + Pembrolizumab + Platinum Chemotherapy n=410	Placebo + Alimta + Platinum Chemotherapy n=206
p-Value§	<0.0001	
Response duration		
Median in months (range)	11.2 (1.1+, 18.0+)	7.8 (2.1+, 16.4+)
% with duration ≥ 6 months¶	81%	63%
% with duration ≥ 9 months¶	60%	44%

* Based on the stratified Cox proportional hazard model

† Based on stratified log-rank test

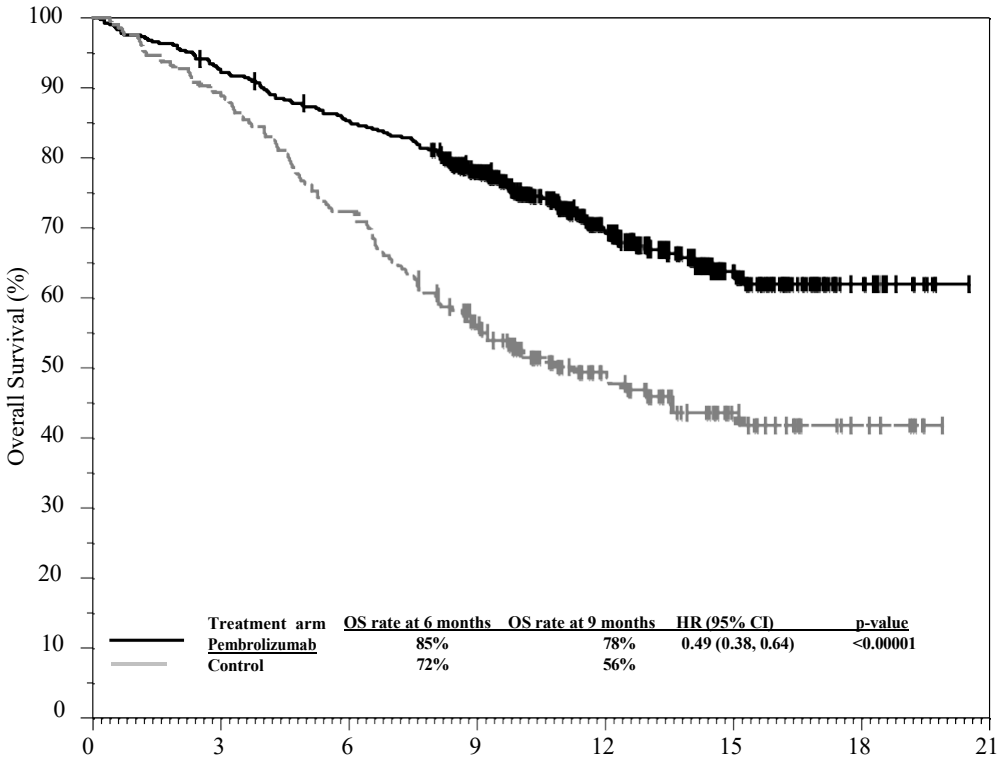
‡ Based on patients with a best overall response as confirmed complete or partial response

§ Based on Miettinen and Nurminen method stratified by PD-L1 status, platinum chemotherapy and smoking status

¶ Based on Kaplan-Meier estimation

NA = not available

Kaplan-Meier curve for overall survival by treatment arm in KEYNOTE-189 (intent to treat population)

