

SUMMARY OF PRODUCT CHARACTERISTICS

1 NAME OF THE MEDICINAL PRODUCT

INVEGA 9 mg prolonged-release tablets

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each prolonged-release tablet contains 9 mg of paliperidone.

For the full list of excipients, see section 6.1.

3 PHARMACEUTICAL FORM

Prolonged-release tablet

Trilayer capsule-shaped pink tablets of 11 mm in length and 5 mm in diameter printed with "PAL 9"

4 CLINICAL PARTICULARS

4.1 Therapeutic indications

INVEGA is indicated for the treatment of schizophrenia in adults and in adolescents 15 years and older.

INVEGA is indicated for the treatment of schizoaffective disorder in adults.

4.2 Posology and method of administration

Posology

Schizophrenia (adults)

The recommended dose of INVEGA for the treatment of schizophrenia in adults is 6 mg once daily, administered in the morning. Initial dose titration is not required. Some patients may benefit from lower or higher doses within the recommended range of 3 mg to 12 mg once daily. Dosage adjustment, if indicated, should occur only after clinical reassessment. When dose increases are indicated, increments of 3 mg/day are recommended and generally should occur at intervals of more than 5 days.

Schizoaffective disorder (adults)

The recommended dose of INVEGA for the treatment of schizoaffective disorder in adults is 6 mg once daily, administered in the morning. Initial dose titration is not required. Some patients may benefit from higher doses within the recommended range of 6 mg to 12 mg once daily. Dosage adjustment, if indicated, should occur only after clinical reassessment. When dose increases are indicated, increments of 3 mg/day are recommended and generally should occur at intervals of more than 4 days.

Switching to other antipsychotic medicinal products

There are no systematically collected data to specifically address switching patients from INVEGA to other antipsychotic medicinal products. Due to different pharmacodynamic and pharmacokinetic profiles among antipsychotic medicinal products, supervision by a clinician is needed when switching to another antipsychotic product is considered medically appropriate.

Elderly

Dosing recommendations for elderly patients with normal renal function (≥ 80 mL/min) are the same as for adults with normal renal function. However, because elderly patients may have diminished renal function, dose adjustments may be required according to their renal function status (see Renal impairment below). INVEGA should be used with caution in elderly patients with dementia with risk factors for stroke (see section 4.4). Safety and efficacy of INVEGA in patients > 65 years of age with schizoaffective disorder have not been studied.

Hepatic impairment

No dose adjustment is required in patients with mild or moderate hepatic impairment. As INVEGA has not been studied in patients with severe hepatic impairment, caution is recommended in such patients.

Renal impairment

For patients with mild renal impairment (creatinine clearance ≥ 50 to < 80 mL/min), the recommended initial dose is 3 mg once daily. The dose may be increased to 6 mg once daily based on clinical response and tolerability.

For patients with moderate to severe renal impairment (creatinine clearance ≥ 10 to < 50 mL/min), the recommended initial dose of INVEGA is 3 mg every other day, which may be increased to 3 mg once daily after clinical reassessment. As INVEGA has not been studied in patients with creatinine clearance below 10 mL/min, use is not recommended in such patients.

Paediatric population

Schizophrenia: The recommended starting dose of INVEGA for the treatment of schizophrenia in adolescents 15 years and older is 3 mg once daily, administered in the morning.

Adolescents weighing < 51 kg: the maximum recommended daily dose of INVEGA is 6 mg.

Adolescents weighing ≥ 51 kg: the maximum recommended daily dose of INVEGA is 12 mg.

Dosage adjustment, if indicated, should occur only after clinical reassessment based on the individual need of the patient. When dose increases are indicated, increments of 3 mg/day are recommended and generally should occur at intervals of 5 days or more. The safety and efficacy of INVEGA in the treatment of schizophrenia in adolescents between 12 and 14 years old has not been established. Currently available data are described in section 4.8 and 5.1 but no recommendation on a posology can be made. There is no relevant use of INVEGA in children aged less than 12 years.

Schizoaffective disorder: The safety and efficacy of INVEGA in the treatment of schizoaffective disorder in patients aged 12 to 17 years has not been studied or established. There is no relevant use of INVEGA in children aged less than 12 years.

Other special populations

No dose adjustment for INVEGA is recommended based on gender, race, or smoking status.

Method of administration

INVEGA is for oral administration. It must be swallowed whole with liquid, and must not be chewed, divided, or crushed. The active substance is contained within a non-absorbable shell designed to release the active substance at a controlled rate. The tablet shell, along with insoluble core components, is eliminated from the body;

patients should not be concerned if they occasionally notice in their stool something that looks like a tablet.

The administration of INVEGA should be standardised in relation to food intake (see section 5.2). The patient should be instructed to always take INVEGA in the fasting state or always take it together with breakfast and not to alternate between administration in the fasting state or in the fed state.

4.3 Contraindications

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

4.4 Special warnings and precautions for use

Patients with schizoaffective disorder treated with paliperidone should be carefully monitored for a potential switch from manic to depressive symptoms.

QT interval

Caution should be exercised when INVEGA is prescribed in patients with known cardiovascular disease or family history of QT prolongation, and in concomitant use with other medicines thought to prolong the QT interval.

Neuroleptic malignant syndrome

Neuroleptic Malignant Syndrome (NMS), characterised by hyperthermia, muscle rigidity, autonomic instability, altered consciousness, and elevated serum creatine phosphokinase levels has been reported to occur with paliperidone. Additional clinical signs may include myoglobinuria (rhabdomyolysis) and acute renal failure. If a patient develops signs or symptoms indicative of NMS, all antipsychotics, including INVEGA, should be discontinued.

Tardive dyskinesia/extrapyramidal symptoms

Medicines with dopamine receptor antagonistic properties have been associated with the induction of tardive dyskinesia characterised by rhythmical, involuntary movements, predominantly of the tongue and/or face. If signs and symptoms of tardive dyskinesia appear, the discontinuation of all antipsychotics, including INVEGA, should be considered.

Caution is warranted in patients receiving both, psychostimulants (e.g., methylphenidate) and paliperidone concomitantly, as extrapyramidal symptoms could emerge when adjusting one or both medications. Gradual withdrawal of stimulant treatment is recommended (see section 4.5).

Leucopenia, neutropenia, and agranulocytosis

Events of leucopenia, neutropenia, and agranulocytosis have been reported with antipsychotic agents, including INVEGA. Agranulocytosis has been reported very rarely (< 1/10,000 patients) during post-marketing surveillance. Patients with a history of a clinically significant low white blood cell count (WBC) or a drug-induced leucopenia/neutropenia should be monitored during the first few months of therapy and discontinuation of INVEGA should be considered at the first sign of a clinically significant decline in WBC in the absence of other causative factors. Patients with clinically significant neutropenia should be carefully monitored for fever or other symptoms or signs of infection and treated promptly if such symptoms or signs occur. Patients with severe neutropenia (absolute neutrophil count < 1 x 10⁹/L) should discontinue INVEGA and have their WBC followed until recovery.

