

# PRODUCT MONOGRAPH

## **Pr** **APO-MIRTAZAPINE**

Mirtazapine Tablets USP

15 mg, 30 mg and 45 mg

Antidepressant

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**PrAPO-MIRTAZAPINE**  
Mirtazapine Tablets USP

**PART I: HEALTH PROFESSIONAL INFORMATION**

**SUMMARY PRODUCT INFORMATION**

<b>Route of Administration</b>	<b>Dosage Form/Strength</b>	<b>All Nonmedicinal Ingredients</b>
Oral	Tablets 15 mg, 30 mg, 45 mg	croscarmellose sodium, hydroxypropyl cellulose, hydroxypropyl methylcellulose, iron oxide red (30 mg tablets), iron oxide yellow (15 mg and 30 mg tablets), lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol and titanium dioxide

**INDICATIONS AND CLINICAL USE**

**Adults**

APO-MIRTAZAPINE (mirtazapine) is indicated for the symptomatic relief of depressive illness.

**Long-term use of mirtazapine**

The efficacy of mirtazapine in maintaining a response in patients with major depressive disorder for up to 40 weeks following 8 to 12 weeks of initial open-label treatment was demonstrated in a placebo-controlled trial. Nevertheless, the physician who elects to use APO-MIRTAZAPINE for extended periods should periodically evaluate the long-term response of the individual patient to the drug.

**Geriatrics (> 65 years of age):**

Evidence from clinical trials and experience suggests that use in geriatric populations may be associated with differences in safety or effectiveness. A brief discussion can be found in the appropriate sections [see WARNINGS AND PRECAUTIONS, Neurologic, Somnolence; Special Populations, Geriatrics (> 65 years of age); DOSAGE AND ADMINISTRATION; ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions, Geriatrics].

**Pediatrics (< 18 years of age):**

APO-MIRTAZAPINE is not indicated for use in patients below the age of 18 years (see WARNINGS AND PRECAUTIONS, General, Potential Association with Behavioural and Emotional Changes, Including Self-Harm; see also ADVERSE REACTIONS/Pediatrics, DOSAGE AND ADMINISTRATION and ACTION AND CLINICAL PHARMACOLOGY Special Populations and Conditions/Pediatrics).

## CONTRAINDICATIONS

**Hypersensitivity:** APO-MIRTAZAPINE is contraindicated in patients who are known to be hypersensitive to the drug or any of its components. For a complete listing, see DOSAGE FORMS, COMPOSITION AND PACKAGING.

**Monoamine Oxidase Inhibitors:** In patients receiving agents that may affect the serotonergic neurotransmitter systems in combination with a monoamine oxidase (MAO) inhibitor, there have been reports of serious, sometimes fatal, reactions including hyperthermia, rigidity, myoclonus, autonomic instability with possible rapid fluctuations of vital signs, and mental status changes that include extreme agitation progressing to delirium and coma. These reactions have also been reported in patients who have recently discontinued (SSRI) Selective Serotonin Reuptake Inhibitor treatment and have begun treatment on a MAO inhibitor. Some cases presented with features resembling serotonin toxicity or neuroleptic malignant syndrome (see WARNINGS AND PRECAUTIONS, Neurologic, Serotonin Toxicity/Neuroleptic Malignant Syndrome). Therefore, APO-MIRTAZAPINE should not be used in combination with MAO inhibitors (including the antibiotic linezolid, and the thiazine dye methylthionium blue (methylene blue), which are less well-known examples of MAO inhibitors) or within a minimum of 2 weeks of terminating treatment with MAO inhibitors. Treatment with APO-MIRTAZAPINE should then be initiated cautiously and dosage increased gradually until optimal response is reached. MAO inhibitors should not be introduced within 2 weeks of cessation of therapy with mirtazapine.

## WARNINGS AND PRECAUTIONS

### General

#### **POTENTIAL ASSOCIATION WITH BEHAVIOURAL AND EMOTIONAL CHANGES, INCLUDING SELF-HARM**

##### **Pediatrics: Placebo-Controlled Clinical Trial Data**

- **Recent analyses of placebo-controlled clinical trial safety databases from SSRIs (Selective Serotonin Reuptake Inhibitors) and other newer anti-depressants suggest that use of these drugs in patients under the age of 18 may be associated with behavioural and emotional changes, including an increased risk of suicidal ideation and behaviour over that of placebo.**
- **The small denominators in the clinical trial database, as well as the variability in placebo rates, preclude reliable conclusions on the relative safety profiles among these drugs.**

##### **Adults and Pediatrics: Additional Data**

- **There are clinical trial and post-marketing reports with SSRIs and other newer anti-depressants, in both pediatrics and adults, of severe agitation-type adverse events coupled with self-harm or harm to others. The agitation-type events include akathisia, agitation, disinhibition, emotional lability, hostility, aggression and depersonalization. In some cases, the events occurred within several weeks of starting treatment.**

**Rigorous clinical monitoring for suicidal ideation or other indicators of potential for suicidal behaviour is advised in patients of all ages. This includes monitoring for agitation-type emotional and behavioural changes.**

### **Discontinuation Symptoms**

**Patients currently taking APO-MIRTAZAPINE (mirtazapine) should NOT discontinue treatment abruptly, due to risk of discontinuation symptoms. At the time that a medical decision is made to discontinue an SSRI or other newer anti-depressant drug, a gradual reduction in the dose, rather than an abrupt cessation, is recommended.**

### **Lactose**

Lactose is a non-medicinal ingredient in APO-MIRTAZAPINE tablets. Therefore, patients with rare hereditary problems of galactose intolerance or glucose-galactose malabsorption should not take APO-MIRTAZAPINE Tablets.

### **Agranulocytosis**

In pre-marketing clinical trials, two (one with Sjögren's Syndrome) out of 2,796 patients treated with mirtazapine tablets and one patient treated with imipramine developed agranulocytosis. In all three cases, the patients recovered after the drug with which they were being treated was stopped. In the post-marketing period with mirtazapine, very rare cases of agranulocytosis have been reported, mostly reversible, but in some cases fatal. Fatal cases have mostly concerned patients above 65 years of age, although there has been at least one such fatality in a younger patient. Patients who are to receive APO-MIRTAZAPINE should be warned about the risk of developing agranulocytosis, and advised to contact their physician if they experience any indication of infection such as fever, chills, sore throat, mucous membrane ulceration. If a patient develops a sore throat, fever, stomatitis or other signs of infection, along with a low WBC count, treatment with APO-MIRTAZAPINE Tablets should be discontinued and the patient should be closely monitored.

### **Discontinuation of Treatment with APO-MIRTAZAPINE**

When discontinuing treatment, patients should be monitored for symptoms which may be associated with discontinuation, e.g., dizziness, abnormal dreams, sensory disturbances (including paresthesia and electric shock sensations), agitation, anxiety, fatigue, confusion, headache, tremor, nausea, vomiting and sweating or other symptoms which may be of clinical significance (see ADVERSE REACTIONS). A gradual reduction in the dosage over several weeks, rather than abrupt cessation, is recommended whenever possible. If intolerable symptoms occur following a decrease in the dose or upon discontinuation of treatment, dose titration should be managed on the basis of the patient's clinical response (see ADVERSE REACTIONS and DOSAGE AND ADMINISTRATION).

The following additional precautions are listed alphabetically.

### **Carcinogenesis and Mutagenesis**

See TOXICOLOGY for animal data.

## **Cardiovascular**

**QT Prolongation / Torsade de Pointes:** Cases of QT prolongation, torsades de pointes (TdeP), ventricular tachycardia, ventricular fibrillation, cardiac arrest, and sudden death, have been reported during the post-marketing use of mirtazapine. The majority of reports occurred in association with overdose or in patients with other risk factors for QT prolongation, including concomitant use of QTc prolonging medicines (see DRUG INTERACTIONS, Drug-Drug Interactions and OVERDOSAGE). Caution should be exercised when mirtazapine is prescribed in patients with known cardiovascular disease or family history of QT prolongation, and in concomitant use with other medicinal products thought to prolong the QTc interval. Torsade de pointes may be asymptomatic or experienced by the patient as dizziness, palpitations, syncope, or seizures. If sustained, torsade de pointes can progress to ventricular fibrillation and sudden cardiac death.

The effect of mirtazapine on QTc interval was assessed in a randomised, placebo and positive controlled (moxifloxacin 400 and 800 mg) clinical trial using exposure response analysis in 54 healthy volunteers. This study revealed that both 45 mg (therapeutic) and 75 mg (supratherapeutic) doses of mirtazapine, unlike moxifloxacin, did not affect the QTc interval to a clinically significant meaningful extent.

However, because TdeP, including ventricular fibrillation and sudden death have been reported during postmarketing use of mirtazapine, it should be taken into consideration that, under certain situations, these events may occur during treatment with mirtazapine.

**Cholesterol/Triglycerides:** In U.S. short-term controlled studies, non-fasting cholesterol increases of > 20% above the upper limits of normal were observed in 15% of patients taking mirtazapine compared to 7% for placebo. In these same studies, non-fasting triglycerides increased to > 500 mg/dl in 6% of patients taking mirtazapine compared to 3% for placebo.

### **Concomitant Illness**

**Use in Patients with Concomitant Illness:** Clinical experience with mirtazapine in patients with concomitant systemic illness is limited. Accordingly, care is advisable in prescribing APO-MIRTAZAPINE for patients with diseases or conditions that affect metabolism or hemodynamic responses.

### **Cardiovascular-Related History**

Mirtazapine has not been systematically evaluated or used to any appreciable extent in patients with a recent history of myocardial infarction or other significant heart disease. Mirtazapine was associated with significant orthostatic hypotension in early clinical pharmacology trials with normal human volunteers. Orthostatic hypotension was infrequently observed in clinical trials with depressed patients. APO-MIRTAZAPINE should be used with caution in patients with known cardiovascular or cerebrovascular disease that could be exacerbated by hypotension (history of myocardial infarction, angina or ischemic stroke) and conditions that would predispose patients to hypotension (dehydration, hypovolemia, and treatment with antihypertensive medication).

### **Dependence/Tolerance**

**Physical and Psychological Dependence:** Mirtazapine has not been systematically studied in animals or humans for its potential for abuse, tolerance or physical dependence. While the clinical trials did not reveal any tendency for any drug-seeking behaviour, these observations were not systematic and it is not possible to predict on the basis of this limited experience the extent to which a CNS-active drug will be misused, diverted and/or abused once marketed. Consequently, patients should be evaluated carefully for history of drug abuse, and such patients should be observed closely for signs of mirtazapine misuse or abuse (e.g., development of tolerance, incrementation of dose, drug-seeking behaviour).

### **Endocrine and Metabolism**

**Increased Appetite/Weight Gain:** In U.S. short-term controlled studies, the use of mirtazapine was associated with increased appetite in 17% and the complaint of weight gain in 12% of patients, compared to 2% for placebo in both cases. In these same trials, weight gain of  $\geq 7\%$  occurred in 7.5% of the patients taking mirtazapine compared to 0% in patients taking placebo. The average weight gain in the U.S. long-term controlled trials was 8 lb over 28 weeks.

**Diabetes:** Care should be taken in patients with diabetes mellitus. In patients with diabetes, antidepressants may alter glycaemic control. Insulin and/or oral hypoglycaemic dosage may need to be adjusted and close monitoring is recommended.

**Hyponatremia:** Hyponatremia has been reported very rarely with the use of mirtazapine. Caution should be exercised in patients at risk, such as elderly patients or patients concomitantly treated with medications known to cause hyponatremia.

### **Genitourinary**

Although mirtazapine has very weak anticholinergic activity, care should be taken in patients with micturition disturbances like prostate hypertrophy.

### **Hematologic**

Please refer to WARNINGS AND PRECAUTIONS, General, Agranulocytosis.

### **Hepatic/Biliary/Pancreatic**

**Hepatic Impairment:** Increased plasma concentrations of mirtazapine occur in patients with moderate and severe hepatic impairment (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions). In such patients, upward dose titration should be carefully monitored (see DOSAGE AND ADMINISTRATION).