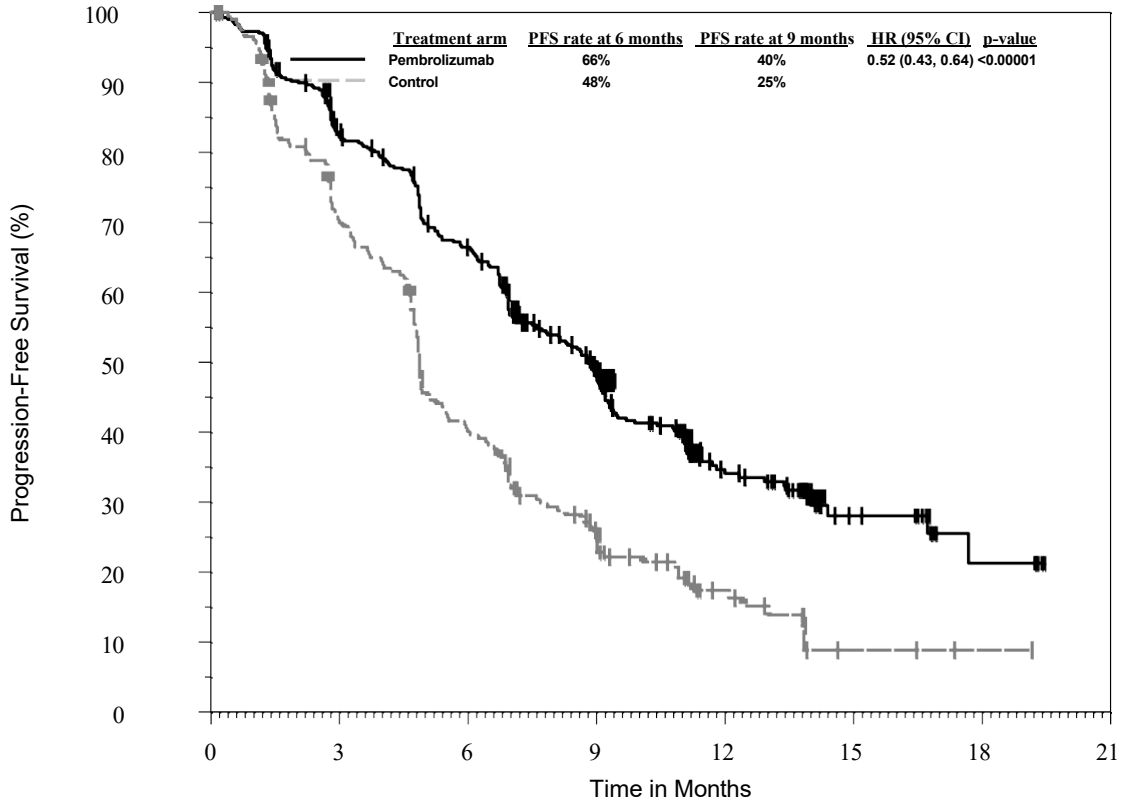


Time in Months

Number at Risk

Pembrolizumab:	410	377	347	278	163	71	18	0
Control:	206	183	149	104	59	25	8	0

Kaplan-Meier curve for progression-free survival by treatment arm in KEYNOTE-189 (intent to treat population)



Number at Risk

Pembrolizumab:	410	322	256	149	60	17	5	0
Control:	206	141	80	40	16	3	1	0

Patient-reported outcomes were assessed using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ) C30 and EORTC QLQ-LC13. Exploratory analyses of patients receiving pembrolizumab combination therapy showed stable EORTC QLQ-C30 Global Health Status/QoL at Week 12 and Week 21 vs declines in patients receiving placebo plus chemotherapy. There was a trend toward a prolonged time to deterioration in the EORTC QLQ-LC13/QLQ-C30 endpoint of cough, dyspnea or chest pain observed for patients receiving pembrolizumab combination therapy.

NSCLC, Maintenance Treatment:

JMEN

A multicentre, randomised, double-blind, placebo-controlled Phase 3 study, compared the efficacy and safety of maintenance treatment with Alimta plus best supportive care (BSC) (n=441) with that of placebo plus BSC (n=222) in patients with locally advanced (Stage IIIB) or metastatic (Stage IV) NSCLC who did not progress after 4 cycles of first line doublet therapy containing cisplatin or carboplatin in combination with gemcitabine, paclitaxel or docetaxel. First line doublet therapy containing Alimta was not included. All patients included in this study had an ECOG performance status 0 or 1. Patients received maintenance treatment until disease progression. Efficacy and safety were measured from the time of randomisation after completion of first line (induction) therapy. Patients received a median of 5 cycles of maintenance treatment with Alimta and 3.5 cycles of placebo. A total of 213 patients (48.3%) completed ≥ 6 cycles and a total of 103 patients (23.4%) completed ≥ 10 cycles of treatment with Alimta.

