

▼ This medicinal product is subject to additional monitoring in Australia. This will allow quick identification of new safety information. Healthcare professionals are asked to report any suspected adverse events at www.tga.gov.au/reporting-problems

AUSTRALIAN PRODUCT INFORMATION – NELARABINE-REACH

Nelarabine solution for infusion

1 NAME OF THE MEDICINE

Nelarabine

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each vial contains 250 mg of nelarabine in 50 mL of solution.

Each mL of solution contains 5 mg of nelarabine.

For the full list of excipients, see section 6.1.

3 PHARMACEUTICAL FORM

NELARABINE-REACH injection is a clear colorless solution free from visible particles. It contains nelarabine equivalent to 5 mg nelarabine in 1 mL vials.

4 CLINICAL PARTICULARS

4.1 THERAPEUTIC INDICATIONS

Nelarabine is indicated for the treatment of patients with relapsing /refractory T-cell acute lymphoblastic leukaemia and T-cell lymphoblastic lymphoma whose disease has not responded to or has relapsed following treatment.

Due to the small patient populations in these disease settings, the information to support these indications is based on limited data.

4.2 DOSE AND METHOD OF ADMINISTRATION

Nelarabine must only be administered under the supervision of a physician experienced in the use of cytotoxic agents.

Product is for single use in one patient only. Discard any residue.

Posology

Complete blood counts including platelets must be monitored regularly (see sections 4.4 and 4.8)

Adults and adolescents (aged 16 years and older)

The recommended dose of nelarabine for adults and adolescents aged 16 years and older is 1,500 mg/m² administered intravenously over two hours on days 1, 3 and 5 and repeated every 21 days.

Children and adolescents (aged 21 years and younger)

The recommended dose of nelarabine for children and adolescents (aged 21 years and younger) is 650 mg/m² administered intravenously over one hour daily for 5 consecutive days, repeated every 21 days.

In clinical studies, the 650 mg/m² and 1,500 mg/m² dose have both been used in patients in the age range 16 to 21 years. Efficacy and safety were similar for both regimens. The prescribing physician should consider which regimen is appropriate when treating patients in this age range.

Limited clinical pharmacology data are available for patients below the age of 4 years (see section 5.2).

Dose modification

Nelarabine must be discontinued at the first sign of neurological events of National Cancer Institute Common Terminology Criteria Adverse Event (NCI CTCAE) grade 2 or greater. Delaying subsequent dosing is an option for other toxicities, including haematological toxicity.

Special populations

Elderly

Insufficient numbers of patients aged 65 years of age and older have been treated with nelarabine to determine whether they respond differently than younger patients (see sections 4.4 and 5.2).

Renal impairment

Nelarabine has not been studied in individuals with renal impairment. Nelarabine and 9-β-D-arabinofuranosylguanine (ara-G) are partially renally excreted (see section 5.2). There are insufficient data to support a dose adjustment recommendation for patients with a renal clearance of creatinine Cl_{cr} less than 50 mL/min. Patients with renal impairment must be closely monitored for toxicities when treated with nelarabine.

Hepatic impairment

Nelarabine has not been studied in patients with hepatic impairment. These patients should be treated with caution.

Method of administration

Nelarabine is for intravenous use only and must not be diluted prior to administration. The appropriate dose of nelarabine must be transferred into polyvinylchloride (PVC) or ethyl vinyl acetate (EVA) infusion bags or glass containers and administered intravenously as a two-hour infusion in adult patients and as a one-hour infusion in paediatric patients.

4.3 CONTRAINDICATIONS

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

4.4 SPECIAL WARNINGS AND PRECAUTIONS FOR USE

NEUROLOGICAL ADVERSE REACTIONS

Severe neurological reactions have been reported with the use of nelarabine. These reactions have included altered mental states including severe somnolence, confusion and coma, central nervous system effects including convulsions, ataxia and status epilepticus, and peripheral neuropathy including hypoesthesia ranging from numbness and paresthesias to motor weakness and paralysis. There have also been reports of reactions associated with demyelination, and ascending peripheral neuropathies similar in appearance to Guillain-Barré Syndrome. (see section 4.8).