Hyperglycaemia and diabetes mellitus

Hyperglycaemia, diabetes mellitus, and exacerbation of pre-existing diabetes have been reported during treatment with paliperidone. In some cases, a prior increase in body weight has been reported which may be a predisposing factor. Association with ketoacidosis has been reported very rarely and rarely with diabetic coma. Appropriate clinical monitoring is advisable in accordance with utilised antipsychotic guidelines. Patients treated with any atypical antipsychotic, including INVEGA, should be monitored for symptoms of hyperglycaemia (such as polydipsia, polyuria, polyphagia, and weakness) and patients with diabetes mellitus should be monitored regularly for worsening of glucose control.

Weight gain

Significant weight gain has been reported with INVEGA use. Weight should be monitored regularly.

Hyperprolactinaemia

Tissue culture studies suggest that cell growth in human breast tumours may be stimulated by prolactin. Although no clear association with the administration of antipsychotics has so far been demonstrated in clinical and epidemiological studies, caution is recommended in patients with relevant medical history. Paliperidone should be used with caution in patients with possible prolactin-dependent tumours.

Orthostatic hypotension

Paliperidone may induce orthostatic hypotension in some patients based on its alpha-blocking activity. Based on pooled data from the three, placebo-controlled, 6-week, fixed-dose trials with INVEGA (3, 6, 9, and 12 mg), orthostatic hypotension was reported by 2.5% of subjects treated with INVEGA compared with 0.8% of subjects treated with placebo. INVEGA should be used with caution in patients with known cardiovascular disease (e.g., heart failure, myocardial infarction or ischaemia, conduction abnormalities), cerebrovascular disease, or conditions that predispose the patient to hypotension (e.g., dehydration and hypovolemia).

Seizures

INVEGA should be used cautiously in patients with a history of seizures or other conditions that potentially lower the seizure threshold.

Potential for gastrointestinal obstruction

Because the INVEGA tablet is non-deformable and does not appreciably change shape in the gastrointestinal tract, INVEGA should not ordinarily be administered to patients with preexisting severe gastrointestinal narrowing (pathologic or iatrogenic) or in patients with dysphagia or significant difficulty in swallowing tablets. There have been rare reports of obstructive symptoms in patients with known strictures in association with the ingestion of medicines in non-deformable controlled-release formulations. Due to the controlled-release design of the dosage form, INVEGA should only be used in patients who are able to swallow the tablet whole.

Conditions with decreased gastro-intestinal transit time

Conditions leading to shorter gastrointestinal transit time, e.g., diseases associated with chronic severe diarrhoea, may result in a reduced absorption of paliperidone.

Renal impairment

The plasma concentrations of paliperidone are increased in patients with renal impairment and, therefore, dosage adjustment may be required in some patients (see sections 4.2 and 5.2). No data are available in patients with a creatinine clearance

below 10 mL/min. Paliperidone should not be used in patients with creatinine clearance below 10 mL/min.

Hepatic impairment

No data are available in patients with severe hepatic impairment (Child-Pugh class C). Caution is recommended if paliperidone is used in such patients.

Elderly patients with dementia

INVEGA has not been studied in elderly patients with dementia. The experience from risperidone is considered valid also for paliperidone.

Overall mortality

In a meta-analysis of 17 controlled clinical trials, elderly patients with dementia treated with other atypical antipsychotics, including risperidone, aripiprazole, olanzapine, and quetiapine had an increased risk of mortality compared to placebo. Among those treated with risperidone, the mortality was 4% compared with 3.1% for placebo.

Cerebrovascular adverse reactions

An approximately 3-fold increased risk of cerebrovascular adverse reactions have been seen in randomised placebo-controlled clinical trials in the dementia population with some atypical antipsychotics, including risperidone, aripiprazole, and olanzapine. The mechanism for this increased risk is not known. INVEGA should be used with caution in elderly patients with dementia who have risk factors for stroke.

Parkinson's disease and dementia with Lewy bodies

Physicians should weigh the risks versus the benefits when prescribing INVEGA to patients with Parkinson's Disease or Dementia with Lewy Bodies (DLB) since both groups may be at increased risk of Neuroleptic Malignant Syndrome as well as having an increased sensitivity to antipsychotics. Manifestation of this increased sensitivity can include confusion, obtundation, postural instability with frequent falls, in addition to extrapyramidal symptoms.

Priapism

Antipsychotic medicinal products (including risperidone) with α -adrenergic blocking effects have been reported to induce priapism. During post-marketing surveillance priapism has also been reported with paliperidone, which is the active metabolite of risperidone. Patients should be informed to seek urgent medical care in case that priapism has not been resolved within 3-4 hours.

Body temperature regulation

Disruption of the body's ability to reduce core body temperature has been attributed to antipsychotic medicinal products. Appropriate care is advised when prescribing INVEGA to patients who will be experiencing conditions which may contribute to an elevation in core body temperature, e.g., exercising strenuously, exposure to extreme heat, receiving concomitant medication with anticholinergic activity, or being subject to dehydration.

Venous thromboembolism

Cases of venous thromboembolism (VTE) have been reported with antipsychotic medicinal products. Since patients treated with antipsychotics often present with acquired risk factors for VTE, all possible risk factors for VTE should be identified before and during treatment with INVEGA and preventive measures undertaken.

Antiemetic effect

An antiemetic effect was observed in preclinical studies with paliperidone. This effect, if it occurs in humans, may mask the signs and symptoms of overdosage with certain medicines or of conditions such as intestinal obstruction, Reye's syndrome, and brain tumour.

Paediatric population

The sedative effect of INVEGA should be closely monitored in this population. A change in the time of administration of INVEGA may improve the impact of sedation on the patient.

Because of the potential effects of prolonged hyperprolactinaemia on growth and sexual maturation in adolescents, regular clinical evaluation of endocrinological status should be considered, including measurements of height, weight, sexual maturation, monitoring of menstrual functioning, and other potential prolactin-related effects.

During treatment with INVEGA regular examination for extrapyramidal symptoms and other movement disorders should also be conducted.

For specific posology recommendations in the paediatric population see section 4.2.

Intraoperative Floppy Iris Syndrome

Intraoperative floppy iris syndrome (IFIS) has been observed during cataract surgery in patients treated with medicines with alpha 1a-adrenergic antagonist effect, such as INVEGA (see section 4.8).

IFIS may increase the risk of eye complications during and after the operation. Current or past use of medicines with alpha 1a-adrenergic antagonist effect should be made known to the ophthalmic surgeon in advance of surgery. The potential benefit of stopping alpha 1 blocking therapy prior to cataract surgery has not been established and must be weighed against the risk of stopping the antipsychotic therapy.

Excipients

Lactose content (*pertains only to the 3 mg tablets*)

Patients with rare hereditary problems of galactose intolerance, the Lapp lactase deficiency or glucose-galactose malabsorption should not take this medicine.

Sodium content

This medicinal product contains less than 1 mmol sodium (23 mg) per tablet, i.e., essentially sodium-free.

4.5 Interaction with other medicinal products and other forms of interaction

Caution is advised when prescribing INVEGA with medicines known to prolong the QT interval, e.g., class IA antiarrhythmics (e.g., quinidine, disopyramide) and class III antiarrhythmics (e.g., amiodarone, sotalol), some antihistaminics, some other antipsychotics and some antimalarials (e.g., mefloquine).