**Transaminase Elevations:** In U.S. short-term controlled studies, clinically significant ALT (SGPT) elevations (3 times the normal range) were noted in 2%, respectively, of patients treated with mirtazapine and in 0% of patients treated with placebo. Most patients did not develop signs or symptoms associated with compromised liver function. While some patients were discontinued due to ALT increases, other patients with elevations continued with enzyme levels returning to normal during ongoing treatment. Mirtazapine should be used with caution in patients with impaired hepatic function (see DOSAGE AND ADMINISTRATION).

**Jaundice:** Treatment should be discontinued if jaundice occurs.

### **Neurologic**

**Somnolence:** The use of mirtazapine tablets was associated with somnolence in 54% of patients in U.S. short-term controlled studies, compared to 18% with placebo. In these studies, somnolence resulted in discontinuation of 10% of mirtazapine-treated patients compared to 2% of placebo-treated patients. mirtazapine may cause mental or motor impairment because of this prominent sedative effect. Thus, patients should be cautioned about engaging in hazardous activities, such as driving a car or operating dangerous machines, until they are reasonably certain that mirtazapine therapy does not adversely affect their ability to engage in such activities.

### **Akathisia/Psychomotor Restlessness**

The use of antidepressants have been associated with the development of akathisia, characterized by a subjectively unpleasant or distressing restlessness and need to move, often accompanied by an inability to sit or stand still. This is most likely to occur within the first few weeks of treatment. In patients who develop these symptoms, increasing the dose may be detrimental.

**Dizziness:** In U.S. short-term controlled studies, the use of mirtazapine was associated with dizziness in 7% of patients, compared to 3% for placebo.

**Activation of Mania/Hypomania:** Mania/hypomania occurred in approximately 0.2% (3/1,299 patients) of mirtazapine-treated patients in all U.S. studies (controlled and non-controlled). Although the incidence of mania/hypomania was very low during treatment with mirtazapine, it should be used carefully in patients with a history of mania/hypomania.

**Seizures:** In pre-marketing clinical trials, only one seizure was reported in the 2,796 U.S. and non-U.S. patients treated with mirtazapine. However, no controlled studies have been carried out in patients with a history of seizures. Therefore, care should be exercised when mirtazapine is used in these patients.

**Serotonin Toxicity/Neuroleptic Malignant Syndrome:** On rare occasions serotonin toxicity or neuroleptic malignant syndrome-like events have occurred in association with treatment of mirtazapine, particularly when given in combination with other serotonergic and/or neuroleptic/antipsychotic drugs (see DRUG INTERACTIONS).

Serotonin toxicity, also known as serotonin syndrome, is a potentially life-threatening condition characterised by neuromuscular excitation, autonomic stimulation (e.g. tachycardia, flushing) and altered mental state (e.g. anxiety, agitation, hypomania). In accordance with the Hunter Criteria, serotonin toxicity diagnosis is likely when, in the presence of at least one serotonergic agent, one of the following is observed:

- Spontaneous clonus
- Inducible clonus or ocular clonus with agitation or diaphoresis
- Tremor and hyperreflexia
- Hypertonia and body temperature >38°C and ocular clonus or inducible clonus

The clinical manifestations of neuroleptic malignant syndrome often overlap with those of



serotonin toxicity, including hyperthermia, hypertonia, altered mental status, and autonomic instability. In contrast to serotonin toxicity, patients with neuroleptic malignant syndrome may present with “leadpipe” muscle rigidity as well as hyporeflexia.

Due to the risk of serotonergic toxicity or neuroleptic malignant syndrome, APO-MIRTAZAPINE should not be used in combination with MAO inhibitors (including the antibiotic linezolid and the thiazine dye methylthioninium chloride (methylene blue) which are less well-known examples of MAOIs) or serotonin-precursors (such as L-tryptophan, oxitriptan) and should be used with caution in patients receiving other serotonergic drugs (triptans, lithium, tramadol, St. John’s Wort, most tricyclic antidepressants) or neuroleptics/antipsychotics (see CONTRAINDICATIONS and DRUG INTERACTIONS).

If concomitant treatment with APO-MIRTAZAPINE and other serotonergic and/or neuroleptic/antipsychotic agents is clinically warranted, careful observation of the patient is advised, particularly during treatment initiation and dose increases (see DRUG INTERACTIONS). Serotonin toxicity and neuroleptic malignant syndrome may result in potentially life-threatening conditions. If serotonin toxicity/neuroleptic malignant syndrome is suspected, discontinuation of APO-MIRTAZAPINE should be considered.

### **Ophthalmologic**

Care should be taken in patients with acute narrow-angle glaucoma and increased intra-ocular pressure.

### **Psychiatric**

**Suicide:** Depression is associated with an increased risk of suicidal thoughts, self harm and suicide (suicide-related events). This risk persists until significant remission occurs. As with any patient receiving anti-depressants, high-risk patients should be closely supervised during initial drug therapy. As improvement may not occur during the first few weeks or more of treatment, patients should be closely monitored until such improvement occurs. It is general clinical experience that the risk of suicide may increase in the early stages of recovery. Patients with a history of suicide-related events or those exhibiting a significant degree of suicidal ideation prior to commencement of treatment are known to be at greater risk of suicidal thoughts or suicide attempts, and should receive careful monitoring during treatment.

In addition, a FDA meta-analysis of placebo-controlled clinical trials of antidepressants in adult patients with psychiatric disorders showed an increased risk of suicidal behavior with antidepressants compared to placebo in patients less than 25 years old.

Prescriptions of APO-MIRTAZAPINE should be written for the smallest amount consistent with good patient management, in order to reduce the risk of overdose (see WARNINGS AND PRECAUTIONS, General, Potential Association with Behavioural and Emotional Changes, Including Self-Harm).

### **Renal**

**Renal and Hepatic Impairment:** Increased plasma concentrations of mirtazapine occur in patients with moderate and severe renal impairment and, to a lesser extent, in patients with hepatic impairment (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations

and Conditions). In such patients, upward dose titration should be carefully monitored (see DOSAGE AND ADMINISTRATION).

### **Special Populations**

**Pregnant Women:** Safe use of mirtazapine during pregnancy has not been established. Therefore, it should not be administered to women of childbearing potential or nursing mothers unless, in the opinion of the treating physician, the expected benefits to the patient outweigh the possible hazards to the child or fetus.

### **Complications following late third trimester exposure to newer antidepressants:**

Post-marketing reports indicate that some neonates exposed to SSRIs or other newer antidepressants, such as mirtazapine, late in the third trimester have developed complications requiring prolonged hospitalization, respiratory support, and tube feeding. Such complications can arise immediately upon delivery. Reported clinical findings have included respiratory distress, cyanosis, apnea, seizures, temperature instability, feeding difficulty, vomiting, hypoglycemia, hypotonia, hypertonia, hyperreflexia, tremor, jitteriness, irritability and constant crying. The frequency of symptoms may vary with each drug. These features are consistent with either a direct toxic effect of SSRIs and other newer anti-depressants, or, possibly, a drug discontinuation syndrome. It should be noted that, in some cases, the clinical picture is consistent with serotonin toxicity (see WARNINGS AND PRECAUTIONS, Neurologic, Serotonin Toxicity/Neuroleptic Malignant Syndrome). When treating a pregnant woman with APO-MIRTAZAPINE during the third trimester, the physician should carefully consider the potential risks and benefits of treatment (see DOSAGE AND ADMINISTRATION).

**The extent of exposure in pregnancy during clinical trials:** None.

**Nursing Women:** Safe use of mirtazapine during lactation has not been established. Animal data and limited human data have detected mirtazapine in breast milk in low concentrations. A decision whether to continue/discontinue therapy with mirtazapine, or to continue/discontinue breast feeding should be made, taking into account the benefits and possible hazards to mother and infant.

**Pediatrics (< 18 years of age):** Safety and efficacy in children under 18 years of age have not been established. APO-MIRTAZAPINE is not indicated for use in patients below the age of 18 years (see WARNINGS AND PRECAUTIONS, General, Potential Association with Behavioural and Emotional Changes, Including Self-Harm; see also ADVERSE REACTIONS, Pediatrics; DOSAGE AND ADMINISTRATION and ACTION AND CLINICAL PHARMACOLOGY Special Populations and Conditions/Pediatrics).

Long-term safety data in children and adolescents concerning growth, maturation and cognitive and behavioral development are lacking.

**Geriatrics (> 65 years of age):** Pharmacokinetic studies revealed a decreased clearance in the elderly, with the lowest clearance in elderly females. Elderly patients may be more susceptible to adverse events such as sedation, dizziness or confusion. Care should be exercised in dosage and

titration to higher doses (see ACTION AND CLINICAL PHARMACOLOGY; DOSAGE AND ADMINISTRATION; WARNINGS AND PRECAUTIONS, Neurologic, Somnolence).

## ADVERSE REACTIONS

### Adverse Drug Reaction Overview

#### **Adverse Events Leading to Discontinuation of Treatment**

Sixteen percent of patients treated with mirtazapine Tablets in U.S. short-term controlled studies discontinued treatment due to an adverse event, compared to 7% of patients treated with placebo. The adverse event that accounted for more than 5% of discontinuations with mirtazapine was somnolence (10%).

**Commonly Observed Adverse Events in U.S. Short-Term Controlled Clinical Trials:** The most commonly observed adverse events related to the use of mirtazapine Tablets (5% or greater drug-related incidence for mirtazapine Tablets and at least twice that of placebo) were somnolence (54% vs. 18%), increased appetite (17% vs. 2%), weight gain (12% vs. 2%) and dizziness (7% vs. 3%).

### Clinical Trial Adverse Drug Reactions

*Because clinical trials are conducted under very specific conditions the adverse drug reaction rates observed in the clinical trials may not reflect the rates observed in practice and should not be compared to the rates in the clinical trials of another drug. Adverse drug reaction information from clinical trials is useful for identifying drug-related adverse events and for approximating rates.*

**Adverse Events Occurring at an Incidence of 1% or More Among Mirtazapine-Treated Patients:** The table that follows enumerates adverse events that occurred at an incidence of 1% or more among mirtazapine-treated patients (and greater than the incidence in placebo-treated patients) who participated in U.S. short-term placebo-controlled trials, in which patients were dosed in a range of 5 to 60 mg/day. The investigators reported adverse clinical experiences using terms of their own choice. Reported adverse events were then classified using the standard COSTART-based dictionary terminology.

The prescriber should be aware that these figures cannot be used to predict the incidence of side effects in the course of usual medical practice where patient characteristics and other factors differ from those which prevailed in the clinical trials. Similarly, the cited frequencies cannot be compared with figures obtained from other investigations involving different treatments, uses and investigators. The cited figures, however, do provide the prescribing physician with some basis for estimating the relative contribution of drug and non-drug factors to the side effect incidence rate in the population studied.

**TABLE 1: Incidence of adverse clinical experiences ( $\geq 1\%$  for mirtazapine) in U.S. short-term placebo controlled studies <sup>1,2,3</sup>**

Body System Adverse Event	Mirtazapine N = 453	Placebo N = 361
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<b>Body System Adverse Event</b>	<b>Mirtazapine N = 453</b>	<b>Placebo N = 361</b>
<b>Body as a Whole</b>		
Asthenia	34 (8%)	17 (5%)
Flu Syndrome	22 (5%)	9 (3%)
Back Pain	9 (2%)	3 (1%)
<b>Digestive System</b>		
Dry Mouth	112 (25%)	54 (15%)
Increased Appetite	76 (17%)	7 (2%)
Constipation	57 (13%)	24 (7%)
<b>Metabolic and Nutritional Disorders</b>		
Weight Gain	54 (12%)	6 (2%)
Peripheral Edema	11 (2%)	4 (1%)
Edema	6 (1%)	1 (0%)
<b>Musculoskeletal System</b>		
Myalgia	9 (2%)	3 (1%)
<b>Nervous System</b>		
Somnolence	243 (54%)	65 (18%)
Dizziness	33 (7%)	12 (3%)
Abnormal Dreams	19 (4%)	5 (1%)
Thinking Abnormal	15 (3%)	4 (1%)
Tremor	7 (2%)	2 (1%)
Confusion	9 (2%)	1 (0%)
<b>Respiratory System</b>		
Dyspnea	5 (1%)	1 (0%)
<b>Urogenital System</b>		
Urinary Frequency	8 (2%)	5 (1%)

N= Number of Patients

1 % rounded off to the nearest whole integer.