Neurotoxicity is the dose-limiting toxicity of nelarabine. Full recovery from these reactions has not always occurred with cessation of nelarabine. Therefore, close monitoring for neurological reactions is strongly recommended, and nelarabine must be discontinued at the first sign of neurological reactions of NCI CTCAE Grade 2 or greater.

Patients treated previously or concurrently with intrathecal chemotherapy or previously with craniospinal irradiation are potentially at increased risk for neurological adverse events (see section 4.2 - dose modification) and therefore concomitant intrathecal therapy and/or craniospinal irradiation is not recommended.

Immunisation using a live organism vaccine has the potential to cause infection in immunocompromised hosts. Therefore, immunisations with live organism vaccines are not recommended.

Leukopenia, thrombocytopenia, anaemia, and neutropenia, (including febrile neutropenia) have been associated with nelarabine therapy. Complete blood counts including platelets must be monitored regularly (see sections 4.2 and 4.8).

Patients receiving nelarabine are recommended to receive intravenous hydration according to standard medical practice for the management of hyperuricaemia in patients at risk of tumour lysis syndrome. For patients at risk of hyperuricaemia, the use of allopurinol should be considered.

Elderly

Clinical studies of nelarabine did not include sufficient numbers of patients aged 65 and over to determine whether they respond differently from younger patients. In an exploratory analysis, increasing age, especially age 65 years and older, appeared to be associated with increased rates of neurological adverse events.

Carcinogenicity and mutagenicity

Carcinogenicity testing of nelarabine has not been performed. Nelarabine however, is known to be genotoxic to mammalian cells (see section 5.3).

Sodium warning

This medicinal product contains 88.51 mg (3.85 mmol) sodium per vial (50 mL), equivalent to 4.4% of the WHO recommended maximum daily intake of 2 g sodium for an adult.

4.5 INTERACTIONS WITH OTHER MEDICINAL PRODUCTS AND OTHER FORMS OF INTERACTION

Nelarabine and ara-G did not significantly inhibit the activities of the major hepatic cytochrome P450 (CYP) isoenzymes CYP1A2, CYP2A6, CYP2B6, CYP2C8, CYP2C9, CYP2C19, CYP2D6, or CYP3A4 *in vitro*. Neither agent induced CYP1A2, 2B6 or 3A4 in experiments with human hepatocytes.

Concomitant administration of nelarabine in combination with adenosine deaminase inhibitors such as pentostatin is not recommended. Concomitant administration may reduce the efficacy of nelarabine and/or change the adverse event profile of either active substance.

4.6 FERTILITY, PREGNANCY AND LACTATION

Contraception in males and females

Both sexually active men and women should use effective methods of contraception during treatment with nelarabine. Men with partners who are pregnant or could become pregnant should use condoms during treatment with nelarabine and for at least three months following cessation of treatment.

Effects on fertility

The effect of nelarabine on fertility in humans is unknown. No animal studies on fertility have been conducted. Based on the cytotoxic action of the compound, impairment of male and female fertility is possible. Family planning should be discussed with patients as appropriate.

Use in pregnancy – Pregnancy Category D

There are no or limited amount of data from the use of nelarabine in pregnant women.

Animal data indicate that exposure during pregnancy will likely lead to malformations of the fetus.

Nelarabine caused fetal malformations in pregnant rabbits at all dose levels tested (30, 100 and 300 mg/kg/day IV). Exposure to ara-G (the active component formed from nelarabine) in animals at these doses ranged from 6 times lower to 1.7 times higher than in patients at the maximum recommended human dose (based on plasma AUC). Teratogenicity in rabbits was encountered in the absence of maternotoxicity. Findings comprised absent gall bladders, accessory lung lobes, fused/extra sternebrae, absent pollices (innermost digit of the forelimb) and cleft palate. Delayed fetal skeletal ossification was also seen at all dose levels.