Potential for INVEGA to affect other medicines

Paliperidone is not expected to cause clinically important pharmacokinetic interactions with medicines that are metabolised by cytochrome P-450 isozymes. *In vitro* studies indicate that paliperidone is not an inducer of CYP1A2 activity.

Given the primary CNS effects of paliperidone (see section 4.8), INVEGA should be used with caution in combination with other centrally acting medicines, e.g., anxiolytics, most antipsychotics, hypnotics, opiates, etc. or alcohol.

Paliperidone may antagonise the effect of levodopa and other dopamine agonists. If this combination is deemed necessary, particularly in end-stage Parkinson's disease, the lowest effective dose of each treatment should be prescribed.

Because of its potential for inducing orthostatic hypotension (see section 4.4), an additive effect may be observed when INVEGA is administered with other therapeutic agents that have this potential, e.g., other antipsychotics, tricyclics.

Caution is advised if paliperidone is combined with other medicines known to lower the seizure threshold (i.e., phenothiazines or butyrophenones, clozapine, tricyclics or SSRIs, tramadol, mefloquine, etc.).

No interaction study between INVEGA and lithium has been performed, however, a pharmacokinetic interaction is unlikely to occur.

Co-administration of INVEGA 12 mg once daily with divalproex sodium prolonged-release tablets (500 mg to 2,000 mg once daily) did not affect the steady-state pharmacokinetics of valproate. Co-administration of INVEGA with divalproex sodium prolonged-release tablets increased the exposure to paliperidone (see below).

Potential for other medicines to affect INVEGA

In vitro studies indicate that CYP2D6 and CYP3A4 may be minimally involved in paliperidone metabolism, but there are no indications *in vitro* nor *in vivo* that these isozymes play a significant role in the metabolism of paliperidone. Concomitant administration of INVEGA with paroxetine, a potent CYP2D6 inhibitor, showed no clinically significant effect on the pharmacokinetics of paliperidone. *In vitro* studies have shown that paliperidone is a P-glycoprotein (P-gp) substrate.

Co-administration of INVEGA once daily with carbamazepine 200 mg twice daily caused a decrease of approximately 37% in the mean steady-state C_{max} and AUC of paliperidone. This decrease is caused, to a substantial degree, by a 35% increase in renal clearance of paliperidone likely as a result of induction of renal P-gp by carbamazepine. A minor decrease in the amount of active substance excreted unchanged in the urine suggests that there was little effect on the CYP metabolism or bioavailability of paliperidone during carbamazepine co-administration. Larger decreases in plasma concentrations of paliperidone could occur with higher doses of carbamazepine. On initiation of carbamazepine, the dose of INVEGA should be re-evaluated and increased if necessary. Conversely, on discontinuation of carbamazepine, the dose of INVEGA should be re-evaluated and decreased if necessary. It takes 2-3 weeks for full induction to be achieved and upon discontinuation of the inducer the effect wears off over a similar time period. Other medicinal products or herbals which are inducers, e.g., rifampicin and St. John's wort (*Hypericum perforatum*) may have similar effects on paliperidone.

Medicinal products affecting gastrointestinal transit time may affect the absorption of paliperidone, e.g., metoclopramide.

Co-administration of a single dose of INVEGA 12 mg with divalproex sodium prolonged-release tablets (two 500 mg tablets once daily) resulted in an increase of approximately 50% in the C_{max} and AUC of paliperidone. Dosage reduction for INVEGA should be considered when INVEGA is co-administered with valproate after clinical assessment.

Concomitant use of INVEGA with risperidone

Concomitant use of INVEGA with oral risperidone is not recommended as paliperidone is the active metabolite of risperidone and the combination of the two may lead to additive paliperidone exposure.

Concomitant use of INVEGA with psychostimulants

The combined use of psychostimulants (e.g., methylphenidate) with paliperidone can lead to extrapyramidal symptoms upon change of either or both treatments (see section 4.4).

Paediatric population

Interaction studies have only been performed in adults.

4.6 Fertility, pregnancy and lactation

Pregnancy

There are no adequate data from the use of paliperidone during pregnancy.

Paliperidone was not teratogenic in animal studies, but other types of reproductive toxicity were observed (see section 5.3). Neonates exposed to antipsychotics (including paliperidone) during the third trimester of pregnancy are at risk of adverse reactions including extrapyramidal and/or withdrawal symptoms that may vary in severity and duration following delivery. There have been reports of agitation, hypertonia, hypotonia, tremor, somnolence, respiratory distress, or feeding disorder. Consequently, newborns should be monitored carefully. INVEGA should not be used during pregnancy unless clearly necessary. If discontinuation during pregnancy is necessary, it should not be done abruptly.

Breast-feeding

Paliperidone is excreted in the breast milk to such an extent that effects on the breast-fed infant are likely if therapeutic doses are administered to breast-feeding women. INVEGA should not be used while breast feeding.

Fertility

There were no relevant effects observed in the non-clinical studies.

4.7 Effects on ability to drive and use machines

Paliperidone can have minor or moderate influence on the ability to drive and use machines due to potential nervous system and visual effects (see section 4.8).

Therefore, patients should be advised not to drive or operate machines until their individual susceptibility to INVEGA is known.

4.8 Undesirable effects

Adults

Summary of the safety profile

The adverse drug reactions (ADRs) most frequently reported in clinical trials with adults were headache, insomnia, sedation/somnolence, parkinsonism, akathisia, tachycardia, tremor, dystonia, upper respiratory tract infection, anxiety, dizziness, weight increased, nausea, agitation, constipation, vomiting, fatigue, depression, dyspepsia, diarrhoea, dry mouth, toothache, musculoskeletal pain, hypertension, asthenia, back pain, electrocardiogram QT prolonged, and cough.

The ADRs that appeared to be dose-related included headache, sedation/somnolence, parkinsonism, akathisia, tachycardia, dystonia, dizziness, tremor, upper respiratory tract infection, dyspepsia, and musculoskeletal pain.

In the schizoaffective disorder studies, a greater proportion of subjects in the total INVEGA dose group who were receiving concomitant therapy with an antidepressant or mood stabiliser experienced adverse events as compared to those subjects treated with INVEGA monotherapy.

Tabulated list of adverse reactions

The following are all the ADRs that were reported in clinical trials and post-marketing experience with paliperidone by frequency category estimated from INVEGA clinical trials in adults. The following terms and frequencies are applied: *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). Within each frequency grouping, adverse reactions are presented in order of decreasing seriousness.