2 Events which had an incidence on placebo > mirtazapine: infection, pain, headache, nausea, diarrhea and insomnia.

3 Events which had an incidence of mirtazapine comparable to placebo: chest pain, palpitation, tachycardia, postural hypotension, dyspepsia, flatulence, libido decreased, hypertonia, nervousness, rhinitis, pharyngitis, sweating, amblyopia, tinnitus and taste perversion.

There was evidence of adaptation to some adverse events with continued therapy (e.g., increased appetite, dizziness and somnolence).

**ECG Changes:** The electrocardiograms for 338 patients who received mirtazapine and 261 patients who received placebo in the U.S. short-term controlled trials were analyzed, in which the QTc calculations using the method of Fridericia was employed. Prolongation in QTc  $\geq$  500 msec was not observed among mirtazapine-treated patients. Mean change in QTc was +1.6 msec for mirtazapine and -3.1 msec for placebo. Mirtazapine was associated with a mean increase in heart rate of 3.4 bpm, compared to 0.8 bpm for placebo. The clinical significance of these changes is unknown.

### **Less Common Clinical Trial Adverse Drug Reactions (< 1%)**

During worldwide controlled and uncontrolled clinical trials, mirtazapine was administered to 2,796 patients. The listing of events which follows includes those events which were judged by the investigator to be adverse clinical experiences. The investigators used terminology of their own choice to describe the adverse experiences. Consequently, it is not possible to provide a

meaningful estimate of the proportion of individuals experiencing adverse events without first grouping similar types of untoward events into a smaller number of standardized categories. It is important to emphasize that although the events occurred during treatment with mirtazapine, they were not necessarily drug-related. Following the adverse experiences tabulations, the incidence of clinically significant laboratory values which occurred at a rate of  $\geq 1\%$  of patients is presented.

In the tabulations that follow, adverse events as reported by the investigator were classified using a standard COSTART-based dictionary terminology. Events are further categorized by body system and listed in order of decreasing frequency according to the following definitions:

**frequent** adverse events are those occurring on one or more occasions in at least 1/100 patients, **infrequent** adverse events are those occurring in 1/100 to 1/1,000 patients, and **rare** events are those occurring in fewer than 1/1,000 patients. Only those events not already listed in Table 1 appear in this listing. Events of major clinical importance are also described in the WARNINGS AND PRECAUTIONS section.

**Body as a Whole: frequent:** malaise, abdominal pain, abdominal syndrome acute; **infrequent:** chills, fever, face edema, ulcer, photosensitivity reaction, neck rigidity, neck pain, abdomen enlarged; **rare:** cellulitis, substernal chest pain.

**Cardiovascular System: frequent:** hypertension, vasodilatation; **infrequent:** angina pectoris, myocardial infarction, bradycardia, ventricular extrasystoles, syncope, migraine, hypotension; **rare:** atrial arrhythmia, bigeminy, vascular headache, pulmonary embolus, cerebral ischemia, cardiomegaly, phlebitis, left heart failure.

**Digestive System: frequent:** vomiting, anorexia; **infrequent:** eructation, glossitis, cholecystitis, nausea and vomiting, gum hemorrhage, stomatitis, colitis, liver function tests abnormal; **rare:** tongue discolouration, ulcerative stomatitis, salivary gland enlargement, increased salivation, intestinal obstruction, pancreatitis, aphthous stomatitis, cirrhosis of liver, gastritis, gastroenteritis, oral moniliasis, tongue edema.

**Endocrine System: rare:** goiter, hypothyroidism.

**Hemic and Lymphatic Systems: rare:** lymphadenopathy, leukopenia, petechia, anemia, thrombocytopenia, lymphocytosis, pancytopenia.

**Metabolic and Nutritional Disorders: frequent:** thirst; **infrequent:** dehydration, weight loss, **rare:** gout, SGOT increased, healing abnormal, acid phosphatase increased, SGPT increased, diabetes mellitus.

**Musculoskeletal System: frequent:** myasthenia, arthralgia; **infrequent:** arthritis, tenosynovitis; **rare:** pathologic fracture, osteoporosis fracture, bone pain, myositis, tendon rupture, arthrosis, bursitis.

**Nervous System: frequent:** hypoesthesia, apathy, depression, hypokinesia, vertigo, twitching, agitation, anxiety, amnesia, hyperkinesia, paresthesia; **infrequent:** aggression, ataxia, delirium,

delusions, depersonalization, dyskinesia, extrapyramidal syndrome, libido increased, coordination abnormal, dysarthria, hallucinations, manic reaction, neurosis, dystonia, hostility, reflexes increased, emotional lability, euphoria, paranoid reaction; **rare:** aphasia, nystagmus, akathisia, stupor, dementia, diplopia, drug dependence, paralysis, grand mal convulsion, hypotonia, myoclonus, psychotic depression, withdrawal syndrome.

**Respiratory Systems: frequent:** cough increased, sinusitis; **infrequent:** epistaxis, bronchitis, asthma, pneumonia; **rare:** asphyxia, laryngitis, pneumothorax, hiccup.

**Skin and Appendages: frequent:** pruritus, rash; **infrequent:** acne, exfoliative dermatitis, dry skin, herpes simplex, alopecia; **rare:** urticaria, herpes zoster, skin hypertrophy, seborrhea, skin ulcer.

**Special Senses: infrequent:** eye pain, abnormality of accommodation, conjunctivitis, deafness, keratoconjunctivitis, lacrimation disorder, glaucoma, hyperacusis, ear pain; **rare:** blepharitis, partial transitory deafness, otitis media, taste loss, parosmia.

**Urogenital System: frequent:** urinary tract infection; **infrequent:** kidney calculus, cystitis, dysuria, urinary incontinence, urinary retention, vaginitis, hematuria, breast pain, amenorrhea, dysmenorrhea, leukorrhea, impotence, **rare:** polyuria, urethritis, metrorrhagia, menorrhagia, abnormal ejaculation, breast engorgement, breast enlargement, urinary urgency.

### Pediatrics

The following adverse events were observed commonly in clinical trials in children: significant weight gain ( $\geq 7\%$ ) was observed in 48.8 % of the mirtazapine treated subjects compared to 5.7 % in the placebo arm; urticaria (11.8 % vs. 6.8 %) and hypertriglyceridaemia (2.9 % vs. 0 %) were also commonly observed. (See also ACTION AND CLINICAL PHARMACOLOGY Special Populations and Conditions/Pediatrics).

### Abnormal Hematologic and Clinical Chemistry Findings

**Abnormal Laboratory Values:** Elevated cholesterol, serum glucose and triglycerides were the most common blood chemistry parameters observed in U.S. studies.

The plasma samples were drawn from non-fasting patients, and these parameters are affected by diet. Patients taking mirtazapine had increased appetite and weight gain, and are likely to have had increased food intake. Increased food intake may account for the increased triglyceride and cholesterol values. Moreover, LDL:HDL ratio data from a limited number of patients suggest that fat metabolism does not change with mirtazapine treatment, further suggesting that the increase in triglyceride and cholesterol values reflected increased dietary intake.

Mild changes in liver function are shown by increases in liver enzymes. However, changes are temporary, mild, and are not expected to negatively influence liver function. Premature terminations due to liver enzyme abnormalities were, respectively, mirtazapine, 1.7% and placebo, 1.1%.

The incidence of neutropenias in all clinical studies for mirtazapine was 1.5%. Most of the observed cases of neutropenia were mild isolated and nonprogressive (see WARNINGS AND PRECAUTIONS).

### **Post-Market Adverse Drug Reactions**

#### **Adverse Events Observed During Post-Marketing Evaluation of mirtazapine**

Adverse events reported after market introduction, which were temporally (but not necessarily causally) related to mirtazapine therapy and which were not reported in clinical trials.

#### **Adverse events are listed under the appropriate System Organ Class**

**Blood and lymphatic system disorders:** bone marrow depression (granulocytopenia, agranulocytopenia, aplastic anemia) (see also WARNINGS AND PRECAUTIONS, Agranulocytosis), eosinophilia.

**Endocrine disorders:** hyperprolactinemia (and related symptoms e.g. galactorrhea and gynecomastia)

**Metabolism and nutrition disorders:** hyponatremia.

**Psychiatric disorders:** insomnia, nightmares, psychomotor restlessness, suicidal ideation, suicidal behaviours, somnambulism.

**Nervous system disorders:** headache, oral paresthesia, serotonin toxicity, restless legs, syncope, lethargy, sedation.

**Investigations:** electrocardiogram QT prolonged, increased creatine kinase.

**Cardiac disorders:** cardiac arrest, long QT, torsade de pointes (see WARNINGS AND PRECAUTIONS, QT Prolongation/Torsade de Pointes), sudden death, ventricular arrhythmia (torsade de pointes), ventricular fibrillation, ventricular tachycardia.

**Vascular disorders:** orthostatic hypotension

**Gastrointestinal disorders:** diarrhea, mouth edema, oral hypoaesthesia.

**Skin and subcutaneous tissue disorders:** Stevens-Johnson syndrome, dermatitis bullous, erythema multiforme, toxic epidermal necrolysis.

**Musculoskeletal and connective tissue disorders:** rhabdomyolysis.

Reproductive system and breast disorders: priapism

**General disorders and administration site conditions:** Generalized and local edema, fatigue.

### **Adverse Reactions following Discontinuation of Treatment (or Dose Reduction)**

There have been reports of adverse reactions upon the discontinuation of mirtazapine (particularly when abrupt), including but not limited to the following: dizziness, abnormal dreams, sensory disturbances (including paresthesia and electric shock sensations), agitation, anxiety, fatigue, confusion, headache, tremor, nausea, vomiting and sweating or other symptoms which may be of clinical significance (see WARNINGS AND PRECAUTIONS and DOSAGE AND ADMINISTRATION).

Patients should be monitored for these or any other symptoms. A gradual reduction in the dosage over several weeks, rather than abrupt cessation, is recommended whenever possible. If intolerable symptoms occur following a decrease in dose or upon discontinuation of treatment, dose titration should be managed on the basis of the patient's clinical response. These events are generally self-limiting. Symptoms associated with discontinuation have been reported for other anti-depressants with serotonergic effects (see WARNINGS AND PRECAUTIONS and DOSAGE AND ADMINISTRATION).

## **DRUG INTERACTIONS**

### **Serious Drug Interactions**

- **Monoamine Oxidase Inhibitors: See CONTRAINDICATIONS**

### **Overview**

As with other drugs, the potential for interaction by a variety of mechanisms (e.g., pharmacodynamic, pharmacokinetic inhibition or enhancement, etc.) is a possibility (see CLINICAL PHARMACOLOGY).

The metabolism and pharmacokinetics of mirtazapine may be affected by the induction or inhibition of drug-metabolizing enzymes.

Mirtazapine is extensively metabolized by CYP2D6, CYP3A4, and to a lesser extent by CYP1A2.

### **Drug-Drug Interactions**

**Monoamine Oxidase Inhibitors:** Combined use of mirtazapine and monoamine oxidase inhibitors (including the antibiotic linezolid and the thiazine dye methylthionium chloride (methylene blue) which are less well-known examples of MAOIs) is contraindicated due to the potential for serious reactions with features resembling serotonin toxicity or neuroleptic malignant syndrome (see CONTRAINDICATIONS and WARNINGS AND PRECAUTIONS, Neurologic, Serotonin Toxicity/Neuroleptic Malignant Syndrome).