Nelarabine should not be used during pregnancy unless the benefit to the mother outweighs the risk to the fetus. If a patient becomes pregnant during treatment with nelarabine, they should be informed of the possible risk to the fetus.

Use in lactation

It is unknown whether nelarabine or its metabolites are excreted in human breast milk. A risk to the newborn/infant cannot be excluded. Breast-feeding should be discontinued during treatment with NELARABINE-REACH.

4.7 EFFECTS ON ABILITY TO DRIVE AND USE MACHINES

NELARABINE-REACH has major influence on the ability to drive and use machines.

Patients treated with nelarabine are potentially at risk of suffering from somnolence during and for several days after treatment. Patients must be cautioned that somnolence can affect performance of skilled tasks, such as driving.

4.8 ADVERSE EFFECTS (UNDESIRABLE EFFECTS)

Summary of the safety profile

The safety profile from pivotal clinical studies at the recommended doses of nelarabine in adults (1,500 mg/m²) and children (650 mg/m²) is based on data from 103 adults and 84 paediatric patients respectively. The most frequently occurring adverse events were fatigue; gastrointestinal disorders; haematological disorders; respiratory disorders; nervous system disorders (somnolence, peripheral neurological disorders [sensory and motor], dizziness, hypoaesthesia, paraesthesia, headache); and pyrexia. Neurotoxicity is the dose-limiting toxicity associated with nelarabine therapy (see section 4.4).

Tabulated list of adverse reactions

The following convention has been utilised for the classification of frequency: very common ($\geq 1/10$), common ($\geq 1/100$ to $< 1/10$), uncommon ($\geq 1/1,000$ to $< 1/100$), rare ($\geq 1/10,000$ to $< 1/1,000$), very rare ($< 1/10,000$), and not known (cannot be estimated from the available data).

Adverse reactions	Adults (1,500 mg/m ²) N=103	Children (650 mg/m ²) N=84
Infections and infestations		
Infection (including but not limited to sepsis, bacteraemia, pneumonia, fungal infection)	Very common: 40 (39%)	Very common: 13 (15%)
Neoplasms benign, malignant and unspecified (including cysts and polyps)		
Tumour lysis syndrome	Common: 1 (1%)	N/A
Blood and lymphatic system disorders		
Febrile neutropenia	Very common: 12 (12%)	Common: 1 (1%)
Neutropenia	Very common: 83 (81%)	Very common: 79 (94%)
Leukopenia	Common: 3 (3%)	Very common: 32 (38%)
Thrombocytopenia	Very common: 89 (86%)	Very common: 74 (88%)
Anaemia	Very common: 102 (99%)	Very common: 80 (95%)
Metabolism and nutrition disorders		
Hypoglycaemia	N/A	Common: 5 (6%)
Hypocalcaemia	Common: 3 (3%)	Common: 7 (8%)
Hypomagnesaemia	Common: 4 (4%)	Common: 5 (6%)
Hypokalaemia	Common: 4 (4%)	Very common: 9 (11%)
Anorexia	Common: 9 (9%)	N/A
Psychiatric disorders		
Confusional state	Common: 8 (8%)	Common: 2 (2%)
Nervous system disorders		
Seizures (including convulsions, grand mal convulsions, status epilepticus)	Common: 1 (1%)	Common: 5 (6%)
Amnesia	Common: 3 (3%)	N/A
Somnolence	Very common: 24 (23%)	Common: 6 (7%)
Peripheral neurological disorders (sensory and motor)	Very common: 22 (21%)	Very common: 10 (12%)
Hypoesthesia	Very common: 18 (17%)	Common: 5 (6%)
Paraesthesia	Very common: 15 (15%)	Common: 3 (4%)
Ataxia	Common: 9 (9%)	Common: 2 (2%)
Balance disorder	Common: 2 (2%)	N/A
Tremor	Common: 5 (5%)	Common: 3 (4%)
Dizziness	Very common: 22 (21%)	N/A
Headache	Very common: 15 (15%)	Very common: 14 (17%)
Dysgeusia	Common: 3 (3%)	N/A
Eye disorders		
Blurred vision	Common: 4(4%)	N/A
Vascular disorders		
Hypotension	Common: 8 (8%)	N/A
Respiratory, thoracic and mediastinal disorders		