System Organ Class	Adverse Drug Reaction				
	Frequency				
	Very common	Common	Uncommon	Rare	Not known
Infections and infestations		bronchitis, upper respiratory tract infection, sinusitis, urinary tract infection, influenza	pneumonia, respiratory tract infection, cystitis, ear infection, tonsillitis	eye infection, onychomycosis, cellulitis, acarodermatitis	
Blood and lymphatic system disorders			white blood cell count decreased, thrombocytopenia, anaemia, haematocrit decreased	agranulocytosis ^c , neutropenia, eosinophil count increased	
Immune system disorders				anaphylactic reaction, hypersensitivity	
Endocrine disorders			hyperprolactinaemia ^a	inappropriate antidiuretic hormone secretion ^c , glucose urine present	
Metabolism and nutrition disorders		weight increased, increased appetite, weight decreased, decreased appetite	diabetes mellitus ^d , hyperglycaemia, waist circumference increased, anorexia, blood triglycerides increased	water intoxication, diabetic ketoacidosis ^c , hypoglycaemia, polydipsia, blood cholesterol increased	hyperinsulinaemia
Psychiatric disorders	insomnia ^e	mania, agitation, depression, anxiety	sleep disorder, confusional state, libido decreased, anorgasmia, nervousness, nightmare	catatonia, somnambulism, blunted affect ^c	

Nervous system disorders	parkinsonism ^b , akathisia ^b , sedation/ somnolence, headache	dystonia ^b , dizziness, dyskinesia ^b , tremor ^b	tardive dyskinesia, convulsion ^e , syncope, psychomotor hyperactivity, dizziness postural, disturbance in attention, dysarthria, dysgeusia, hypoaesthesia, paresthaesia	neuroleptic malignant syndrome, cerebral ischaemia, unresponsive to stimuli ^e , loss of consciousness, depressed level of consciousness ^e , diabetic coma ^e balance disorder, coordination abnormal, head titubation ^e	
Eye disorders		vision blurred	photophobia, conjunctivitis, dry eye	glaucoma, eye movement disorder ^e , eye rolling ^e , lacrimation increased, ocular hyperaemia	
Ear and labyrinth disorders			vertigo, tinnitus, ear pain		
Cardiac disorders		atrioventricular block, conduction disorder, electrocardiogram QT prolonged, bradycardia, tachycardia	sinus arrhythmia, electrocardiogram abnormal, palpitations	atrial fibrillation, postural orthostatic tachycardia syndrome ^e	
Vascular disorders		orthostatic hypotension, hypertension	hypotension	pulmonary embolism, venous thrombosis, ischaemia, flushing	
Respiratory, thoracic and mediastinal disorders		pharyngolaryngeal pain, cough, nasal congestion	dyspnoea, wheezing, epistaxis	sleep apnoea syndrome, hyperventilation, pneumonia aspiration, respiratory tract congestion, dysphonia	pulmonary congestion
Gastrointestinal disorders		abdominal pain, abdominal discomfort, vomiting, nausea, constipation, diarrhoea, dyspepsia, dry mouth, toothache	swollen tongue, gastroenteritis, dysphagia, flatulence	pancreatitis ^e , intestinal obstruction, ileus, faecal incontinence, faecaloma ^e , cheilitis	
Hepatobiliary disorders		transaminases increased	gamma-glutamyltransferase increased, hepatic enzyme increased	jaundice	

Skin and subcutaneous tissue disorders		pruritus, rash	urticaria, alopecia, eczema, acne	angioedema, drug eruption ^c , hyperkeratosis, dry skin, erythema, skin discoloration, seborrhoeic dermatitis, dandruff	
Musculoskeletal and connective tissue disorders		musculoskeletal pain, back pain, arthralgia	blood creatine phosphokinase increased, muscle spasms, joint stiffness, joint swelling, muscular weakness, neck pain	rhabdomyolysis ^c , posture abnormal ^c	
Renal and urinary disorders			urinary incontinence, pollakiuria, urinary retention, dysuria		
Pregnancy, puerperium and perinatal conditions				drug withdrawal syndrome neonatal (see section 4.6) ^c	
Reproductive system and breast disorders		amenorrhoea	erectile dysfunction, ejaculation disorder, menstrual disorder ^e , galactorrhoea, sexual dysfunction, breast pain, breast discomfort	priapism ^c , menstruation delayed ^c , gynaecomastia, breast engorgement, breast enlargement ^c , breast discharge, vaginal discharge	
General disorders		pyrexia, asthenia, fatigue	face oedema, oedema ^c , chills, body temperature increased, gait abnormal, thirst, chest pain, chest discomfort, malaise	hypothermia ^c , body temperature decreased ^c , drug withdrawal syndrome ^c , induration ^c	
Injury, poisoning and procedural complications			fall		

^a Refer to 'Hyperprolactinaemia' below.

^b Refer to 'Extrapyramidal symptoms' below.

^c Not observed in INVEGA clinical studies but observed in post-marketing environment with paliperidone.

^d In placebo-controlled pivotal trials, diabetes mellitus was reported in 0.05% in INVEGA-treated subjects compared to a rate of 0% in placebo group. Overall incidence from all clinical trials was 0.14% in all INVEGA-treated subjects.

^e **Insomnia includes:** initial insomnia, middle insomnia; **Convulsion includes:** grand mal convulsion; **Oedema includes:** generalised oedema, oedema peripheral, pitting oedema; **Menstrual disorder includes:** menstruation irregular, oligomenorrhoea.

Undesirable effects noted with risperidone formulations

Paliperidone is the active metabolite of risperidone, therefore, the adverse reaction profiles of these compounds (including both the oral and injectable formulations) are relevant to one another. In addition to the above adverse reactions, the following adverse reactions have been noted with the use of risperidone products and can be expected to occur with INVEGA.

Psychiatric disorders: sleep-related eating disorder

Nervous system disorders: cerebrovascular disorder

Eye disorders: floppy iris syndrome (intraoperative)

Respiratory, thoracic and mediastinal disorders: rales

Skin and subcutaneous tissue disorders: Stevens-Johnson syndrome/toxic epidermal necrolysis

Description of selected adverse reactions

Extrapyramidal symptoms (EPS)

In schizophrenia clinical trials, there was no difference observed between placebo and the 3 and 6 mg doses of INVEGA. Dose dependence for EPS was seen with the two higher doses of INVEGA (9 and 12 mg). In the schizoaffective disorder studies, the incidence of EPS was observed at a higher rate than placebo in all dose groups without a clear relationship to dose.

EPS included a pooled analysis of the following terms: Parkinsonism (includes salivary hypersecretion, musculoskeletal stiffness, parkinsonism, drooling, cogwheel rigidity, bradykinesia, hypokinesia, masked facies, muscle tightness, akinesia, nuchal rigidity, muscle rigidity, parkinsonian gait, and glabellar reflex abnormal, parkinsonian rest tremor), akathisia (includes akathisia, restlessness, hyperkinesia, and restless leg syndrome), dyskinesia (dyskinesia, muscle twitching, choreoathetosis, athetosis, and myoclonus), dystonia (includes dystonia, hypertonia, torticollis, muscle contractions involuntary, muscle contracture, blepharospasm, oculogyration, tongue paralysis, facial spasm, laryngospasm, myotonia, opisthotonus, oropharyngeal spasm, pleurothotonus, tongue spasm, and trismus), and tremor. It should be noted that a broader spectrum of symptoms are included that do not necessarily have an extrapyramidal origin.

Weight gain

In schizophrenia clinical trials, the proportions of subjects meeting a weight gain criterion of $\geq 7\%$ of body weight were compared, revealing a similar incidence of weight gain for INVEGA 3 mg and 6 mg compared with placebo, and a higher incidence of weight gain for INVEGA 9 mg and 12 mg compared with placebo.