**Drugs Known to Prolong the QT Interval:** The risk of QT prolongation and/or ventricular arrhythmias (e.g. Torsades de Pointes) may be increased with concomitant use of medicines



which prolong the QTc interval (e.g. some antipsychotics and antibiotics) and in case of mirtazapine overdose.

**Diazepam:** The impairment of motor skills produced by mirtazapine has been shown to be additive with those caused by diazepam. Accordingly, patients should be advised to avoid diazepam and other similar drugs while taking APO-MIRTAZAPINE

### CYP Enzyme Inducers

#### CYP3A4 Inducers (these studies used both drugs at steady state):

- **Phenytoin:** In healthy male patients (n=18), phenytoin (200 mg daily) increased mirtazapine (30 mg daily) clearance, resulting in about a twofold decrease in plasma mirtazapine concentrations. Mirtazapine did not significantly affect the pharmacokinetics of phenytoin. During combined use of mirtazapine and phenytoin, 3 out of 19 patients experienced fatigue and 1 out of 19 patients developed rash (and none had experienced either fatigue or rash with mirtazapine alone or phenytoin alone). The rash was severe enough to necessitate withdrawal from the study.
- **Carbamazepine:** In healthy male patients (n=24), carbamazepine (400 mg b.i.d.) increased mirtazapine (15 mg b.i.d.) clearance, resulting in about a twofold decrease in plasma mirtazapine concentrations.

When phenytoin, carbamazepine or another inducer of hepatic metabolism (such as rifampicin) is added to mirtazapine therapy, the mirtazapine dose may have to be increased. If treatment with such a medicinal product is discontinued, it may be necessary to reduce the mirtazapine dose.

### CYP Enzyme Inhibitors

**Cimetidine:** In healthy male patients (n=12), when cimetidine (800 mg b.i.d.) at steady state was co-administered with mirtazapine (30 mg daily) at steady state, the Area Under the Curve (AUC) of mirtazapine increased by about 60%. Mirtazapine did not significantly change the pharmacokinetics of cimetidine. During combined use, side effects included somnolence [10 of 12 patients (including 1 of moderate severity) vs. 7 of 12 with mirtazapine alone and none with cimetidine alone], arrhythmia (2 of 12 patients vs. none with mirtazapine or cimetidine alone). The mirtazapine dose may have to be decreased when concomitant treatment with cimetidine is started, or increased when cimetidine treatment is discontinued.

**Ketoconazole:** In healthy, male, Caucasian patients (n=24), co-administration of the potent CYP3A4 inhibitor ketoconazole (200 mg b.i.d. for 6.5 days) increased the peak plasma levels and the AUC of a single 30 mg dose mirtazapine by approximately 40% and 50% respectively. During combined use, 2 severe adverse events have been reported: One patient experienced circulatory collapse and another patient experienced syncope. Both patients have lost consciousness for a brief period. Caution should be exercised when co-administering mirtazapine with potent CYP3A4 inhibitors, HIV protease inhibitors, azole antifungals, erythromycin or nefazodone.

**Paroxetine:** In an *in vivo* interaction study in healthy, CYP2D6 extensive metabolizer patients (n=24), mirtazapine (30 mg/day), at steady state, did not significantly change the pharmacokinetics of steady state paroxetine (40 mg/day), a CYP2D6 inhibitor. However, plasma

concentrations of mirtazapine and its demethyl metabolite were slightly higher (about 18 and 25%, respectively) during combined administration with paroxetine. This difference is considered to be without clinical relevance. During combined use, side effects included exanthema (1 of 24 patients) that required withdrawal of the patient. Increases in AST and ALT were also reported, with a greater increase in men due to several outliers (including a patient that was withdrawn due to high AST (about 4 fold higher than the upper normal limit) and ALT (about 2 fold higher than the upper normal limit) levels; this patient also showed elevated WBC, neutrophils, decreased lymphocytes and basophils). AST/ALT levels returned to normal following the end of the treatment. Caution is advised for the co-administration of paroxetine with mirtazapine.

### **Other Drug-Drug Interactions**

**Amitriptyline:** In healthy, CYP2D6 extensive metabolizer patients (n=32), amitriptyline (75 mg daily), at steady state, did not change the pharmacokinetics of steady state mirtazapine (30 mg daily) considerably and mirtazapine also did not change the pharmacokinetics of amitriptyline considerably. During combined use the following adverse reactions have been reported at considerably higher frequencies than with either drug alone: postural hypotension, impaired concentration (about 5 fold higher incidence), nausea (over 4 fold higher incidence) and dizziness (about 2 fold higher incidence). A CYP2D6 slow metabolizer patient experienced a serious adverse event following combined use of amitriptyline and mirtazapine. The subject complained of abdominal discomfort accompanied by dizziness and nausea and then leading to loss of consciousness for about 30 s. Apart from slight tremor (resembling myoclonic contractions) there were no other abnormalities. Caution is advised for the co-administration of amitriptyline with mirtazapine.

**Warfarin:** In healthy male subjects (n=16) mirtazapine (30 mg daily), at steady state, caused a small (0.2) but statistically significant increase in the International Normalised Ratio (INR) in subjects treated with warfarin to achieve subtherapeutic levels of prothrombin activity (1.5 to 2.0 INR) at steady state. As at a higher dose of mirtazapine, a more pronounced effect can not be excluded it is advisable to monitor the INR in case of concomitant treatment of warfarin with mirtazapine.

**Lithium:** No relevant clinical effects or significant changes in pharmacokinetics have been observed in healthy male subjects on concurrent treatment with subtherapeutic levels of lithium (600 mg/day for 10 days) at steady state and a single 30 mg dose of mirtazapine. The serum levels of lithium were approximately 0.3 mmol/L 10 hrs after dosing. The effects of higher doses of lithium on the pharmacokinetics of mirtazapine are unknown.

**Risperidone:** In an *in vivo* non-randomized, interaction study subjects (n=6) in need of treatment with an antipsychotic and antidepressant drug, the results of the effect of mirtazapine (30 mg daily) at steady state on the pharmacokinetics of risperidone (up to 3 mg b.i.d.) at steady state is inconclusive, due to high inter-patient variability and low number of patients. The study design does not permit conclusions to be made on the safety on the combined use of mirtazapine and risperidone. However, a case report of a male patient receiving combined treatment with mirtazapine (60 mg daily) and risperidone (3 mg daily) documents that, 6 weeks after initiation

of this combination therapy, the patient developed pulmonary embolism and rhabdomyolysis. Caution is advised for the co-administration of risperidone with mirtazapine.

### **Serotonergic Drugs:**

Based on the mechanism of action of mirtazapine and the potential for serotonin toxicity, caution is advised when APO-MIRTAZAPINE is coadministered with other drugs or agents that may affect the serotonergic neurotransmitter systems, such as tryptophan, triptans, serotonin reuptake inhibitors, lithium, tramadol, linezolid, methylene blue or St. John's Wort (see CONTRAINDICATIONS and WARNINGS AND PRECAUTIONS, Neurologic, Serotonin Toxicity/Neuroleptic Malignant Syndrome).

**Drugs Bound to Plasma Protein:** Because mirtazapine is bound to plasma proteins (85%), care should be exercised when APO-MIRTAZAPINE is co-administered to a patient who may be receiving another drug which is highly protein-bound.

### **Drug-Herb Interactions**

**St. John's Wort:** Pharmacodynamic interactions between APO-MIRTAZAPINE and the herbal remedy St. John's Wort may occur and may result in an increase in undesirable effects. Dose adjustment of APO-MIRTAZAPINE should be considered if clinically indicated.

### **Drug-Lifestyle Interactions**

**Alcohol:** The impairment of mental and motor skills produced by mirtazapine have been shown to be additive with those produced by alcohol. Accordingly, patients should be advised to avoid alcohol while taking APO-MIRTAZAPINE.

## **DOSAGE AND ADMINISTRATION**

**APO-MIRTAZAPINE (mirtazapine) is not indicated for use in children under 18 years of age (see WARNINGS AND PRECAUTIONS, POTENTIAL ASSOCIATION WITH BEHAVIOURAL AND EMOTIONAL CHANGES, INCLUDING SELF-HARM).**

### **Dosing Considerations**

#### **TREATMENT OF PREGNANT WOMEN DURING THE THIRD TRIMESTER:**

Post-marketing reports indicate that some neonates exposed to SSRIs or other newer antidepressants, such as mirtazapine, late in the third trimester have developed complications requiring prolonged hospitalization, respiratory support and tube feeding (see WARNINGS AND PRECAUTIONS). When treating pregnant women with APO-MIRTAZAPINE during the third trimester, the physician should carefully consider the potential risks and benefits of treatment. The physician may consider tapering APO-MIRTAZAPINE in the third trimester.

#### **Children:**

**See WARNINGS AND PRECAUTIONS, POTENTIAL ASSOCIATION WITH BEHAVIOURAL AND EMOTIONAL CHANGES, INCLUDING SELF-HARM.**

**ELDERLY AND PATIENTS WITH MODERATE TO SEVERE RENAL OR HEPATIC IMPAIRMENT:** In elderly patients, and patients with moderate to severe renal or hepatic

impairment, limited pharmacokinetic data (see ACTION AND CLINICAL PHARMACOLOGY) demonstrates increased serum concentration and/or reduced clearance of mirtazapine. APO-MIRTAZAPINE should thus be dosed with care in these populations (see ACTION AND CLINICAL PHARMACOLOGY, Pharmacokinetics).

### **Recommended Dose and Dosage Adjustment**

#### **INITIAL TREATMENT**

##### **ADULTS:**

APO-MIRTAZAPINE Tablets should be administered as a single dose, preferably in the evening prior to sleep. The recommended initial dose is 15 mg daily. In clinical trials, patients generally received doses of mirtazapine in the range of 15 to 45 mg/day.

While a relationship between dose and anti-depressant response for APO-MIRTAZAPINE has not been established, patients not responding to the initial 15 mg dose may benefit from dose increases up to a maximum of 45 mg/day (see ACTION AND CLINICAL PHARMACOLOGY, Clinical Trials Showing Efficacy). Mirtazapine has an elimination half-life of approximately 20 to 40 hours, therefore, dose changes should occur in intervals of not less than one week. Dosage adjustments may be made according to the tolerance and based on the patient's response.

#### **LONGER-TERM TREATMENT**

It is generally agreed that acute episodes of depression require several months or longer of sustained therapy beyond response to the acute episode. Systematic evaluation of mirtazapine has demonstrated that its efficacy in major depressive disorder is maintained for periods of up to 40 weeks following 8 to 12 weeks of initial treatment at a dose 15 to 45 mg/day (see ACTION AND CLINICAL PHARMACOLOGY). Based on these limited data, it is unknown whether or not the dose of APO-MIRTAZAPINE needed for continuation treatment is identical to the dose needed to achieve an initial response. Patients should be periodically reassessed to determine the need for continuation treatment and the appropriate dose for such treatment.

#### **DISCONTINUATION OF APO-MIRTAZAPINE TREATMENT:**

Symptoms associated with the discontinuation or dose reduction of mirtazapine have been reported. Patients should be monitored for these and other symptoms when discontinuing treatment or during dosage reduction (see WARNINGS AND PRECAUTIONS and ADVERSE REACTIONS).

A gradual reduction in the dose over several weeks, rather than abrupt cessation, is recommended whenever is possible. If intolerable symptoms occur following a decrease in the dose or upon discontinuation of treatment, dose titration should be managed on the basis of the patient's clinical response (see WARNINGS AND PRECAUTIONS and ADVERSE REACTIONS).

#### **Missed Dose**

Do not take a double dose to make up for forgotten doses.

If a patient forgets to take the evening dose, advise the patient not to take the missed dose the next morning. Continue treatment in the evening (prior to sleep) with the normal dose.

### **Administration**

#### **Administration of APO-MIRTAZAPINE Tablets**

Patients should be instructed to take the tablets at the same time each day, preferably as a single evening dose (prior to sleep). The tablets should be swallowed with water, without chewing (see **PART III – CONSUMER INFORMATION**).