Adverse reactions	Adults (1,500 mg/m ²) N=103	Children (650 mg/m ²) N=84
Pleural effusion	Common: 10 (10%)	N/A
Wheezing	Common: 5 (5%)	N/A
Dyspnoea	Very common: 21 (20%)	N/A
Cough	Very common: 26 (25%)	N/A
Gastrointestinal disorders		
Diarrhoea	Very common: 23 (22%)	Common: 2 (2%)
Stomatitis	Common: 8 (8%)	Common: 1 (1%)
Vomiting	Very common: 23 (22%)	Common: 8 (10%)
Abdominal pain	Common: 9 (9%)	N/A
Constipation	Very common: 22 (21%)	Common: 1 (1%)
Nausea	Very common: 42 (41%)	Common: 2 (2%)
Hepatobiliary disorders		
Hyperbilirubinaemia	Common: 3 (3%)	Common: 8 (10%)
Transaminases increased	N/A	Very common: 10(12%)
Aspartate aminotransferase increased	Common: 6 (6%)	N/A
Musculoskeletal and connective tissue disorders		
Muscle weakness	Common: 8 (8%)	N/A
Myalgia	Very common: 13 (13%)	N/A
Arthralgia	Common: 9 (9%)	Common: 1 (1%)
Back pain	Common: 8 (8%)	N/A
Pain in extremity	Common: 7 (7%)	Common: 2 (2%)
Rhabdomyolysis, blood creatine phosphokinase increased	Rare: N/A	Rare: N/A
Renal and urinary disorders		
Blood creatinine increased	Common: 2 (2%)	Common: 5 (6%)
General disorders and administration site conditions		
Oedema	Very common: 11 (11%)	N/A
Gait abnormal	Common: 6 (6%)	N/A
Oedema peripheral	Very common: 15 (15%)	N/A
Pyrexia	Very common: 24 (23%)	Common: 2 (2%)
Pain	Very common: 11 (11%)	N/A
Fatigue	Very common: 51 (50%)	Common: 1 (1%)
Asthenia	Very common: 18 (17%)	Common: 5 (6%)

Description of selected adverse reactions

Infection and infestations

There was a single additional report of biopsy confirmed progressive multifocal leukoencephalopathy in the adult population.

There was a single additional report of biopsy confirmed progressive multifocal leukoencephalopathy in the adult population.

There have been reports of sometimes fatal opportunistic infections in patients receiving nelarabine therapy.

Nervous system disorders

There have been reports of events associated with demyelination and ascending peripheral neuropathies similar in appearance to Guillain-Barré syndrome.

Two paediatric patients had fatal neurological events.

Data from NCI studies/compassionate use programme and phase I studies

In addition to the adverse reactions seen in the pivotal clinical studies, there are also data from 875 patients from NCI studies/compassionate use programme (694 patients) and Phase I (181 patients) studies of nelarabine. The following additional adverse reactions were seen:

Neoplasms benign and malignant (including cysts and polyps)

Tumour lysis syndrome – 7 cases (see sections 4.2 and 4.4) Post-

marketing data

Rhabdomyolysis and increased blood creatine phosphokinase have been identified during post-approval use of nelarabine. This includes spontaneous case reports as well as serious adverse events from ongoing studies.

Reporting suspected adverse effects

Reporting suspected adverse reactions after registration of the medicinal product is important. It allows continued monitoring of the benefit-risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions at www.tga.gov.au/reporting-problems.