The study met its primary endpoint and showed a statistically significant improvement in PFS in the Alimta arm over the placebo arm (n=581, independently reviewed population; median of 4.0 months and 2.0 months respectively) (HR=0.60, 95% CI=0.49-0.73, p<0.00001). The independent review of patient scans confirmed the findings of the investigator assessment of PFS. The median OS for the overall population (n=663) was 13.4 months for the Alimta arm and 10.6 months for the placebo arm, HR=0.79 (95% CI=0.65-0.95, p=0.01192).

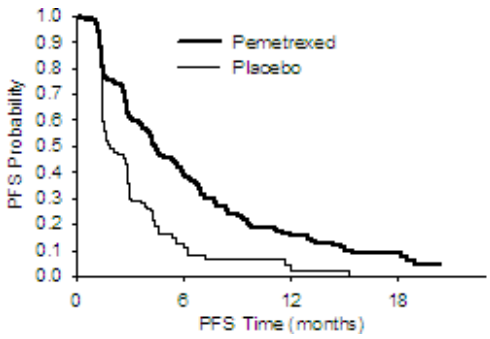
Consistent with other Alimta studies, a difference in efficacy according to NSCLC histology was observed in JMEN. For patients with non-squamous NSCLC (n=430, independently reviewed population) median PFS was 4.4 months for the Alimta arm and 1.8 months for the placebo arm, HR=0.47 (95% CI=0.37-0.60, p=0.00001). The median OS for patients with non-squamous NSCLC (n=481) was 15.5 months for the Alimta arm and 10.3 months for the placebo arm, HR= 0.70 (95% CI=0.56-0.88, p=0.002). Including the induction phase the median OS for patients with non-squamous NSCLC was 18.6 months for the Alimta arm and 13.6 months for the placebo arm, HR=0.71 (95% CI=0.56-0.88, p=0.002).

The PFS and OS results in patients with squamous cell histology suggested no advantage for Alimta over placebo.

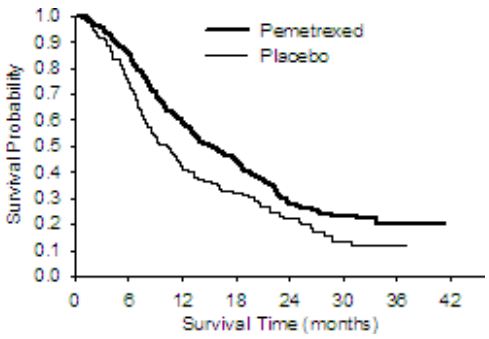
There were no clinically relevant differences observed for the safety profile of Alimta within the histology subgroups.

JMEN: Kaplan Meier plots of progression-free survival and overall survival Alimta versus placebo in patients with non-squamous NSCLC:

Progression-free survival



Overall Survival



PARAMOUNT

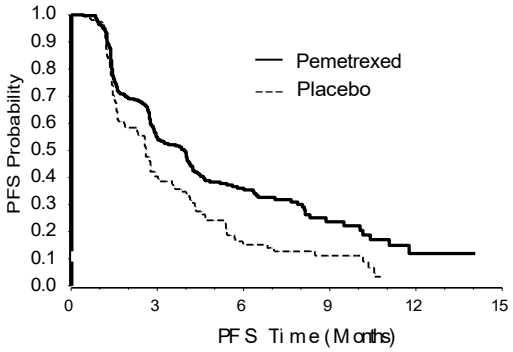
A multicentre, randomised, double-blind, placebo-controlled Phase 3 study (PARAMOUNT), compared the efficacy and safety of continuation maintenance treatment with Alimta plus BSC (n=359) with that of placebo plus BSC (n=180) in patients with locally advanced (Stage IIIB) or metastatic (Stage IV) non-squamous NSCLC who did not progress after 4 cycles of first line doublet therapy of Alimta in combination with cisplatin. Of the 939 patients treated with Alimta plus cisplatin induction, 539 patients were randomised to maintenance treatment with Alimta or placebo. Of the randomised patients, 44.9% had a complete/partial response and 51.9% had a response of stable disease to Alimta plus cisplatin induction. Patients randomised to maintenance treatment were required to have an ECOG performance status 0 or 1. The median time from the start of Alimta plus cisplatin induction therapy to the start of maintenance treatment was 2.96 months on both the Alimta arm and the placebo arm. Randomised patients received maintenance treatment until disease progression. Efficacy and safety were measured from the time of randomisation after completion of first line (induction) therapy. Patients received a median of 4 cycles of maintenance treatment with Alimta and 4 cycles of placebo. A total of 169 patients (47.1%) completed ≥ 6 cycles maintenance treatment with Alimta, representing at least 10 total cycles of Alimta.