In schizoaffective disorder clinical trials, a higher percentage of INVEGA-treated subjects (5%) had an increase in body weight of $\geq 7\%$ compared with placebo-treated subjects (1%). In the study that examined two dose groups (see section 5.1), the increase in body weight of $\geq 7\%$ was 3% in the lower-dose (3-6 mg) group, 7% in the higher-dose (9-12 mg) group, and 1% in the placebo group.

Hyperprolactinaemia

In schizophrenia clinical trials, increases in serum prolactin were observed with INVEGA in 67% of subjects. Adverse reactions that may suggest increase in prolactin levels (e.g., amenorrhoea, galactorrhoea, menstrual disturbances, gynaecomastia) were reported overall in 2% of subjects. Maximum mean increases of serum prolactin concentrations were generally observed on day 15 of treatment, but remained above baseline levels at study endpoint.

Class effects

QT prolongation, ventricular arrhythmias (ventricular fibrillation, ventricular tachycardia), sudden unexplained death, cardiac arrest and Torsade de pointes may occur with antipsychotics. Cases of venous thromboembolism, including cases of pulmonary embolism and cases of deep vein thrombosis have been reported with antipsychotic drugs - Frequency unknown.

Paliperidone is the active metabolite of risperidone. The safety profile of risperidone may be pertinent.

Elderly

In a study conducted in elderly subjects with schizophrenia, the safety profile was similar to that seen in non-elderly subjects. INVEGA has not been studied in elderly patients with dementia. In clinical trials with some other atypical antipsychotics, increased risks of death and cerebrovascular accidents have been reported (see section 4.4).

Paediatric population

Summary of the safety profile

In one short-term and two longer-term studies with paliperidone prolonged-release tablets conducted in adolescents 12 years and older with schizophrenia, the overall safety profile was similar to that seen in adults. In the pooled adolescent schizophrenia population (12 years and older, N = 545) exposed to INVEGA, the frequency and type of undesirable effects were similar to those in adults except for the following ADRs that were reported more frequently in adolescents receiving INVEGA than adults receiving INVEGA (and more frequently than placebo): sedation/somnolence, parkinsonism, weight increase, upper respiratory tract infection, akathisia, and tremor were reported very commonly ($\geq 1/10$) in adolescents; abdominal pain, galactorrhoea, gynaecomastia, acne, dysarthria, gastroenteritis, epistaxis, ear infection, blood triglyceride increased, and vertigo were reported commonly ($\geq 1/100$, $< 1/10$) in adolescents.

Extrapyramidal Symptoms (EPS)

In the short-term, placebo-controlled, fixed-dose adolescent study, the incidence of EPS was higher than placebo for all doses of INVEGA with an increased frequency of EPS at higher doses. Across all adolescent studies, EPS was more common in adolescents than in adults for each INVEGA dose.

Weight gain

In the short-term, placebo-controlled, fixed-dose adolescent study, a higher percentage of INVEGA-treated subjects (6-19% depending on dose) had an increase in body weight of $\geq 7\%$ compared to placebo-treated subjects (2%). There was no clear dose relationship. In the long-term 2-year study, the subjects who were exposed to INVEGA during both the double-blind and open-label studies reported a modest weight gain (4.9 kg).

In adolescents, weight gain should be assessed against that expected with normal growth.

Prolactin

In the up to 2-year, open-label treatment study of INVEGA in adolescents with schizophrenia, incidence of elevated serum prolactin levels occurred in 48% of females and 60% of males. Adverse reactions that may suggest increase in prolactin

levels (e.g., amenorrhoea, galactorrhoea, menstrual disturbances, gynaecomastia) were reported overall in 9.3% of subjects.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medical 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 via the Yellow Card Scheme Website: www.mhra.gov.uk/yellowcard or search for MHRA Yellow Card in the Google Play or Apple App Store.

4.9 Overdose

In general, expected signs and symptoms are those resulting from an exaggeration of paliperidone's known pharmacological effects, i.e., drowsiness and sedation, tachycardia and hypotension, QT prolongation, and extrapyramidal symptoms. Torsade de pointes and ventricular fibrillation have been reported in association with overdose. In the case of acute overdosage, the possibility of multiple medicinal product involvement should be considered.

Consideration should be given to the prolonged-release nature of the product when assessing treatment needs and recovery. There is no specific antidote to paliperidone. General supportive measures should be employed. Establish and maintain a clear airway and ensure adequate oxygenation and ventilation. Cardiovascular monitoring should commence immediately and should include continuous electrocardiographic monitoring for possible arrhythmias. Hypotension and circulatory collapse should be treated with appropriate measures such as intravenous fluid and/or sympathomimetic agents. Administration of activated charcoal together with a laxative should be considered. In case of severe extrapyramidal symptoms, anticholinergic agents should be administered. Close supervision and monitoring should continue until the patient recovers.

5 PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacologic group: Psycholeptics, other antipsychotics, ATC code: N05AX13

INVEGA contains a racemic mixture of (+)- and (-)-paliperidone.

Mechanism of action

Paliperidone is a selective blocking agent of monoamine effects, whose pharmacological properties are different from that of traditional neuroleptics. Paliperidone binds strongly to serotonergic 5-HT₂- and dopaminergic D₂-receptors. Paliperidone also blocks alfa₁-adrenergic receptors and blocks, to a lesser extent, H₁-histaminergic and alfa₂-adrenergic receptors. The pharmacological activity of the (+)- and (-)-paliperidone enantiomers are qualitatively and quantitatively similar.

Paliperidone is not bound to cholinergic receptors. Even though paliperidone is a strong D₂-antagonist, which is believed to relieve the positive symptoms of schizophrenia, it causes less catalepsy and decreases motor functions to a lesser extent than traditional neuroleptics. Dominating central serotonin antagonism may reduce the tendency of paliperidone to cause extrapyramidal side effects.

Clinical efficacy

Schizophrenia

The efficacy of INVEGA in the treatment of schizophrenia was established in three multi-centre, placebo-controlled, double-blind, 6-week trials in subjects who met DSM-IV criteria for schizophrenia. INVEGA doses, which varied across the three studies, ranged from 3 to 15 mg once daily. The primary efficacy endpoint was defined as a decrease in total Positive and Negative Syndrome Scale (PANSS) scores as shown in the following table. The PANSS is a validated multi-item inventory composed of five factors to evaluate positive symptoms, negative symptoms, disorganised thoughts, uncontrolled hostility/excitement, and anxiety/depression. All tested doses of INVEGA separated from placebo on day 4 ($p < 0.05$). Predefined secondary endpoints included the Personal and Social Performance (PSP) scale and the Clinical Global Impression – Severity (CGI-S) scale. In all three studies, INVEGA was superior to placebo on PSP and CGI-S. Efficacy was also evaluated by calculation of treatment response (defined as decrease in PANSS Total Score $\geq 30\%$) as a secondary endpoint.