4.9 OVERDOSE

No case of overdose has been reported.

Nelarabine has been administered in clinical studies up to a dose of 75 mg/kg (approximately 2,250 mg/m²) daily for 5 days to a paediatric patient, up to a dose of 60 mg/kg (approximately 2,400 mg/m²) daily for 5 days to 5 adult patients and up to 2,900 mg/m² in a further 2 adults on days 1, 3 and 5.

Symptoms and signs

It is likely that nelarabine overdose would result in severe neurotoxicity (possibly including paralysis, coma), myelosuppression and potentially death. At a dose of 2200 mg/m² given on days 1, 3 and 5 every 21 days, 2 patients developed a significant grade 3 ascending sensory neuropathy. MRI evaluations of the 2 patients demonstrated findings consistent with a demyelinating process in the cervical spine.

Treatment

There is no known antidote for nelarabine overdose. Supportive care consistent with good clinical practice should be provided.

For information on the management of overdose, contact the Poisons Information Centre on 13 11 26 (Australia).

5 PHARMACOLOGICAL PROPERTIES

5.1 PHARMACODYNAMIC PROPERTIES

Pharmacotherapeutic group: Antineoplastic agents, antimetabolites, purine analogues, ATC code: L01B B 07

Mechanism of action

Nelarabine is a pro-drug of the deoxyguanosine analogue ara-G. Nelarabine is rapidly demethylated by adenosine deaminase (ADA) to ara-G and then phosphorylated intracellularly by deoxyguanosine kinase and deoxycytidine kinase to its 5'-monophosphate metabolite. The monophosphate metabolite is subsequently converted to the active 5'-triphosphate form, ara-GTP. Accumulation of ara-GTP in leukaemic blasts allows for preferential incorporation of ara-GTP into deoxyribonucleic acid (DNA) leading to inhibition of DNA synthesis. This results in cell death. Induction and liberation of soluble Fas ligand from T cells also contributes to the cytotoxic effects of nelarabine. *In vitro*, T cells are more sensitive than B cells to the cytotoxic effects of nelarabine.

Clinical efficacy and data

Adult clinical study in relapsed or refractory T-ALL and T-LBL

In an open-label study carried out by the Cancer and Leukaemia Group B and the Southwest Oncology Group, the safety and efficacy of nelarabine were evaluated in 39 adults with T-cell acute lymphoblastic leukaemia (T-ALL) or lymphoblastic lymphoma (T-LBL). Twenty-eight of the 39 adults had relapsed or were refractory to at least two prior induction regimens and aged between 16 to 65 years of age (mean 34 years). Nelarabine at a dose of 1500 mg/m²/day was administered intravenously over two hours on days 1, 3 and 5 of a 21 day cycle. Patients who experienced signs or symptoms of grade 2 or greater neurologic toxicity on therapy were to be discontinued from further therapy with NELARABINE. Seventeen patients had a diagnosis of T-ALL and 11 had a diagnosis of T-LBL. For patients with ≥ 2 prior inductions, the age range was 16-65 years (mean 34 years) and most patients were male (82%) and Caucasian (61%). Patients with central nervous system (CNS) disease were not eligible. Complete response (CR) in this study was defined as bone marrow blast counts $\leq 5\%$, no other evidence of disease, and full recovery of peripheral blood counts. Complete response without complete hematologic recovery (CR*) was also assessed.

The results of the study for patients who had received ≥ 2 prior inductions are shown in the below table.

Efficacy Results in Adult Patients With ≥ 2 Prior Inductions Treated with 1,500 mg/m² of NELARABINE Administered Intravenously Over 2 Hours on Days 1, 3, and 5 Repeated Every 21 Days

	N = 28
CR plus CR* % (n) [95% CI]	21% (6) [8%, 41%]
CR % (n) [95% CI]	18% (5) [6%, 37%]
CR* % (n) [95% CI]	4% (1) [0%, 18%]
Duration of CR plus CR* (range in weeks) ^a	4 to 195+
Median overall survival (weeks) [95% CI]	20.6 weeks [10.4, 36.4]

CR = Complete response

CR* = Complete response without hematologic recovery

^a Does not include 1 patient who was transplanted (duration of response was 156+ weeks).