### **OVERDOSAGE**

**Human Experience:** In clinical trials, the only drug overdose death reported while taking mirtazapine tablets was in combination with amitriptyline and chlorprohixene in a non-U.S. clinical study. Based on plasma levels, the mirtazapine dose taken was 30 to 45 mg, while plasma levels of amitriptyline and chlorprohixene were found to be at toxic levels. In other pre-marketing overdose cases with mirtazapine tablets, the following signs and symptoms were reported: disorientation, drowsiness, impaired memory and tachycardia. There were no reports of ECG abnormalities, coma or convulsions following overdose with mirtazapine tablets alone.

In post-marketing experience with more than 35 million patients exposed to mirtazapine (based on average treatment courses of 30 mg/day during 3 months), fatal cases of overdose with mirtazapine alone have been reported. In many cases details regarding the precise dose are lacking. Fatal acute overdoses with mirtazapine alone are documented at doses as low as approximately 440 mg, which is estimated from the post-mortem plasma levels, assuming linear pharmacokinetics. However, survival has also been reported with a single mirtazapine overdose as high as 1,350 mg.

Present experience concerning overdose with mirtazapine alone indicates that symptoms are usually mild. Depression of the central nervous system with disorientation and prolonged sedation has been reported, together with tachycardia and mild hyper- or hypotension. However, there is a possibility of more serious outcomes (including fatalities) at dosages much higher than the therapeutic dose, especially with mixed overdoses. In these cases QT prolongation and Torsade de Pointes have also been reported.

**Overdose Management:** Treatment should consist of those general measures employed in the management of overdose with any anti-depressant.

Ensure an adequate airway, oxygenation and ventilation. Monitor vital signs and cardiac rhythm (ECG monitoring should be undertaken). General supportive and symptomatic measures are also recommended. Induction of emesis is not recommended. Activated charcoal or gastric lavage may be appropriate.

There is no experience with the use of forced diuresis, dialysis, hemoperfusion or exchange transfusion in the treatment of mirtazapine overdosage. No specific antidotes for mirtazapine are known.

In managing overdose, consider the possibility of multiple drug involvement. The physician should consider contacting a poison control centre for additional information on the treatment of any overdose.

For management of a suspected drug overdose, contact your regional Poison Control Centre.
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## **ACTION AND CLINICAL PHARMACOLOGY**

### **Mechanism of Action**

The mechanism of action of mirtazapine tablets, as with other drugs effective in the treatment of major depressive disorder, is unknown.

Evidence gathered in preclinical studies suggests that mirtazapine enhances central noradrenergic and serotonergic activity. These studies have shown that mirtazapine acts as an antagonist at central presynaptic  $\alpha_2$  adrenergic inhibitory autoreceptors and heteroreceptors, an action that is postulated to result in an increase in central noradrenergic and serotonergic activity. The clinical **relevance of this finding is unknown.**

### **Pharmacodynamics**

Mirtazapine acts as an antagonist at central presynaptic  $\alpha_2$  adrenergic inhibitory autoreceptors and heteroreceptors, which results in an increase in central noradrenergic and serotonergic activity. The clinical relevance of this finding is unknown, however, this action may explain its anti-depressant activity.

Mirtazapine is a potent antagonist of 5-HT<sub>2</sub> and 5-HT<sub>3</sub> receptors. The clinical relevance of this finding is unclear, however, the 5-HT<sub>2</sub> and 5-HT<sub>3</sub> antagonism by mirtazapine may account for its low rate of nausea, insomnia and anxiety as observed in clinical trials. Mirtazapine has no significant direct effect on 5-HT<sub>1A</sub> and 5-HT<sub>1B</sub> receptors.

Both enantiomers of mirtazapine appear to contribute to its pharmacological activity. The (+) enantiomer blocks 5-HT<sub>2</sub> receptors as well as  $\alpha_2$  receptors, and the (-) enantiomer blocks 5-HT<sub>3</sub> receptors. The clinical relevance of this finding is unclear, but this may explain its anti-depressant activity and side-effects profile.

Mirtazapine is a potent histamine (H<sub>1</sub>) receptor antagonist, which may contribute to its sedative effect and possibly to weight gain due to increased appetite.

Mirtazapine is a moderate peripheral  $\alpha_1$  adrenergic antagonist, a property which may explain the occasional orthostatic hypotension reported in association with its use.

Mirtazapine is a moderate antagonist at muscarinic receptors, a property that may explain the occasional occurrence of anticholinergic side effects associated with its use as shown in clinical trials.

### **Pharmacokinetics**

Mirtazapine is well absorbed following oral administration and its absolute bioavailability is approximately 50% after either single or multiple doses. Peak plasma concentrations are reached within about 2 hours following an oral dose. The time to peak plasma concentration is independent of dose. The presence of food in the stomach somewhat slows the rate but not the extent of absorption, and thus does not require a dosage adjustment.

Plasma levels are linear over a dose range of 30 to 80 mg. Steady-state plasma levels are attained within about 5 days. The half-life of elimination of mirtazapine after oral administration is approximately 20 to 40 hours.

**Metabolism:** Mirtazapine is extensively metabolized and quantitatively eliminated via urine (75%) and feces (15%); approximately 90% of this elimination occurs within the first 72 to 96 hours. Major pathways of biotransformation are demethylation and oxidation followed by conjugation. *In vitro* data from human liver microsomes indicate that cytochrome 2D6 and 1A2 are involved in the formation of the 8-hydroxy metabolite of mirtazapine, whereas cytochrome 3A is considered to be responsible for the formation of the N-demethyl and N-oxide metabolite. The demethyl metabolite is pharmacologically active and appears to have a similar pharmacokinetic profile as that of the parent compound.

The (-) enantiomer has an elimination half-life that is approximately twice as long, and achieves plasma levels that are three times as high as that of the (+)enantiomer.

**Protein Binding:** Mirtazapine is approximately 85% bound to plasma proteins over a concentration range of 10 to 1,000 ng/mL. Binding appears to be both non-specific and reversible. The binding affinity of mirtazapine to human liver proteins is 2.8 times greater than to human plasma proteins. As with all drugs that are protein-bound, care should be exercised when co-administering medications that may interact with APO-MIRTAZAPINE at protein-binding sites (see WARNINGS AND PRECAUTIONS).

**TABLE 2: Effect of age and gender on plasma half-life of mirtazapine**

Group	T <sub>½</sub> (MEAN ± SD)*	
	Single Dose	Multiple Dose
Adult male N = 9	21.7 ± 4.2	22.1 ± 3.7
Adult female N = 9	37.7 ± 13.3	35.4 ± 13.7
Elderly# male N = 8	32.2 ± 15.4	31.1 ± 15.1
Elderly# female N = 8	40.6 ± 12.8	39.0 ± 10.8

\*Expressed in hours.

# The “elderly” group consisted of subjects 55 and older (55 to 75; mean age 65)

**Special Populations and Conditions**

**Pediatrics:** Mirtazapine is not indicated for use in patients below the age of 18 years. Two randomized, double-blind, placebo-controlled trials in children aged between 7 and 18 years with major depressive disorder (n=259) failed to demonstrate significant differences between

mirtazapine and placebo on the primary and all secondary endpoints. Significant weight gain ( $\geq 7\%$ ) was observed in 48.8% of the mirtazapine treated subjects compared to 5.7 % in the placebo arm. Urticaria (11.8 % vs. 6.8 %) and hypertriglyceridaemia (2.9 % vs. 0 %) were also commonly observed. (see WARNINGS AND PRECAUTIONS, General, **Potential Association with Behavioural and Emotional Changes, Including Self-Harm**; and **DOSAGE AND ADMINISTRATION**).

#### **Geriatrics:**

Following administration of mirtazapine 20 mg/day for 7 days, oral clearance was reduced in older subjects (mean age 65; range 55 to 75) compared to younger subjects (see Table 2). The difference was greatest in males, with a 40% lower clearance for mirtazapine in the older vs. younger group, while clearance is lowest overall in elderly females. Caution is indicated in administering APO-MIRTAZAPINE Tablets in the elderly (see WARNINGS AND PRECAUTIONS and DOSAGE AND ADMINISTRATION).

#### **Gender:**

**Age and Sex:** In the same study above (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions, Geriatrics) females of all ages (range 25 to 74) exhibited significantly longer elimination half-lives than males (mean half-life 37 hours for females vs. 26 hours for males) (see Table 2). Although these differences result on average in higher AUC for females compared to males, there is considerable overlap in individual AUCs between groups. Because of substantial individual variation of AUC and half-life, no specific dosage recommendations based on sex are indicated (see DOSAGE AND ADMINISTRATION).

#### **Hepatic Insufficiency:**

**Liver Disease:** In a single-dose study conducted with mirtazapine 15 mg, the elimination half-life of mirtazapine was increased 40% in mild to moderately hepatically impaired subjects as compared to patients with normal hepatic function; this effect on elimination resulted in a 57% increase in AUC and a 33% decrease in clearance.

#### **Renal Insufficiency:**

**Renal Disease:** In a single-dose study conducted with mirtazapine 15 mg, subjects with moderate and severe renal impairment showed a significant decrease in the clearance of mirtazapine and a consequent increase in the AUC (54% and 215% for moderate and severe renal impairment, respectively). Subjects with severe renal impairment had significantly higher peak plasma levels of mirtazapine (about double that of subjects without renal impairment). These results suggest that caution must be exercised in administering APO-MIRTAZAPINE to patients who may have compromised renal function.

### **STORAGE AND STABILITY**

Store at room temperature (15°C to 30°C).



## SPECIAL HANDLING INSTRUCTIONS

The tablets should be swallowed with water, without chewing. The patient should be instructed not to chew the tablet.

## DOSAGE FORMS, COMPOSITION AND PACKAGING

APO-MIRTAZAPINE Tablets are supplied as:

APO-MIRTAZAPINE (mirtazapine) 15 mg Tablets: Pale yellow, oval shaped, scored, film coated tablets, imprinted “APO” on one side and “MI” bisect “15” on the other side. Available in bottles of 30 tablets.

APO-MIRTAZAPINE (mirtazapine) 30 mg Tablets: Light pink, oval shaped, scored, film coated tablets, imprinted “APO” on one side and “MI” bisect “30” on the other side. Available in bottles of 100 tablets.

APO-MIRTAZAPINE (mirtazapine) 45 mg Tablets: White to off-white, oval shaped, unscored, film coated tablets, imprinted “APO” on one side and “MI-45” on the other side. Available in bottles of 30 and 100 tablets.

**Composition:** Each film-coated tablet contains 15 mg, 30 mg or 45 mg of mirtazapine. each tablet also contains croscarmellose sodium, hydroxypropyl cellulose, hydroxypropyl methylcellulose, iron oxide red (30 mg tablets), iron oxide yellow (15 mg and 30 mg tablets), lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol and titanium dioxide.

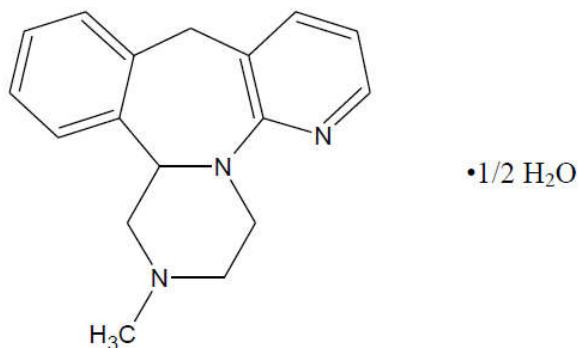
## PART II: SCIENTIFIC INFORMATION

### PHARMACEUTICAL INFORMATION

#### Drug Substance

Proper Name:	Mirtazapine
Chemical name:	Pyrazino[2,1- <i>a</i> ]pyrido[2,3- <i>c</i> ][2]benzazepine, 1,2,3,4,10,14b-hexahydro-2-methyl-, hemihydrate  1,2,3,4,10,14b-Hexahydro-2- methylpyrazino[2,1- <i>a</i> ]pyrido[2,3- <i>c</i> ]benzazepine, hemihydrate
Molecular formula and molecular mass:	C <sub>17</sub> H <sub>19</sub> N <sub>3</sub> •1/2 H <sub>2</sub> O, 274.36 g/mol

Structural formula:



Physicochemical properties:

Mirtazapine is a white to yellowish white crystalline powder, which is practically insoluble in water, pK<sub>a</sub> of 7.1, pH of 7.54 (1% solution in water), melting point of 114 – 116°C (crystals from petroleum ether) and UV maximum absorption at 294 nm

## CLINICAL TRIALS

### Comparative Bioavailability Studies

A randomized single dose crossover comparative bioavailability study, conducted under fasting conditions, was performed on healthy male and female volunteers. The results obtained from twenty-six (26) adult male and female volunteers (age range = 18 to 45 years) who completed the study are summarized in the following table. The rate and extent of absorption of mirtazapine was measured and compared following a single oral dose of 30 mg tablets of APO-MIRTAZAPINE (mirtazapine) (Apotex Inc.) and REMERON<sup>®</sup>, 30 mg tablets (mirtazapine) (Organon Canada Ltd.).