Schizophrenia Studies: Positive and Negative Syndrome Scale for Schizophrenia (PANSS) Total Score - Change From Baseline to End Point - LOCF for Studies R076477-SCH-303, R076477-SCH-304, and R076477-SCH-305: Intent-to-Treat Analysis Set					
	Placebo	INVEGA 3 mg	INVEGA 6 mg	INVEGA 9 mg	INVEGA 12 mg
R076477-SCH-303	(N = 126)		(N = 123)	(N = 122)	(N = 129)
Mean baseline (SD)	94.1 (10.74)		94.3 (10.48)	93.2 (11.90)	94.6 (10.98)
Mean change (SD)	-4.1 (23.16)		-17.9 (22.23)	-17.2 (20.23)	-23.3 (20.12)
P-value (vs, Placebo)			<0.001	<0.001	<0.001
Diff. of LS Means (SE)			-13.7 (2.63)	-13.5 (2.63)	-18.9 (2.60)
R076477-SCH-304	(N = 105)		(N = 111)		(N = 111)
Mean baseline (SD)	93.6 (11.71)		92.3 (11.96)		94.1 (11.42)
Mean change (SD)	-8.0 (21.48)		-15.7 (18.89)		-17.5 (19.83)
P-value (vs, Placebo)			0.006		<0.001
Diff. of LS Means (SE)			-7.0 (2.36)		-8.5 (2.35)
R076477-SCH-305	(N = 120)	(N = 123)		(N = 123)	
Mean baseline (SD)	93.9 (12.66)	91.6 (12.19)		93.9 (13.20)	
Mean change (SD)	-2.8 (20.89)	-15.0 (19.61)		-16.3 (21.81)	
P-value (vs, Placebo)		<0.001		<0.001	
Diff. of LS Means (SE)		-11.6 (2.35)		-12.9 (2.34)	

Note: Negative change in score indicates improvement. For all 3 studies, an active control (olanzapine at a dose of 10 mg) was included. LOCF = last observation carried forward. The 1-7 version of the PANSS was used. A 15 mg dose was also included in Study R076477-SCH-305, but results are not presented since this is above the maximum recommended daily dose of 12 mg.

Schizophrenia Studies: Proportion of Subjects with Responder Status at LOCF End Point					
Studies R076477-SCH-303, R076477-SCH-304, and R076477-SCH-305: Intent-to-Treat Analysis Set					
	Placebo	INVEGA 3 mg	INVEGA 6 mg	INVEGA 9 mg	INVEGA 12 mg
R076477-SCH-303					
N	126		123	122	129
Responder, n (%)	38 (30.2)		69 (56.1)	62 (50.8)	79 (61.2)
Non-responder, n (%)	88 (69.8)		54 (43.9)	60 (49.2)	50 (38.8)
P value (vs Placebo)	--		< 0.001	0.001	< 0.001
R076477-SCH-304					
N	105		110		111
Responder, n (%)	36 (34.3)		55 (50.0)		57 (51.4)
Non-responder, n (%)	69 (65.7)		55 (50.0)		54 (48.6)
P value (vs Placebo)	--		0.025		0.012
R076477-SCH-305					
N	120	123		123	
Responder, n (%)	22 (18.3)	49 (39.8)		56 (45.5)	
Non-responder, n (%)	98 (81.7)	74 (60.2)		67 (54.5)	
P value (vs Placebo)	--	0.001		< 0.001	

In a long-term trial designed to assess the maintenance of effect, INVEGA was significantly more effective than placebo in maintaining symptom control and delaying relapse of schizophrenia. After having been treated for an acute episode for 6 weeks and stabilised for an additional 8 weeks with INVEGA (doses ranging from 3 to 15 mg once daily) patients were then randomised in a double-blind manner to either continue on INVEGA or on placebo until they experienced a relapse in schizophrenia symptoms. The trial was stopped early for efficacy reasons by showing a significantly longer time to relapse in patients treated with INVEGA compared to placebo (p=0.0053).

Schizoaffective disorder

The efficacy of INVEGA in the acute treatment of psychotic or manic symptoms of schizoaffective disorder was established in two placebo-controlled, 6-week trials in non-elderly adult subjects. Enrolled subjects 1) met DSM-IV criteria for schizoaffective disorder, as confirmed by the Structured Clinical Interview for DSM-IV Disorders, 2) had a Positive and Negative Syndrome Scale (PANSS) total score of at least 60, and 3) had prominent mood symptoms as confirmed by a score of at least 16 on the Young Mania Rating Scale (YMRS) and/or Hamilton Rating Scale 21 for Depression (HAM-D 21). The population included subjects with schizoaffective bipolar and depressive types. In one of these trials, efficacy was assessed in 211 subjects who received flexible doses of INVEGA (3-12 mg once daily). In the other study, efficacy was assessed in 203 subjects who were assigned to one of two dose levels of INVEGA: 6 mg with the option to reduce to 3 mg (n = 105) or 12 mg with the option to reduce to 9 mg (n = 98) once daily. Both studies included subjects who received INVEGA either as monotherapy or in combination with mood stabilisers and/or antidepressants. Dosing was in the morning without regard to meals. Efficacy was evaluated using the PANSS.

The INVEGA group in the flexible-dose study (dosed between 3 and 12 mg/day, mean modal dose of 8.6 mg/day) and the higher dose group of INVEGA in the 2 dose-level study (12 mg/day with option to reduce to 9 mg/day) were each superior to placebo in the PANSS at 6 weeks. In the lower dose group of the 2 dose-level

study (6 mg/day with option to reduce to 3 mg/day), INVEGA was not significantly different from placebo as measured by the PANSS. Only few subjects received the 3 mg dose in both studies and efficacy of this dose could not be established. Statistically superior improvements in manic symptoms as measured by YMRS (secondary efficacy scale) were observed in patients from the flexible-dose study and the INVEGA higher dose in the second study.

Taking the results of both studies together (pooled study-data), INVEGA improved the psychotic and manic symptoms of schizoaffective disorder at endpoint relative to placebo when administered either as monotherapy or in combination with mood stabilisers and/or antidepressants. However, overall the magnitude of effect in regard to PANSS and YMRS observed on monotherapy was larger than that observed with concomitant antidepressants and/or mood stabilisers. Moreover, in the pooled population, INVEGA was not efficacious in patients concomitantly receiving mood stabiliser and antidepressants in regard to the psychotic symptoms, but this population was small (30 responders in the paliperidone group and 20 responders in the placebo group). Additionally, in study SCA-3001 in the ITT population the effect on psychotic symptoms measured by PANSS was clearly less pronounced and not reaching statistical significance for patients receiving concomitantly mood stabilisers and/or antidepressants. An effect of INVEGA on depressive symptoms was not demonstrated in these studies, but has been demonstrated in a long-term study with the long-acting injectable formulation of paliperidone (described further down in this section).

An examination of population subgroups did not reveal any evidence of differential responsiveness on the basis of gender, age, or geographic region. There were insufficient data to explore differential effects based on race. Efficacy was also evaluated by calculation of treatment response (defined as decrease in PANSS Total Score \geq 30% and CGI-C Score \leq 2) as a secondary endpoint.