Paediatric clinical study in relapsed or refractory T-ALL and T-LBL

In an open-label, multicenter study carried out by Childrens Oncology Group, nelarabine was administered intravenously over 1 hour for 5 days to 151 patients ≤ 21 years of age, 149 of whom had relapsed or refractory T-cell acute lymphoblastic leukaemia (T-ALL) or T-cell lymphoblastic lymphoma (T-LBL). Eighty-four (84) patients, 39 of whom had received two or more prior induction regimens and 31 whom had received one prior induction regimen, were treated with 650 mg/m²/day of nelarabine administered intravenously over 1 hour daily for 5 consecutive days repeated every 21 days.

Of the 39 patients who had received two or more prior induction regimens, 5 (13 %) [95 % CI: 4 %–27 %] achieved a complete response (bone marrow blast counts ≤ 5 %, no other evidence of disease, and full recovery of peripheral blood counts) and 9 (23 %) [95 % CI: 11 %–39 %] achieved complete responses with or without full haematological recovery. Duration of response in both classifications of response ranged between 4.7 and 36.4 weeks, median overall survival was 13.1 weeks [95 % CI: 8.7–17.4] and survival at one year was 14 % [95 % CI: 3 %–26 %].

Thirteen (42 %) of the 31 patients treated with one prior induction regimen achieved a complete response overall. Nine of these 31 patients failed to respond to prior induction (refractory patients). Four (44 %) of the nine refractory patients experienced a complete response to nelarabine.

5.2 Pharmacokinetic properties

In a cross-study analysis using data from four Phase I studies, the pharmacokinetics of nelarabine and ara-G were characterized in patients aged less than 18 years and adult patients with refractory leukaemia or lymphoma.

Absorption

Adults

Plasma ara-G C_{max} values generally occurred at the end of the nelarabine infusion and were generally higher than nelarabine C_{max} values, suggesting rapid and extensive conversion of nelarabine to ara-G. After infusion of 1,500 mg/m² nelarabine over two hours in adult patients, mean (%CV) plasma nelarabine C_{max} and AUC_{inf} values were 13.9 µM (81 %) and 13.5 µM.h (56 %) respectively. Mean plasma ara-G C_{max} and AUC_{inf} values were 115 µM (16 %) and 571 µM.h (30 %), respectively.

Intracellular C_{max} for ara-GTP appeared within 3 to 25 hours on day 1. Mean (%CV) intracellular ara-GTP C_{max} and AUC values were 95.6 µM (139 %) and 2214 µM.h (263 %) at this dose.

Paediatric patients

After infusion of 400 or 650 mg/m² nelarabine over one hour in 6 paediatric patients, mean (%CV) plasma nelarabine C_{max} and AUC_{inf} values, adjusted to a 650 mg/m² dose, were 45.0 µM (40 %) and 38.0 µM.h (39 %), respectively. Mean plasma ara-G C_{max} and AUC_{inf} values were 60.1 µM (17 %) and 212 µM.h (18 %), respectively.

Distribution

Nelarabine and ara-G are extensively distributed throughout the body based on combined Phase I pharmacokinetic data at nelarabine doses of 104 to 2,900 mg/m². Specifically, for nelarabine, mean (%CV) V_{ss} values were 115 l/m² (159 %) and 89.4 l/m² (278 %) in adult and paediatric patients, respectively. For ara-G, mean V_{ss}/F values were 44.8 l/m² (32 %) and 32.1 l/m² (25 %) in adult and paediatric patients, respectively.