Summary Table of the Comparative Bioavailability Data				
Mirtazapine				
(A Single 30 mg Dose: 1 x 30 mg)				
From Measured Data				
Geometric Mean				
Arithmetic Mean (CV%)				
Parameter	Test APO-MIRTAZAPINE	Reference Remeron <sup>®</sup> †	Ratio of Geometric Means (%)**	90% Confidence Interval (%)**
AUC <sub>0-72</sub> (pg•h/mL)	747362.49 789685.03 (34)	754494.15 788647.80 (29)	99.05	94.13 – 104.23
AUC <sub>t</sub> (pg•h/mL)	814724.59 870303.70 (38)	826778.40 873896.19 (33)	98.54	93.4 – 103.97
C <sub>max</sub> (pg/mL)	77951.51 82777.31 (34)	75937.43 79901.50 (32)	102.65	94.27 – 111.78
T <sub>max</sub> * (h)	1.65 (46)	1.87 (47)		
T <sub>1/2</sub> * (h)	23.02 (29)	23.68 (31)		
*Expressed as arithmetic means (CV%) only.				
**Based on the least square means.				
†Remeron <sup>®</sup> (manufactured by Organon Canada Ltd.) was purchased in Canada.				

### **Clinical Trials Showing Efficacy**

The efficacy of mirtazapine Tablets in the treatment of depression was demonstrated in four U.S. placebo-controlled trials (6 week duration) in adult outpatients meeting DSM III criteria for major depression. Patients were titrated with mirtazapine starting at a dose of 5 mg/day up to a dose of 35 mg/day (by the beginning of Week 3). Outcome measures included the Hamilton Depression Rating Scale (21-item), and the Montgomery and Asberg Depression Rating Scale. The mean mirtazapine dose for patients completing the four studies ranged from 21 to 32 mg/day. Additional supportive studies used higher doses up to 50 mg/day. In the U.S. short-term flexible-dose controlled trials (mirtazapine Tablets, n=323), 70% and 54% of the patients received final doses  $\geq 20$  mg and  $\geq 25$  mg, respectively.

In a longer-term study, patients meeting DSM-IV criteria for major depressive disorder who had

responded during an initial 8 to 12 weeks of acute treatment on mirtazapine Tablets were randomized to continuation of mirtazapine Tablets or placebo for up to 40 weeks of observation for relapse. Response during the open phase was defined as having achieved a HAMD-17 total score of  $\leq 8$  and a CGI-Improvement score of 1 or 2 at two consecutive visits, beginning with Week 6 of the 8 to 12 weeks in the open-label phase of the study. Relapse during the double-blind phase was determined by the individual investigators. Patients receiving continued mirtazapine treatment experienced significantly lower relapse rates over the subsequent 40 weeks compared to those receiving placebo. This pattern was demonstrated in both male and female patients.

## DETAILED PHARMACOLOGY

Mirtazapine and its enantiomers have been studied for their pharmacological effects in behavioural models for depression (Table 3) in mice and rats, in EEG-derived rat sleep-waking analysis and in receptor interaction studies [receptors for noradrenaline, serotonin (5-HT), *histamine, acetylcholine* and dopamine in rats and guinea pigs].

**TABLE 3: CNS-Pharmacological profile of mirtazapine and its enantiomers**

CNS-Pharmacological Profile	Mirtazapine	(S)+enant.	(R)-enant.
<u>Behavioural models</u>			
Anti-depressant-like effects			
– bulbectomized rat: behavioural	+	+	-
– biochemical	+	-	+
– acquired immobility test	-	-	+
Anti-anxiety effects			
– anxioisof test	±	±	±
<u>EEG-studies</u>			
Anti-depressant profile			
– sleep (rat)	+	+	±
– sleep (human)	+	+	+
<u>Receptor interactions</u>			
Noradrenaline ( $\alpha_2$ -blockade)			
– enhancement NA release	+	+	-
– rauwolscine displacement	+	+	-
– antagonism clonidine mydriasis	+	+	-
Serotonin			
– affinity 5HT <sub>2</sub>	+	+	±
– affinity 5HT <sub>3</sub>	+	-	+
Histamine			
– H <sub>1</sub> -antagonism	+	+	+
Acetylcholine			
– QNB binding	-	-	-
– guinea-pig ileum	-	-	-

### Pharmacological Indices of Side Effects (Table 3)

The commonly observed side-effects of anti-depressants that can be ascribed to receptor

interactions are those of anticholinergic (dry mouth, blurred vision, constipation, urinary retention),  $\alpha_1$ -adrenolytic (orthostatic hypotension) and antihistaminic (sedation) origin.

Mirtazapine is virtually devoid of anticholinergic activity, as has been shown in *in vitro* receptor interactions and confirmed in the *in vivo* tremorine antagonism test. It is therefore predicted that the incidence of anticholinergic side-effects observed with mirtazapine in clinical practice should be low. This has been confirmed in clinical trials.

Mirtazapine is a moderately weak antagonist at central and peripheral  $\alpha_1$  adrenoceptors, as observed *in vitro* in the labelled prazosin binding assay in rat brain cortex homogenates and in the isolated rat vas deferens assay. On the basis of these observations, a low incidence of orthostatic hypotension would be predicted, which is in line with the clinical observations in depressed patients.

### **Contribution of Mirtazapine Enantiomers to its Pharmacological Profile (Table 3)**

In the acquired immobility test for anti-depressant activity, both mirtazapine and the (S)-enantiomer are inactive, whereas the (R)-enantiomer is active.

In the olfactory bulbectomized rat, subchronic treatment with the (S)-enantiomer reverses deficient behaviour, whereas the (R)-enantiomer is inactive. However, the bulbectomy-induced decreases in noradrenaline and MHPG levels are reversed by subchronic treatment with the (R)-enantiomer, but not with the (S)-enantiomer.

Both enantiomers are active in the conflict-punishment test (display anti-anxiety activity) and in the sleep-waking EEG test in rats (suppression of REM sleep, an effect shared by many psychotropic drugs). In human pharmaco-EEG profiling in healthy volunteers (16), both enantiomers show a clear-cut “anti-depressant” profile, at similar dose levels (0.5 and 1 mg per subject).

The enantiomers of mirtazapine differ considerably with respect to biochemical activity. The  $\alpha_2$ -blocking activity of mirtazapine is virtually confined to the (S)-enantiomer, which is also the more potent 5HT<sub>2</sub> antagonist. However, the (R)-enantiomer is the active principle in mirtazapine with regard to 5HT<sub>3</sub> antagonistic activity. Both enantiomers contribute to a similar extent to the antihistaminic and (weak)  $\alpha_1$ -adrenolytic properties of mirtazapine.

### **Contribution of Mirtazapine Main Metabolites to its Pharmacological Profile**

Demethyl mirtazapine, the only metabolite found in the rat brain after oral administration of mirtazapine, has anti-anxiety activity in the conflict-punishment test in rats, but is less active in the rat EEG profile for anti-depressant activity than the parent compound. The demethyl metabolite is also less active than the parent compound in *in vivo* tests for  $\alpha_2$ -blocking and 5HT<sub>2</sub> antagonistic activity. This may be due to poor bioavailability upon systemic administration, since the *in vitro* tests show that the compound is approximately equally active to mirtazapine as an  $\alpha_2$  and 5HT<sub>2</sub> antagonist; important indices for therapeutic anti-depressant activity. With respect to antagonism at the histamine H<sub>1</sub> receptor, which is probably related to sedation, the demethyl metabolite appears to be less active than the parent compound.

8-hydroxy mirtazapine, 8-hydroxy demethyl mirtazapine and N(2)-oxide of mirtazapine have not been found to penetrate into the rat brain and are inactive *in vivo*, with the exception of the N(2)-oxide and the 8-hydroxy metabolite, which display some anti-serotonergic activity. *In vitro*, these metabolites are much less active than the parent compound at important receptors, like the  $\alpha_2$ , 5HT<sub>2</sub> and histamine H<sub>1</sub> receptors. They are, therefore, not considered to be relevant for the pharmacodynamic profile of mirtazapine, with regard to therapeutic activity or side-effects.

Glucuronide and sulphonate conjugates are not expected to be pharmacologically active and therefore only a limited number of *in vivo* and *in vitro* tests have been performed with these metabolites; they did not show any activity.

## **Cardiovascular Pharmacology of Mirtazapine**

### Cardiovascular effects

In conscious rabbits, mirtazapine, at doses of 0.1 and 1.0 mg/kg i.v., has no effect on blood pressure, heart rate and the autonomic nervous system; at 10 mg/kg i.v., mirtazapine also has no effect on blood pressure and heart rate but slightly reduces the noradrenaline-induced increase in blood pressure and isoprenaline-induced increase in heart rate.

In anesthetized cats, mirtazapine, at doses of 0.1 and 1.0 mg/kg i.v., induces no cardiovascular effects and does not affect the autonomic nervous system; at 10 mg/kg i.v., mirtazapine induces a decrease in blood pressure and heart rate and reduces the changes in blood pressure induced by vagus stimulation and carotid occlusion.

### Hemodynamic effects

In anesthetized dogs, mirtazapine, at 0.1 mg/kg i.v., does not induce any hemodynamic changes; at 1.0 mg/kg i.v., mirtazapine slightly decreases heart rate and myocardial contractility and slightly increases peripheral vascular resistance; at a dose of 10 mg/kg i.v., mirtazapine induces a slight decrease in heart rate and stroke index, resulting in a slightly decreased cardiac index, a decrease in myocardial contractility and an increase in peripheral vascular resistance, resulting in decreased femoral and common carotid blood flow.

### Cardiotoxicity

In artificially ventilated, anesthetized dogs, cardiotoxicity has been investigated by infusing mirtazapine intravenously (30 mg/kg/h) until the animal died from cardiac arrest. If the animal was still alive 5 hours after the start of the infusion, the experiment was stopped. Four out of five dogs died at the end of the 5-hour infusion period and one dog survived the infusion period. The mean extrapolated plasma level of mirtazapine prior to death in these four dogs was approximately 20 mcg/mL; this is approximately 200 times the anticipated clinical peak plasma levels. There was a linear relationship between the severity of the cardiovascular effects (e.g., decrease in blood pressure, decrease in cardiac output and decrease in dP/dt) and the measured plasma level of mirtazapine.

## TOXICOLOGY

### Acute toxicity

The oral LD<sub>50</sub> value for mirtazapine in male Swiss mice was 830 mg/kg (760 to 940 mg/kg) after 24 hours and 810 mg/kg (720 to 1,010 mg/kg) after 7 days, and in females, 720 mg/kg (620 to 850 mg/kg) after 24 hours and 7 days.