Schizoaffective Disorder Studies: Primary Efficacy Parameter, PANSS Total Score Change from Baseline from Studies R076477-SCA-3001 and R076477-SCA-3002: Intent-to-Treat Analysis Set				
	Placebo	INVEGA Lower Dose (3-6 mg)	INVEGA Higher Dose (9-12 mg)	INVEGA Flexible Dose (3-12 mg)
R076477-SCA-3001	(N=107)	(N=105)	(N=98)	
Mean baseline (SD)	91.6 (12.5)	95.9 (13.0)	92.7 (12.6)	
Mean change (SD)	-21.7 (21.4)	-27.4 (22.1)	-30.6 (19.1)	
P-value (vs. Placebo)		0.187	0.003	
Diff. of LS Means (SE)		-3.6 (2.7)	-8.3 (2.8)	
R076477-SCA-3002	(N=93)			(N=211)
Mean baseline (SD)	91.7 (12.1)			92.3 (13.5)
Mean change (SD)	-10.8 (18.7)			-20.0 (20.23)
P-value (vs. Placebo)				< 0.001
Diff. of LS Means (SE)				-13.5 (2.63)

Note: Negative change in score indicates improvement. LOCF = last observation carried forward.

Schizoaffective Disorder Studies: Secondary Efficacy Parameter, Proportion of Subjects with Responder Status at LOCF End Point: Studies R076477-SCA-3001 and R076477-SCA-3002: Intent-to-Treat Analysis Set				
	Placebo	INVEGA Lower Dose (3-6 mg)	INVEGA Higher Dose (9-12 mg)	INVEGA Flexible Dose (3-12 mg)
R076477-SCA-3001				
N	107	104	98	
Responder, n (%)	43 (40.2)	59 (56.7)	61 (62.2)	
Non-responder, n (%)	64 (59.8)	45 (43.3)	37 (37.8)	
P value (vs Placebo)	--	0.008	0.001	
R076477-SCA-3002				
N	93			210
Responder, n (%)	26 (28.0)			85 (40.5)
Non-responder, n (%)	67 (72.0)			125 (59.5)
P value (vs Placebo)	--			0.046

Response defined as decrease from baseline in PANSS Total Score \geq 30% and CGI-C Score \leq 2

In a long-term trial designed to assess the maintenance of effect, the long-acting injectable formulation of paliperidone was significantly more effective than placebo in maintaining symptom control and delaying relapse of psychotic, manic, and depressive symptoms of schizoaffective disorder. After having been successfully treated for an acute psychotic or mood episode for 13 weeks and stabilised for an additional 12 weeks with the long-acting injectable formulation of paliperidone (doses ranging from 50 to 150 mg) patients were then randomised to a 15-month double-blind relapse prevention period of the study to either continue on the long-acting injectable formulation of paliperidone or on placebo until they experienced a relapse of schizoaffective symptoms. The study showed a significantly longer time to relapse in patients treated with the long-acting injectable formulation of paliperidone compared to placebo ($p < 0.001$).

Paediatric population

The European Medicines Agency has waived the obligation to submit the results of studies with INVEGA in all subsets of the paediatric population in the treatment of schizoaffective disorders. (See section 4.2 for information on paediatric use).

The efficacy of INVEGA in the treatment of schizophrenia in adolescents between 12 and 14 years old has not been established.

The efficacy of INVEGA in adolescent subjects with schizophrenia (INVEGA N = 149, placebo N = 51) was studied in a randomised, double-blind, placebo-controlled, 6-week study using a fixed-dose weight-based treatment group design over the dose range of 1.5 mg/day to 12 mg/day. Subjects were 12-17 years of age and met DSM-IV criteria for schizophrenia. Efficacy was evaluated using PANSS. This study demonstrated the efficacy of INVEGA of the medium dose group in adolescent subjects with schizophrenia. Secondary by dose analysis demonstrated the efficacy of 3 mg, 6 mg, and 12 mg dose given once daily.

Adolescent Schizophrenia Study: R076477-PSZ-3001: 6-week, fixed-dose, placebo-controlled Intent-to-Treat Analysis Set. LOCF endpoint change from baseline				
	Placebo N=51	INVEGA Low Dose 1.5 mg N=54	INVEGA Medium Dose 3 or 6 mg* N=48	INVEGA High Dose 6 or 12 mg** N=47
Change in PANSS Score				
Mean baseline (SD)	90.6 (12.13)	91.6 (12.54)	90.6 (14.01)	91.5 (13.86)
Mean change (SD)	-7.9 (20.15)	-9.8 (16.31)	-17.3 (14.33)	-13.8 (15.74)
P-value (vs Placebo)		0.508	0.006	0.086
Diff. of LS Means (SE)		-2.1 (3.17)	-10.1 (3.27)	-6.6 (3.29)
Responder Analysis				
Responder, n (%)	17 (33.3)	21 (38.9)	31 (64.6)	24 (51.1)
Non-responder, n (%)	34 (66.7)	33 (61.1)	17 (35.4)	23 (48.9)
P value (vs Placebo)		0.479	0.001	0.043

Response defined as decrease from baseline in PANSS Total Score \geq 20%

Note: Negative change in score indicates improvement. LOCF = last observation carried forward.

* Medium dose group: 3 mg for subjects < 51 kg, 6 mg for subjects \geq 51 kg

** High dose group: 6 mg for subjects < 51 kg, 12 mg for subjects \geq 51 kg

Efficacy of INVEGA over a flexible dose range of 3 mg/day to 9 mg/day in adolescent subjects (12 years and older) with schizophrenia (INVEGA N = 112, aripiprazole N = 114) was also evaluated in a randomised, double-blind, active-controlled study that included an 8-week, double-blind acute phase and an 18-week, double-blind maintenance phase. The changes in PANSS total scores from baseline to week 8 and week 26 were numerically similar between the INVEGA and aripiprazole treatment groups. In addition, the difference in the percentage of patients demonstrating \geq 20% improvement in PANSS total score at week 26 between the two treatment groups was numerically similar.

Adolescent Schizophrenia Study: R076477-PSZ-3003: 26-week, flexible-dose, active-controlled Intent-to-Treat Analysis Set. LOCF endpoint change from baseline		
	INVEGA 3-9 mg N=112	Aripiprazole 5-15 mg N=114
Change in PANSS Score 8 week, acute endpoint		
Mean baseline (SD)	89.6 (12.22)	92.0 (12.09)
Mean change (SD)	-19.3 (13.80)	-19.8 (14.56)
P-value (vs aripiprazole)	0.935	
Diff. of LS Means (SE)	0.1 (1.83)	
Change in PANSS Score 26 week endpoint		
Mean baseline (SD)	89.6 (12.22)	92.0 (12.09)
Mean change (SD)	-25.6 (16.88)	-26.8 (18.82)
P-value (vs aripiprazole)	0.877	
Diff. of LS Means (SE)	-0.3 (2.20)	

Responder Analysis		
26 week endpoint		
Responder, n (%)	86 (76.8)	93 (81.6)
Non-responder, n (%)	26 (23.2)	21 (18.4)
P value (vs aripiprazole)	0.444	

Response defined as decrease from baseline in PANSS Total Score \geq 20%

Note: Negative change in score indicates improvement. LOCF = last observation carried forward.

5.2 Pharmacokinetic properties

The pharmacokinetics of paliperidone following INVEGA administration are dose proportional within the available dose range.

Absorption

Following a single dose, INVEGA exhibits a gradual ascending release rate, allowing the plasma concentrations of paliperidone to steadily rise to reach peak plasma concentration (C_{max}) approximately 24 hours after dosing. With once-daily dosing of INVEGA, steady-state concentrations of paliperidone are attained within 4-5 days of dosing in most subjects.