Nelarabine and ara-G are not substantially bound to human plasma proteins (less than 25 %) *in vitro*, and binding is independent of nelarabine or ara-G concentrations up to 600 µM.

No accumulation of nelarabine or ara-G was observed in plasma after nelarabine administration on either a daily or a day 1, 3, 5 schedule.

Intracellular ara-GTP concentrations in leukaemic blasts were quantifiable for a prolonged period after nelarabine administration. Intracellular ara-GTP accumulated with repeated administration of nelarabine. On the day 1, 3, and 5 schedule, C_{max} and AUC_(0-t) values on day 3 were approximately 50 % and 30 %, respectively, greater than C_{max} and AUC_(0-t) values on day 1.

Metabolism

The principal route of metabolism for nelarabine is O-demethylation by adenosine deaminase to form ara-G, which undergoes hydrolysis to form guanine. In addition, some nelarabine is hydrolysed to form methylguanine, which is O-demethylated to form guanine. Guanine is N-deaminated to form xanthine, which is further oxidized to yield uric acid.

Elimination

Nelarabine and ara-G are rapidly eliminated from plasma with a half-life of approximately 30 minutes and 3 hours, respectively. These findings were demonstrated in patients with refractory leukaemia or lymphoma given a dose of 1,500 mg/m² nelarabine (adults) or a 650 mg/m² (paediatrics).

Combined Phase 1 pharmacokinetic data at nelarabine doses of 104 to 2,900 mg/m² indicate that mean (%CV) clearance (Cl) values for nelarabine are 138 l/h/m² (104 %) and 125 l/h/m² (214 %) in adult and paediatric patients, respectively, on day 1 (n = 65 adults, n = 21 paediatric patients). The apparent clearance of ara-G (Cl/F) is comparable between the two groups [9.5 l/h/m² (35 %) in adult patients and 10.8 l/h/m² (36 %) in paediatric patients] on day 1.

Nelarabine and ara-G are partially eliminated by the kidneys. In 28 adult patients, 24 hours after nelarabine infusion on day 1, mean urinary excretion of nelarabine and ara-G was 5.3 % and 23.2 % of the administered dose, respectively. Renal clearance averaged 9.0 l/h/m² (151 %) for nelarabine and 2.6 l/h/m² (83 %) for ara-G in 21 adult patients.

Because the timecourse of intracellular ara-GTP was prolonged, its elimination half-life could not be accurately estimated.

Paediatric population

Limited clinical pharmacology data are available for patients below the age of 4 years.

Combined Phase 1 pharmacokinetic data at nelarabine doses of 104 to 2,900 mg/m² indicate that the clearance (Cl) and V_{ss} values for nelarabine and ara-G are comparable between the two groups. Further data with respect to nelarabine and ara-G pharmacokinetics in the paediatric population are provided in other subsections.

Gender

Gender has no effect on nelarabine or ara-G plasma pharmacokinetics. Intracellular ara-GTP C_{max} and AUC_(0-t) values at the same dose level were 2- to 3- fold greater on average in adult female than in adult male patients.

Race

The effect of race on nelarabine and ara-G pharmacokinetics has not been specifically studied. In a pharmacokinetic/pharmacodynamic cross study analysis, race had no apparent effect on nelarabine, ara-G, or intracellular ara-GTP pharmacokinetics.

Renal impairment

The pharmacokinetics of nelarabine and ara-G have not been specifically studied in renally impaired or haemodialysed patients. Nelarabine is excreted by the kidney to a small extent (5 to 10 % of the administered dose). Ara-G is excreted by the kidney to a greater extent (20 to 30 % of the administered nelarabine dose). Adults and children in clinical studies were categorized into the three groups according to renal impairment: normal with Cl_{cr} greater than 80 ml/min (n = 56), mild with Cl_{cr} equalling 50 to 80 ml/min (n = 12), and moderate with Cl_{cr} less than 50 ml/min (n = 2). The mean apparent clearance (Cl/F) of ara-G was about 7 % lower in patients with mild renal impairment than in patients with normal renal function (see section 4.2). No data are available to provide a dose advice for patients with Cl_{cr} less than 50 ml/min.