The oral LD<sub>50</sub> value for mirtazapine after 24 hours and 7 days was 490 mg/kg (427 to 534 mg/kg) and 320 mg/kg (240 to 430 mg/kg) in male and female Wistar rats, respectively. In a separate study in rats, the enantiomers of mirtazapine displayed similar acute toxicity, the LD<sub>50</sub> being 222 mg/kg and 208 mg/kg for the (R)- and (S)-enantiomers, respectively. Clinical signs observed in both species, mainly at the highest doses, included motor incoordination, reduced activity, ptosis, twitches, abnormally slow respiration and piloerection; these symptoms reached their peak 2 hours after administration and gradually disappeared during the first day. Gross anatomy revealed no drug-related morphological changes.

### Repeated dose toxicity

Oral 13-week toxicity studies were carried out with mirtazapine in rats of both sexes followed by a 4-week recovery period with daily doses of 10, 40 and 120 mg/kg, and in dogs of both sexes followed by a 7-week recovery period at daily doses of 5, 20, and 80 mg/kg. A second study in dogs was performed at a single dose level of 20 mg/kg/day to investigate possible changes in the prostate seen in the initial study in male dogs. One-year toxicity studies, followed by a five-week recovery period, were carried out in rats and dogs with daily doses of 2.5, 20 and 120 mg/kg and 2.5, 15 and 80 mg/kg, respectively.

### Subchronic toxicity

Oral administration of mirtazapine at 10 mg/kg/day to Wistar rats for 13 consecutive weeks induced no untoward effects, whereas mirtazapine at 40 and 120 mg/kg/day induced:

- transient clinical signs including mydriasis, lachrymation, ptosis, hypothermia, bradypnea and hypersalivation (only in females receiving 120 mg/kg)
- transient decrease in body weight gain and initial decrease in food consumption followed by an increase in food intake
- increased thyroidal weight (males only) associated with hypertrophy of thyroid follicular cells, a finding known to occur with compounds inducing microsomal hepatic enzymes in this species (see rat carcinogenicity study)
- increased adrenal gland weight (females only) not associated with morphological changes
- mild vacuolation of cortical renal tubules not associated with any other cytoplasmic or nuclear changes suggestive of degenerative/necrotic response, lipid deposition or any disturbances in renal function tests; this is not a nephrotoxic response as confirmed in the subsequent chronic toxicity study (see below)
- mild hepatic cell hypertrophy not indicative of hepatotoxicity and not accompanied by hepatic functional disturbances or degenerative changes

All these findings were reversible after a 4 week post-dosing period.

Oral administration of mirtazapine to Beagle dogs for 13 consecutive weeks induced:

- increased liver weights not associated with hepatotoxicity at dose levels of 5, 20 and 80 mg/kg/day
- behavioural changes including incidental vomiting, loose defecation, reduced motor activity and body tremors at 20 and 80 mg/kg/day
- slight body weight loss in male dogs at 80 mg/kg/day
- decreased red blood cell parameters (hemoglobin and packed cell volume) at 80 mg/kg/day
- decreased testicular weight associated with reduced spermatogenesis, decreased epididymal weights and reduced epididymal spermatozoal content in two out of five animals at 80 mg/kg/day

A significant decrease in prostatic weights was seen in all drug-treated animals, as well as in a male in the control group kept for recovery. This effect was evaluated in a supplementary study (20 mg/kg/day for 13 consecutive weeks), after which it was concluded that the prostatic weight changes found in the first study most probably were not due to mirtazapine treatment but related to seasonal variations and age differences (younger males appearing to be more sensitive to changes in prostatic weight than the older animals). There is no evidence from the clinical studies to suggest that mirtazapine will affect the prostate in man.

### **Chronic toxicity**

Oral administration of mirtazapine for one year to Sprague-Dawley rats (2.5, 20 and 120 mg/kg/day) and Beagle dogs (2.5, 15 and 80 mg/kg/day) did not induce any effects additional to those observed in the subchronic toxicity studies.

In the rat study, body weight in low-dose (males and females) and mid-dose (females) groups was generally slightly lower than in control animals; there was a marked decrease in body weight in the high-dose animals.

Microscopic examinations revealed that the only drug-related finding was an increased incidence of intracytoplasmic vacuolation in the renal proximal convoluted tubules in the high-dose group of rats after 6 months, and those of the high- and intermediate-dose groups after 12 months. In addition, there was an increased incidence of finely granular brown pigment in the cytoplasm of the tubular epithelial cells in the high-dose rats. The above-mentioned changes were not accompanied by any cytoplasmic or nuclear degenerative changes or by any disturbance in the renal function tests. From the light microscopy, it was suggested that the vacuolations are the result of an increase in the size and numbers of the vacuoles constituting the endocytotic/lysosomal system in the proximal convoluted tubules. This was verified by electron microscopic examination of the kidneys. Vacuolations are known to occur whenever there is an incompatibility between material that enters the lysosomes and the digestive enzymes stored there. Thus, in the chronic toxicity study with mirtazapine in rats, a transient incompatibility may have taken place due to overloading with the high dose of the test material. As in the subchronic 13-week study, tubular vacuolation and brown pigmentation were reversed during the one-month recovery period.

Oral administration of mirtazapine at 2.5 and 15 mg/kg/day to Beagle dogs for 12 months induced no untoward effects, whereas at 80 mg/kg/day, induced:

- neurological signs (trembling and convulsions)



- decline in condition and mild gastro-intestinal disturbances
- body weight loss mainly during the first half of the dosing period
- decreases in red blood cell parameters (RBC, Hb, PCV)
- mild increases in alkaline phosphatase and glutamic-pyruvic transaminase during the first half of the dosing period, together with liver enlargement and hepatic cell hypertrophy, possibly indicative of enzyme induction. These changes were not associated with hepatic morphological changes indicative of hepatotoxicity after six or 12 months
- increases in the erythroid/myeloid ratios in the bone marrow in males and, to a lesser extent, in females receiving 15 or 80 mg/kg/day after 52 weeks of dosing due to mildly decreased total myeloid elements in males and females and mildly increased erythroid elements in males

Reversibility of the drug-related effects was seen after the one-month post-dosing period.

### **Carcinogenesis, Mutagenesis, Impairment of Fertility**

**Carcinogenesis:** Carcinogenicity studies were conducted with mirtazapine given in the diet at doses of 2, 20, and 200 mg/kg/day to mice and 2, 20, and 60 mg/kg/day to rats. Based on AUC exposure, the highest doses used were approximately 0.7 and 1.2 times the maximum recommended human dose (MRHD) of 45 mg/day in mice and rats, respectively. There was an increased incidence of hepatocellular adenoma and carcinoma in male mice at the high dose. In rats, there was an increase in hepatocellular adenoma in females at the mid and high doses, and in hepatocellular tumours and thyroid follicular adenoma/cystadenoma and carcinoma in males at the high dose. The data suggest that the above effects could possibly be mediated by non-genotoxic mechanisms, the relevance of which to humans is not known.

The doses used in the mouse study may not have been enough to fully characterize the carcinogenic potential of mirtazapine Tablets.

**Mutagenesis:** Mirtazapine was not mutagenic or clastogenic and did not induce general DNA damage as determined in several genotoxicity tests: Ames test, *in vitro* gene mutation assay in Chinese hamster V 79 cells, *in vitro* sister chromatid exchange assay in cultured rabbit lymphocytes, *in vivo* bone marrow micronucleus test in rats, and unscheduled DNA synthesis assay in HeLa cells.

**Impairment of Fertility:** In a fertility study in rats, mirtazapine was given at doses up to 100 mg/kg (1.9 times the MRHD on an AUC basis). Mating and conception were not affected by the drug, but estrous cycling was disrupted at doses that were 1.3 times MRHD based on AUC and pre-implantation losses occurred at 1.9 times MRHD based on AUC.

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**PART III: CONSUMER INFORMATION**

**PrAPO-MIRTAZAPINE  
Mirtazapine Tablets USP**

**This leaflet is part III of a three-part “Product Monograph” published when APO-MIRTAZAPINE was approved for sale in Canada and is designed specifically for Consumers. This leaflet is a summary and will not tell you everything about APO-MIRTAZAPINE. Contact your doctor or pharmacist if you have any questions about the drug.**

**ABOUT THIS MEDICATION**

**What the medication is used for:**

APO-MIRTAZAPINE belongs to a group of medicines known as antidepressants.

APO-MIRTAZAPINE has been prescribed to you to relieve your symptoms of depression. **Treatment with these types of medications is most safe and effective when you and your doctor have good communication about how you are feeling.**

**What it does:**

The way mirtazapine works to treat depression is unknown.

Mirtazapine is thought to have an effect in the brain on chemicals called serotonin and norepinephrine.

**When it should not be used:**

Do not use APO-MIRTAZAPINE if you are:

- allergic to it or any of the components (see section - What the important nonmedicinal ingredients are);
- currently taking or have recently taken monoamine oxidase (MAO) inhibitors (including some types of anti-depressants and anti-Parkinson treatments) (see section INTERACTIONS WITH THIS MEDICATION).

**What the medicinal ingredient is:**

Mirtazapine

**What the important nonmedicinal ingredients are:**

APO-MIRTAZAPINE tablets contain the following nonmedicinal ingredients: croscarmellose sodium, hydroxypropyl cellulose, hydroxypropyl methylcellulose, iron oxide red (30 mg tablets only), iron oxide yellow (15 mg and 30 mg tablets only), lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol and titanium dioxide.

**What dosage forms it comes in:**

15 mg Tablets: Pale yellow, oval shaped, scored, film coated tablets, imprinted “APO” on one side and “MI” bisect “15” on the other side. Available in bottles of 30 tablets.

30 mg Tablets: Light pink, oval shaped, scored, film coated tablets, imprinted “APO” on one side and “MI” bisect “30” on the other side. Available in bottles of 100 tablets.

45 mg Tablets: White to off-white, oval shaped, unscored, film coated tablets, imprinted “APO” on one side and “MI-45” on the other side. Available in bottles of 30 and 100 tablets.

**WARNINGS AND PRECAUTIONS**

**During treatment with these types of medications, it is important that you and your doctor have good ongoing communication about how you are feeling.**

**APO-MIRTAZAPINE is not for use in children under 18 years of age.**

**Changes in Feelings and Behaviour:**

It is important that you have good communication with your doctor about how you feel. Discussing your feelings and treatment with a friend or relative who can tell you if they think you are getting worse is also useful.

Some patients may feel worse when first starting or changing the dose of drugs such as APO-MIRTAZAPINE. You may feel more anxious or may have thoughts of hurting yourself or others, especially if you have had thoughts of hurting yourself before. These changes in feelings can happen in patients treated with drugs like APO-MIRTAZAPINE for any condition, and at any age, although it may be more likely if you are aged 18 to 24 years old. If this happens, see your doctor immediately. Do not stop taking APO-MIRTAZAPINE on your own.

**BEFORE you use APO-MIRTAZAPINE, talk to your doctor or pharmacist:**

- if you have ever had an allergic reaction to any medication;
- if you have QT/QTc prolongation or a family history of QT/QTc prolongation;
- if you have heart disease;
- about all your medical conditions, including a history of seizures, liver or kidney disease, heart problems, such as certain kinds of heart conditions that may change your heart rhythm, a

recent heart attack, heart failure, or take certain medicines that may affect the heart's rhythm, diabetes, low blood pressure, glaucoma (increased intra-ocular pressure), high cholesterol and/or high triglycerides (fats in the blood), difficulties in urinating as a result of an enlarged prostate, psychiatric diseases such as schizophrenia and bipolar disorder (alternating periods of elation/overactivity and depressed mood);

- about any medications (prescription or nonprescription) you are taking (refer to the next section for specific interactions with APO-MIRTAZAPINE);
- about any natural or herbal products you are taking (e.g., St. John's Wort);
- if you are pregnant or thinking of becoming pregnant, or if you are breastfeeding;
- about your habits of alcohol consumption;
- if you have hereditary galactose intolerance or glucose-galactose malabsorption.

APO-MIRTAZAPINE is not for use in children under 18 years of age.

Refrain from potentially hazardous tasks, such as driving a car or operating dangerous machines, until you are certain that this medication does not affect your mental alertness or physical coordination.