The study met its primary endpoint and showed a statistically significant improvement in PFS in the Alimta arm over the placebo arm (n=472, independently reviewed population; median of 3.9 months and 2.6 months, respectively) (HR=0.64, 95% CI=0.51-0.81, p=0.0002). The independent review of patient scans confirmed the findings of the investigator assessment of PFS. For randomised patients, as measured from the start of Alimta plus cisplatin first line induction treatment, the median investigator-assessed PFS was 6.9 months for the Alimta arm and 5.6 months for the placebo arm (HR=0.59, 95% CI=0.47-0.74).

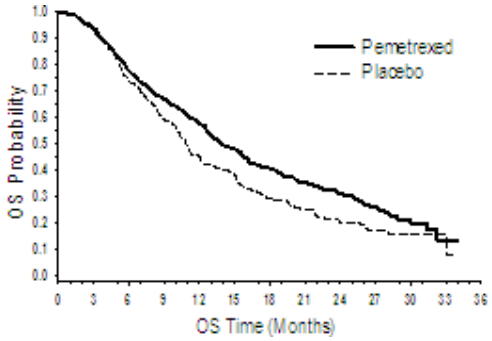
Following Alimta plus cisplatin induction (4 cycles), treatment with Alimta was statistically superior to placebo for OS (median 13.9 months versus 11.0 months, HR=0.78, 95% CI=0.64-0.96, p=0.0195). At the time of this final survival analysis, 28.7% of patients were alive or lost to follow up on the Alimta arm versus 21.7% on the placebo arm. The relative treatment effect of Alimta was internally consistent across subgroups (including disease stage, induction response, ECOG PS, smoking status, gender, histology and age) and similar to that observed in the unadjusted OS and PFS analyses. The 1 year and 2 year survival rates for patients on Alimta were 58% and 32% respectively, compared to 45% and 21% for patients on placebo. From the start of Alimta plus cisplatin first line induction treatment, the median OS of patients was 16.9 months for the Alimta arm and 14.0 months for the placebo arm (HR=0.78, 95% CI= 0.64-0.96). The percentage of patients that received post study treatment was 64.3% for Alimta and 71.7% for placebo.

PARAMOUNT: Kaplan Meier plot of progression-free survival and overall survival for continuation Alimta maintenance versus placebo in patients with non-squamous NSCLC (measured from randomisation)

Progression-free Survival



Overall Survival



The Alimta maintenance safety profiles from the two studies JMEN and PARAMOUNT were similar.

5.2. Pharmacokinetic properties

The pharmacokinetics of Alimta following single-agent administration have been evaluated in 426 cancer patients with a variety of solid tumours at doses ranging from 0.2 to 838 mg/m^2 infused over a 10-minute period. Alimta has a steady-state volume of distribution of 9 litres/m^2. *In vitro* studies indicate that Alimta is approximately 81% bound to plasma proteins. Binding was not notably affected by varying degrees of renal impairment. Alimta undergoes limited hepatic metabolism. Alimta is primarily eliminated in the urine with 70%-90% of the administered dose being recovered unchanged in urine within the first 24 hours following administration. *In vitro* studies indicate that Alimta is actively secreted by OAT3 (organic anion transporter). Alimta total systemic clearance is 91.8ml/min and the elimination half-life from plasma is 3.5 hours in patients with normal renal function (creatinine clearance of 90 ml/min). The clearance decreases and exposure (AUC) increases, as renal function decreases. Between patient variability in clearance is moderate at 19.3%. Alimta total systemic exposure (AUC) and maximum plasma concentration increase proportionally with dose. The pharmacokinetics of Alimta are consistent over multiple treatment cycles.

The pharmacokinetic properties of Alimta are not influenced by concurrently administered cisplatin. Oral folic acid and intramuscular vitamin B_{12} supplementation do not affect the pharmacokinetics of Alimta.

5.3. Preclinical safety data

Administration of Alimta to pregnant mice resulted in decreased foetal viability, decreased foetal weight, incomplete ossification of some skeletal structures and cleft palate.