Paliperidone is the active metabolite of risperidone. The release characteristics of INVEGA result in minimal peak-trough fluctuations as compared to those observed with immediate-release risperidone (fluctuation index 38% versus 125%).

The absolute oral bioavailability of paliperidone following INVEGA administration is 28% (90% CI of 23%-33%).

Administration of paliperidone prolonged-release tablets with a standard high-fat/high-caloric meal increases C_{max} and AUC of paliperidone by up to 50-60% compared with administration in the fasting state.

Distribution

Paliperidone is rapidly distributed. The apparent volume of distribution is 487 L. The plasma protein binding of paliperidone is 74%. It binds primarily to α 1-acid glycoprotein and albumin.

Biotransformation and elimination

One week following administration of a single oral dose of 1 mg immediate-release ^{14}C -paliperidone, 59% of the dose was excreted unchanged into urine, indicating that paliperidone is not extensively metabolised by the liver. Approximately 80% of the administered radioactivity was recovered in urine and 11% in the faeces. Four metabolic pathways have been identified *in vivo*, none of which accounted for more than 6.5% of the dose: dealkylation, hydroxylation, dehydrogenation, and benzisoxazole scission. Although *in vitro* studies suggested a role for CYP2D6 and CYP3A4 in the metabolism of paliperidone, there is no evidence *in vivo* that these isozymes play a significant role in the metabolism of paliperidone. Population pharmacokinetics analyses indicated no discernible difference on the apparent clearance of paliperidone after administration of INVEGA between extensive metabolisers and poor metabolisers of CYP2D6 substrates. *In vitro* studies in human liver microsomes showed that paliperidone does not substantially inhibit the metabolism of medicines metabolised by cytochrome P450 isozymes, including CYP1A2, CYP2A6, CYP2C8/9/10, CYP2D6, CYP2E1, CYP3A4, and CYP3A5. The terminal elimination half-life of paliperidone is about 23 hours.

In vitro studies have shown that paliperidone is a P-gp substrate and a weak inhibitor of P-gp at high concentrations. No *in vivo* data are available and the clinical relevance is unknown.

Hepatic impairment

Paliperidone is not extensively metabolised in the liver. In a study in subjects with moderate hepatic impairment (Child-Pugh class B), the plasma concentrations of free paliperidone were similar to those of healthy subjects. No data are available in patients with severe hepatic impairment (Child-Pugh class C).

Renal impairment

Elimination of paliperidone decreased with decreasing renal function. Total clearance of paliperidone was reduced in subjects with impaired renal function by 32% in mild (Creatinine Clearance [CrCl] = 50 to < 80 mL/min), 64% in moderate (CrCl = 30 to < 50 mL/min), and 71% in severe (CrCl = < 30 mL/min) renal impairment. The mean terminal elimination half-life of paliperidone was 24, 40, and 51 hours in subjects with mild, moderate, and severe renal impairment, respectively, compared with 23 hours in subjects with normal renal function (CrCl ≥ 80 mL/min).

Elderly

Data from a pharmacokinetic study in elderly subjects (≥ 65 years of age, n = 26) indicated that the apparent steady-state clearance of paliperidone following INVEGA administration was 20% lower compared to that of adult subjects (18-45 years of age, n = 28). However, there was no discernable effect of age in the population pharmacokinetic analysis involving schizophrenia subjects after correction of age-related decreases in CrCl.

Adolescents

Paliperidone systemic exposure in adolescent subjects (15 years and older) was comparable to that in adults. In adolescents weighing < 51 kg, a 23% higher exposure was observed than in adolescents weighing ≥ 51 kg. Age alone did not influence the paliperidone exposure.

Race

Population pharmacokinetics analysis revealed no evidence of race-related differences in the pharmacokinetics of paliperidone following INVEGA administration.

Gender

The apparent clearance of paliperidone following INVEGA administration is approximately 19% lower in women than men. This difference is largely explained by differences in lean body mass and creatinine clearance between men and women.

Smoking status

Based on *in vitro* studies utilising human liver enzymes, paliperidone is not a substrate for CYP1A2; smoking should, therefore, not have an effect on the pharmacokinetics of paliperidone. A population pharmacokinetic analysis showed a slightly lower exposure to paliperidone in smokers compared with non-smokers. The difference is unlikely to be of clinical relevance, though.

5.3 Preclinical safety data

Repeat-dose toxicity studies of paliperidone in rat and dog showed mainly pharmacological effects, such as sedation and prolactin-mediated effects on mammary glands and genitals. Paliperidone was not teratogenic in rat and rabbit. In

rat reproduction studies using risperidone, which is extensively converted to paliperidone in rats and humans, a reduction was observed in the birth weight and survival of the offspring. Other dopamine antagonists, when administered to pregnant animals, have caused negative effects on learning and motor development in the offspring. Paliperidone was not genotoxic in a battery of tests. In oral carcinogenicity studies of risperidone in rats and mice, increases in pituitary gland adenomas (mouse), endocrine pancreas adenomas (rat), and mammary gland adenomas (both species) were seen. These tumours can be related to prolonged dopamine D2 antagonism and hyperprolactinaemia. The relevance of these tumour findings in rodents in terms of human risk is unknown.

In a 7-week juvenile toxicity study in rats administered oral doses of paliperidone up to 2.5 mg/kg/day, corresponding to an exposure approximately equal to the clinical exposure based on AUC, no effects on growth, sexual maturation and reproductive performance were observed. Paliperidone did not impair the neurobehavioural development in males at doses up to 2.5 mg/kg/day. At 2.5 mg/kg/day in females, an effect on learning and memory was observed. This effect was not observed after discontinuation of treatment. In a 40-week juvenile toxicity study in dogs with oral doses of risperidone (which is extensively converted to paliperidone) up to 5 mg/kg/day, effects on sexual maturation, long bone growth and femur mineral density were observed from 3 times the clinical exposure based on AUC.

6 PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Core

Polyethylene oxide 200K

Sodium chloride

Povidone (K29-32)

Stearic acid

Butyl hydroxytoluene (E321)

Polyethylene oxide 7000K

Ferric oxide (red) (E172)

Iron oxide (black) (E172)

Hydroxyethyl cellulose

Polyethylene glycol 3350

Cellulose acetate

Overcoat

Hypromellose

Titanium dioxide (E171)

Polyethylene glycol 400

Ferric oxide (red) (E172)

Carnauba wax

Printing ink

Iron oxide (black) (E172)

Propylene glycol

Hypromellose

6.2 Incompatibilities

Not applicable.

6.3 Shelf life

2 years

6.4 Special precautions for storage

Blisters: Do not store above 30°C. Store in the original package in order to protect from moisture.

6.5 Nature and contents of container

Blisters:

Oriented polyamide (OPA)-aluminium-polyvinyl chloride (PVC)/aluminium push-through child-resistant blister.

Pack size of 28 prolonged-release tablets.

6.6 Special precautions for disposal

No special requirements for disposal.

7 MARKETING AUTHORISATION HOLDER

Janssen-Cilag Limited
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UK

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