Contact your physician before stopping or reducing your dosage of APO-MIRTAZAPINE. Symptoms such as dizziness, abnormal dreams, electric shock sensations, agitation, anxiety, difficulty concentrating, headache, tremor, nausea, vomiting, sweating or other symptoms may occur after stopping or reducing the dosage of APO-MIRTAZAPINE. Such symptoms may also occur if a dose is missed. These symptoms usually disappear without needing treatment. Tell your doctor immediately if you have these or any other symptoms. Your doctor may adjust the dosage of APO-MIRTAZAPINE to alleviate these symptoms.

**Effects on Pregnancy and Newborns**

**If you are already taking/using APO-MIRTAZAPINE and have just found out that you are pregnant, you should talk to your doctor immediately. You should also talk to your doctor if you are planning to become pregnant.**

**Possible complications at birth (from taking any newer antidepressant, including APO-MIRTAZAPINE):**

Post-marketing reports indicate that some newborns whose mothers took an SSRI (Selective Serotonin Reuptake Inhibitor) or other newer anti-depressants, such as APO-MIRTAZAPINE, during pregnancy have

developed complications at birth requiring prolonged hospitalization, breathing support and tube feeding. Reported symptoms include: feeding and/or breathing difficulties, seizures, tense or overly relaxed muscles, jitteriness and constant crying. In most cases, the newer anti-depressant was taken during the third trimester of pregnancy. These symptoms are consistent with either a direct adverse effect of the anti-depressant on the baby, or possibly a discontinuation syndrome caused by sudden withdrawal from the drug. These symptoms normally resolve over time. However, if your baby experiences any of these symptoms, contact your doctor as soon as you can.

If you are pregnant, or nursing, and taking an SSRI or other newer anti-depressants, such as APO-MIRTAZAPINE, you should discuss the risks and benefits of the various treatment options with your doctor. It is very important that you do NOT stop taking these medications without first consulting your doctor. See also SIDE EFFECTS AND WHAT TO DO ABOUT THEM section.

**INTERACTIONS WITH THIS MEDICATION**

**Serious Drug Interactions**

**Do not use APO-MIRTAZAPINE if you are taking or have recently taken:**

- Monoamine oxidase inhibitor (e.g., phenelzine, tranylcypromine, moclobemide, selegiline, linezolid, methylene blue)
- Thioridazine
- Pimozide

**You should tell your doctor if you are taking or have recently taken any medications (prescription, non-prescription or natural/herbal), especially:**

- other antidepressants, such as SSRIs, venlafaxine and certain tricyclics
- other drugs that affect serotonin such as tryptophan, triptans, lithium, tramadol, methylene blue (used to treat high levels of methemoglobin in the blood), St. John's Wort
- ketoconazole (medicine for treating fungal infections)
- cimetidine (used to treat reflux and stomach ulcers)
- erythromycin [used to treat bacterial infections (antibiotic)]
- drugs used to treat Human Immunodeficiency Virus (HIV), such as a combination of fosamprenavir and ritonavir
- nefazodone (used to treat depression)
- certain drugs used to treat epilepsy, such as carbamazepine and phenytoin
- rifampicin (used to treat tuberculosis)

- warfarin (used to prevent blood clotting)
- benzodiazepines (e.g midazolam, oxazepam and diazepam) – as APO-MIRTAZAPINE may add to the sedative effects of these agents.
- medicines that may affect the heart's rhythm such as certain antibiotics and some anti-psychotics.

Avoid alcoholic drinks while taking APO-MIRTAZAPINE.

**PROPER USE OF THIS MEDICATION**

**Usual adult dose:**

It is very important that you take APO-MIRTAZAPINE exactly as your doctor has instructed. Generally, most people take between 15 mg and 45 mg per day.

**How to take APO-MIRTAZAPINE:**

- Never increase or decrease the amount of APO-MIRTAZAPINE you, or those in your care if you are a caregiver or guardian, are taking unless your doctor tells you to, and do not stop taking this medication without consulting your doctor (see Warnings and Precautions when taking APO-MIRTAZAPINE).
- Some symptoms may begin to improve within about two weeks, but significant improvement can take several weeks. Continue to follow the doctor's instructions.
- The tablets should be taken at the same time each day, preferably as a single evening dose (prior to sleep). Do not chew them.
- Keep taking your tablets until the doctor tells you to stop. The doctor may tell you to take your medicine for several months. Continue to follow the doctor's instructions.
- Do not take a double dose to make up for forgotten doses.
- If you forget to take your evening dose, do not take the missed dose the next morning. Continue treatment in the evening (prior to sleep) with your normal dose.

**Overdose:**

In case of drug overdose, contact a health care practitioner, hospital emergency department or regional Poison Control Centre immediately, even if there are no symptoms.

The most likely signs of an overdose of APO-MIRTAZAPINE (without other medicines or alcohol) are drowsiness, disorientation and increased heart rate. The symptoms of a possible overdose may include changes to your heart rhythm (fast, irregular heartbeat)

and/or fainting which could be symptoms of a life-threatening condition known as Torsade de Pointes.

**Missed Dose:**

Do not take a double dose to make up for forgotten doses.

If you forget to take your evening dose, do not take the missed dose the next morning. Continue treatment in the evening (prior to sleep) with your normal dose.

**SIDE EFFECTS AND WHAT TO DO ABOUT THEM**

Like other medications, APO-MIRTAZAPINE can cause some side effects. You may not experience any of them. For most patients, side effects are likely to be minor and temporary. However, some may be serious. Some of these side effects may be dose related.

Consult your doctor if you experience these or other side effects, as the dose may have to be adjusted.

These are not all the possible side effects you may feel when taking APO-MIRTAZAPINE. If you experience any side effects not listed here, contact your healthcare professional.

- The most common side effects (>10%) include sleepiness, dry mouth, increased appetite, constipation and weight gain.
- Other side effects may include: tiredness (feeling weak); swelling (typically in ankles or feet); occasional dizziness or faintness (especially when you get up quickly from a lying or sitting position); itchiness; tremor (shakiness); abnormal dreams; rash; increased levels of fats in the blood ; urinary tract infections; abnormal sensation in the skin (e.g., burning, stinging, tickling or tingly).

**Decrease in White Blood Cells**

If you experience sudden unexplainable signs of infection such as high fever, chills, sore throat and mouth or nose sores, tell your doctor right away. In rare cases, APO-MIRTAZAPINE can cause a decrease in white blood cells, which are needed to fight infection.

**New or Worsened Emotional or Behavioural Problems**

A small number of patients taking drugs of this type may feel worse instead of better; for example, they may experience new or worsened feelings of agitation, hostility or anxiety, or thoughts about suicide. Your doctor should be informed of such changes

immediately. Close observation by a doctor is necessary in this situation. Do not discontinue your medication on your own. See also the WARNINGS AND PRECAUTIONS section.

**Discontinuation Symptoms**

Contact your doctor before stopping or reducing your dosage of APO-MIRTAZAPINE. Symptoms such as dizziness, abnormal dreams, electric shock sensations, agitation, anxiety, difficulty concentrating, headache, tremor, nausea, vomiting, sweating and other symptoms have been reported after stopping mirtazapine. These symptoms usually disappear without needing treatment. Tell your doctor immediately if you have these or any other symptoms. Your doctor may adjust the dosage of APO-MIRTAZAPINE to alleviate the symptoms. See WARNINGS AND PRECAUTIONS section for more information.

**Effects on Newborns**

Some newborns whose mothers took an SSRI or other newer antidepressants during pregnancy have shown such symptoms as breathing and feeding difficulties, jitteriness and constant crying. If your baby experiences any of these symptoms, contact your doctor as soon as you can. See WARNINGS AND PRECAUTIONS section for more information.

<b>SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM</b>				
Symptom / effect		Talk with your doctor or pharmacist		Stop taking drug and get immediate medical help
		Only if severe	In all cases	
Common	Drowsiness which can lead to impaired concentration, generally occurring during the first few weeks of treatment	√		
	Weight gain	√		
Infrequent	Aggression			√
Rare	Bruising and/or unusual bleeding and symptoms of infection such as sudden high fever, sore throat, mouth ulcers, severe digestive		√	

<b>SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM</b>				
Symptom / effect		Talk with your doctor or pharmacist		Stop taking drug and get immediate medical help
		Only if severe	In all cases	
	system disturbances or other signs of infection (symptoms of blood cell disturbances).			
	Convulsions (loss of consciousness with uncontrollable shaking)			√
	Fainting/loss of consciousness		√	
	Nightmares/vivid dreams, agitation or confusion		√	
	Hallucinations (strange visions or sounds)		√	
	Mania (excessive happiness or irritability, racing thoughts, greatly increased energy, severe trouble sleeping, reckless behaviour)			√
	Akathisia (feeling restless and unable to stand still)	√		
	Uncontrolled, sudden movements	√		
	Restless legs (feeling of unrest during night mainly located in the legs combined with sudden muscle contractions in	√		

**IMPORTANT: PLEASE READ**

**SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM**

Symptom / effect	Talk with your doctor or pharmacist		Stop taking drug and get immediate medical help
	Only if severe	In all cases	
the legs)			
Pain in the joints or muscles		√	
Jaundice (yellowing of eyes or skin, dark urine)			√
Symptoms of depression (anxiety and disturbed sleep)	√		
Severe skin reactions such as Stevens-Johnson syndrome (fever, rash, swollen lymph nodes, hives, sore mouth, sore eyes or swelling of lips or tongue)			√
Low sodium levels in blood (feeling ill with symptoms of weakness, drowsiness, confusion, combined with achy, stiff or uncoordinated muscles)			√
Abdominal pain and nausea; this may suggest inflammation of the pancreas (pancreatitis)	√		

**SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM**

Symptom / effect	Talk with your doctor or pharmacist		Stop taking drug and get immediate medical help
	Only if severe	In all cases	
Very Rare	“Serotonin toxicity” (a reaction which may cause feelings of agitation or restlessness, flushing, muscle twitching, involuntary eye movements, heavy sweating, high body temperature (>38°C), or rigid muscles).		√
See WARNINGS & PRECAUTIONS	Changes in feelings or behavior (anger, anxiety, suicidal or violent thoughts)		√
Unknown	Abnormal heart rate or rhythm, palpitations, fainting		√
	Rhabdomyolysis (very dark (“tea coloured”) urine, muscle tenderness and/or aching)		√
	Increased prolactin hormone levels in blood (hyperprolactinemia, including symptoms such as enlarged breasts and/or milky nipple discharge)		√
	Sleepwalking		√



**SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM**

Symptom / effect	Talk with your doctor or pharmacist		Stop taking drug and get immediate medical help
	Only if severe	In all cases	
Prolonged painful erection of the penis			√

*This is not a complete list of side effects. For any unexpected effects while taking APO-MIRTAZAPINE, contact your doctor or pharmacist.*

**HOW TO STORE IT**

- Store at room temperature, 15°C to 30°C
- Keep APO-MIRTAZAPINE out of the reach and sight of children.
- Do not use APO-MIRTAZAPINE after the expiry date indicated on the package.

**Reporting Side Effects**

You can report any suspected side effects associated with the use of health products to Health Canada by:

- Visiting the Web page on Adverse Reaction Reporting (<https://www.canada.ca/en/health-canada/services/drugs-health-products/medeffect-canada.html>) for information on how to report online, by mail or by fax; or
- Calling toll-free at 1-866-234-2345.

*NOTE: Contact your health professional if you need information about how to manage your side effects. The Canada Vigilance Program does not provide medical advice.*

**If you want more information about APO-MIRTAZAPINE:**

- Talk to your healthcare professional
- Find the full product monograph that is prepared for healthcare professionals and includes this Consumer Information by visiting the Health Canada website (<https://health-products.canada.ca/dpd-bdpp/index-eng.jsp>). Find the Consumer Information on the manufacturer's website <http://www.apotex.ca/products>, or by calling 1-800-667-4708.

This leaflet was prepared by Apotex Inc., Toronto, Ontario, M9L 1T9.

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