

## **PRODUCT MONOGRAPH**

### **Pr Solifenacin Succinate Tablets**

Solifenacin succinate  
5 mg, 10 mg

Urinary antispasmodic

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## **Table of Contents**

<b>PART I: HEALTH PROFESSIONAL INFORMATION .....</b>	<b>3</b>
SUMMARY PRODUCT INFORMATION .....	3
INDICATIONS AND CLINICAL USE.....	3
CONTRAINDICATIONS .....	3
WARNINGS AND PRECAUTIONS.....	3
ADVERSE REACTIONS.....	7
DRUG INTERACTIONS .....	9
DOSAGE AND ADMINISTRATION .....	11
OVERDOSAGE .....	11
ACTION AND CLINICAL PHARMACOLOGY .....	12
STORAGE AND STABILITY .....	14
DOSAGE FORMS, COMPOSITION AND PACKAGING .....	15
<b>PART II: SCIENTIFIC INFORMATION .....</b>	<b>16</b>
PHARMACEUTICAL INFORMATION.....	<b>16</b>
CLINICAL TRIALS .....	17
DETAILED PHARMACOLOGY .....	21
TOXICOLOGY .....	23
REFERENCES .....	30
<b>PART III: CONSUMER INFORMATION.....</b>	<b>31</b>

## Pr Solifenacin Succinate Tablets

5 mg and 10 mg

### PART I: HEALTH PROFESSIONAL

#### INFORMATION SUMMARY PRODUCT INFORMATION

Route of Administration	Dosage Form/Strength	All Nonmedicinal Ingredients
Oral	tablet, film coated 5 mg, 10 mg	sodium stearyl fumarate , lactose monohydrate, pvp k30 (povidon), pregelatinised starch, purified water, hpmc 2910 / hypromellose, talc, macrogol, titanium dioxide with iron oxide yellow (5 mg) or iron oxide red (10 mg).

#### INDICATIONS AND CLINICAL USE

Solifenacin Succinate Tablets (solifenacin succinate) is indicated for:

- Treatment of overactive bladder in adults with symptoms of urge urinary incontinence, urinary urgency and urinary frequency.

##### **Geriatrics:**

In placebo controlled clinical studies, similar safety and effectiveness were observed between older (623 patients  $\geq 65$  years and 189 patients  $\geq 75$  years) and younger patients (1188 patients  $<65$  years) treated with solifenacin succinate (see ACTION AND CLINICAL PHARMACOLOGY).

##### **Pediatrics:**

Safety and effectiveness in children have not yet been established.

#### CONTRAINDICATIONS

- Patients with urinary retention, dependent on dialysis, gastroparesis or narrow angle glaucoma
- Patients who are hypersensitive to this drug or to any ingredient in the formulation or component of the container. For a complete listing, see DOSAGE FORMS, COMPOSITION AND PACKAGING.

#### WARNINGS AND PRECAUTIONS

##### **General**

Solifenacin Succinate Tablets (solifenacin succinate), like other anticholinergic drugs, should

be administered with caution in patients with impaired ability to sweat, to reduce the risk of heat prostration, and in patients with clinically significant bladder outflow obstruction because of the risk of urinary retention.

Solifenacin Succinate Tablets may cause blurred vision and somnolence. Patients should be advised to exercise caution in driving or operating machinery until the drug's effect on vision and somnolence has been determined.

Angioedema of the face, lips, tongue, and/or larynx have been reported with solifenacin. In some cases angioedema occurred after the first dose. Angioedema associated with upper airway swelling may be life threatening. If involvement of the tongue, hypopharynx, or larynx occurs, solifenacin should be promptly discontinued and appropriate therapy and/or measures necessary to ensure a patent airway should be promptly provided.

Anaphylactic reaction has been reported in some patients treated with solifenacin succinate. In patients who develop anaphylactic reactions, Solifenacin Succinate Tablets should be discontinued and appropriate therapy and/or measures necessary to ensure a patent airway should be promptly provided.

### **Monitoring and Laboratory Tests**

Monitoring of the QT/QTc interval and/or serum electrolyte levels may be appropriate in high risk patients who are being treated with Solifenacin Succinate Tablets, such as:

Patients with known congenital or acquired QT/QTc interval prolongation or electrolyte disturbances;

Patients who are taking drugs that have been associated with QT/QTc interval prolongation and/or torsade de pointes such as Class IA (e.g., quinidine, procainamide) or Class III (e.g., amiodarone, sotalol) antiarrhythmic medications or those taking potent CYP3A4 inhibitors.

### **Carcinogenesis and Mutagenesis**

Solifenacin succinate was not mutagenic in the *in vitro* *Salmonella typhimurium* or *Escherichia coli* microbial mutagenicity test or chromosomal aberration test in human peripheral blood lymphocytes, with or without metabolic activation, or in the *in vivo* micronucleus test in rats.