Elderly

Age has no effect on the pharmacokinetics of nelarabine or ara-G. Decreased renal function, which is more common in the elderly, may reduce ara-G clearance (see section 4.2).

5.3 PRECLINICAL SAFETY DATA

Nelarabine caused histopathological changes in the central nervous system (white matter vacuolation and degenerative changes in cerebrum, cerebellum and spinal cord) of monkeys after daily treatment with nelarabine for 23 days. Nelarabine showed *in vitro* cytotoxicity to monocytes and macrophages. Observed at therapeutic exposure levels, these findings are regarded as potentially clinically relevant.

Genotoxicity

Nelarabine was shown to be genotoxic in assays using L5178Y/TK mouse lymphoma cells. Mutagenic and clastogenic activity were both evident, and positive results were obtained with and without metabolic activation.

Carcinogenicity

Carcinogenicity studies have not been performed with nelarabine.

6 PHARMACEUTICAL PARTICULARS

6.1 LIST OF EXCIPIENTS

Sodium chloride

Hydrochloric acid

Sodium hydroxide

Water for injection

6.2 INCOMPATIBILITIES

No data available.

6.3 SHELF LIFE

In Australia, information on the shelf life can be found on the public summary of the Australian Register of Therapeutic Goods (ARTG). The expiry date can be found on the packaging.

6.4 SPECIAL PRECAUTIONS FOR STORAGE

Store below 25 °C

6.5 NATURE AND CONTENTS OF CONTAINER

Type-I Clear colorless moulded glass vial with 20mm rubber stopper and sealed with 20mm aluminium seal having blue color polypropylene disc

Each vial contains 50 ml of solution. NELARABINE-REACH is supplied in packs of 1 vial or 6 vials.

6.6 SPECIAL PRECAUTIONS FOR DISPOSAL

The normal procedures for proper handling and disposal of cytotoxic anti-tumour medicinal products should be adopted, namely:

- Staff should be trained in how to handle and transfer the medicinal product.
- Pregnant staff should be excluded from working with this medicinal product.
- Personnel handling this medicinal product during handling/transfer should wear protective clothing including mask, goggles and gloves.
- All items for administration or cleaning, including gloves, should be placed in high-risk, waste disposal bags for high-temperature incineration. Any liquid waste from the preparation of the nelarabine solution for infusion may be flushed with large amounts of water.
- Accidental contact with the skin or eyes should be treated immediately with copious amounts of water.

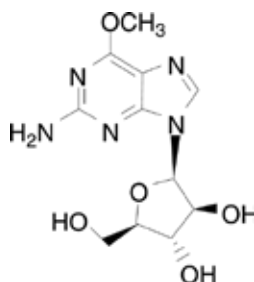
Any unused medicinal product or waste material should be disposed of in accordance with local requirements.

6.7 PHYSICOCHEMICAL PROPERTIES

Nelarabine is a pro-drug of the cytotoxic deoxyguanosine analogue, 9- β -D250 arabinofuranosylguanine (ara-G).

The chemical name for nelarabine is 2-amino-9- β -*D*-arabinofuranosyl-6-methoxy-9*H*-purine.

Chemical structure



It has the molecular formula $C_{11}H_{15}N_5O_5$ and a molecular weight of 297.27.

CAS number: 121032-29-9

7 MEDICINE SCHEDULE (POISONS STANDARD)

S4 - Prescription only medicine

8 SPONSOR

Reach Pharmaceuticals Pty Ltd
Ground Floor, Corporate One
84 Hotham Rd,
Preston VIC 3072
medical@reach-pharma.com

9 DATE OF FIRST APPROVAL

TBA

10 DATE OF REVISION

TBA

SUMMARY TABLE OF CHANGES

Section Changed	Summary of new information
	New PI