Administration of Alimta to male mice resulted in reproductive toxicity characterised by reduced fertility rates and testicular atrophy. In a study conducted in beagle dog by intravenous bolus injection for 9 months, testicular findings (degeneration/necrosis of the seminiferous epithelium) have been observed. This suggests that Alimta may impair male fertility. Female fertility was not investigated.

Alimta was not mutagenic in either the *in vitro* chromosome aberration test in Chinese hamster ovary cells or the Ames test. Alimta has been shown to be clastogenic in the *in vivo* micronucleus test in the mouse.

Studies to assess the carcinogenic potential of Alimta have not been conducted.

6. PHARMACEUTICAL PARTICULARS

6.1. List of excipients

Mannitol
Hydrochloric acid
Sodium hydroxide

6.2. Incompatibilities

Alimta is physically incompatible with diluents containing calcium, including lactated Ringer's Injection and Ringer's Injection. In the absence of compatibility studies, this medicinal product must not be mixed with other medicinal products.

6.3. In-use shelf-life

Reconstituted solution: When prepared as directed, reconstituted and infusion solutions of Alimta contains no antimicrobial preservative. Chemical and physical in-use stability of reconstituted and infusion solutions has been demonstrated for 24 hours at refrigerated temperature. From a microbiological point of view, the product should be used immediately. If not used immediately, in-use storage times and conditions prior to use are the responsibility of the user and would not be longer than 24 hours at 2-8°C.

6.4. Special precautions for storage

Unopened vial

Store below 30°C.

For storage conditions after reconstitution of the medicinal product, see section 6.3.

6.5. Nature and contents of container

Alimta 100mg Powder for Solution for Infusion

Type I glass vial with rubber stopper containing 100mg of pemetrexed. Pack of 1 vial.

Alimta 500mg Powder for Solution for Infusion

Type I glass vial with rubber stopper containing 500mg of pemetrexed. Pack of 1 vial.

6.6. Instructions for use, handling and disposal

1. Use aseptic technique during the reconstitution and further dilution of Alimta for intravenous infusion administration.

2. Calculate the dose and number of Alimta vials needed. Each vial contains an excess of Alimta to facilitate delivery of the label amount.

3. Alimta 100mg

   Reconstitute 100mg vials with 4.2ml of sodium chloride 9 mg/ml (0.9%) solution for injection, without preservative, resulting in a solution containing 25 mg/ml pemetrexed.

   Alimta 500mg

   Reconstitute 500mg vials with 20ml of sodium chloride 9 mg/ml (0.9 %) solution for injection, without preservative, resulting in a solution containing 25 mg/ml pemetrexed.

   Gently swirl each vial until the powder is completely dissolved. The resulting solution is clear and ranges in colour from colourless to yellow or green-yellow without adversely affecting product quality. The pH of the reconstituted solution is between 6.6 and 7.8. **Further dilution is required**.

4. The appropriate volume of reconstituted Alimta solution must be further diluted to 100ml with Sodium Chloride 9 mg/ml (0.9%) solution for Injection, without preservative, and administered as an intravenous infusion over 10 minutes.

5. Alimta infusion solutions prepared as directed above are compatible with polyvinyl chloride and polyolefin lined administration sets and infusion bags.

6. Parenteral medicinal products should be inspected visually for particulate matter and discolouration prior to administration. If particulate matter is observed, do not administer.

7. Alimta solutions are for single use only. Any unused medicinal product or waste material must be disposed of in accordance with local requirements.

Preparation and administration precautions

As with other potentially toxic anti-cancer agents, care should be exercised in the handling and preparation of Alimta infusion solutions. The use of gloves is recommended. If Alimta solution contacts the skin, wash the skin immediately and thoroughly with soap and water. If Alimta solution contacts the mucous membranes, flush thoroughly with water. Alimta is not a vesicant. There is no specific antidote for extravasation of Alimta. There have been few reported cases of Alimta extravasation, which were not assessed as serious by the investigator. Extravasation should be managed by local standard practice as with other non-vesicants.

Product Owner: Eli Lilly and Company, Indianapolis, 46285, United States.

Date of Revision of Text: 06 May 2022