No increase in tumors was found following the administration of solifenacin succinate to male and female mice for 104 weeks at doses up to 200 mg/kg/day (5 and 9 times human exposure at the maximum recommended human dose [MRHD], respectively), and male and female rats for 104 weeks at doses up to 20 and 15 mg/kg/day, respectively (<1 times exposure at the MRHD).

### **Cardiovascular**

A study of the effect of solifenacin on the QT interval was conducted in 76 healthy women. The QTc interval prolongation effect appeared greater for the 30 mg compared to the 10 mg dose of solifenacin. Although the effect of the highest solifenacin dose (three times the maximum

therapeutic dose) studied did not appear as large as that of the positive control moxifloxacin at its therapeutic dose, the confidence interval overlapped. This study was not designed to draw direct statistical comparison between the drugs or the dose levels (see ACTION AND CLINICAL PHARMACOLOGY). This observation should be considered in clinical decisions to prescribe Solifenacin Succinate Tablets for patients with a known history of QT prolongation or patients who are taking medications known to prolong the QT interval.

The effect of solifenacin on QTc interval change in males has not been investigated, and caution should be taken in extrapolating the findings of this study to male subjects.

The effect of solifenacin on QTc interval change in elderly subjects with occult renal insufficiency, (in whom plasma concentration of solifenacin might be higher than those observed in younger subjects), has not been investigated.

QT prolongation and Torsades de Pointes have been observed in patients with risk factors such as pre-existing long QT syndrome and hypokalemia.

Caution should be used when prescribing antimuscarinics/anticholinergics to patients with pre-existing cardiac diseases.

### **Gastrointestinal**

Solifenacin Succinate Tablets, like other anticholinergics, should be used with caution in patients with decreased gastrointestinal motility.

### **Hepatic**

Solifenacin Succinate Tablets should be used with caution in patients with reduced hepatic function. Doses of Solifenacin Succinate Tablets greater than 5 mg are not recommended in patients with moderate hepatic impairment. (Child-Pugh B). Solifenacin Succinate Tablets is not recommended for patients with severe hepatic impairment (Child-Pugh C) (see ACTION AND CLINICAL PHARMACOLOGY, DOSAGE AND ADMINISTRATION and ADVERSE REACTIONS).

### **Renal**

Use with caution in patients with reduced renal function. Doses of Solifenacin Succinate Tablets greater than 5 mg are not recommended in patients with severe renal impairment ( $CL_{Cr} < 30$  mL/min) (see ACTION AND CLINICAL PHARMACOLOGY and DOSAGE AND ADMINISTRATION).

Solifenacin Succinate Tablets is contraindicated in dialysis dependent patients (see CONTRAINDICATIONS).

### **Sexual Function / Reproduction**

No clinical data are available from reproductively competent women who have received long-

term treatment with solifenacin succinate. The potential risk to such women is presently unknown. Therefore, Solifenacin Succinate Tablets should be used during pregnancy only if the potential benefit for the mother justifies the potential risk for the fetus. Women of childbearing potential should be considered for treatment only if using adequate contraception.

In a 13-week toxicity study in mice treated with 400mg/kg/day (15 times exposure at the maximum recommended human dose [MRHD]) of solifenacin succinate and in a 26-week toxicity study in rats treated with 30mg/kg/day (<1 times exposure at the MRHD) or greater of solifenacin succinate, follicular degeneration/reduced corpora lutea in the ovaries and/or uterine atrophy were observed in female animals that died or were sacrificed in extremis. Low uterine weight and uterine immaturity were observed in female dogs treated with 3 mg/kg/day (<1 times exposure at the MRHD) or greater of solifenacin succinate in the 13-week toxicity study.

Solifenacin succinate had no effect on reproductive function, fertility or early embryonic development of the fetus in male and female mice treated with 250 mg/kg/day (13 times exposure at the MRHD) of solifenacin succinate for 4 weeks and 2 weeks, respectively, and in male rats treated with 50 mg/kg/day (<1 times exposure at the MRHD) for 4 weeks and female rats treated with 100mg/kg/day (1.7 times exposure at the MRHD) for 2 weeks.

### **Special Populations**

**Pregnant Women:** There are no adequate and well-controlled studies investigating the effects of solifenacin succinate in pregnant women. Animal reproduction studies are not always predictive of human response; therefore, Solifenacin Succinate Tablets should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Women of childbearing potential should be considered for treatment only if using adequate contraception.

Reproduction studies have been performed in mice, rats and rabbits. After oral administration of <sup>14</sup>C-solifenacin succinate to pregnant mice, drug-related material has been shown to cross the placental barrier. No embryotoxicity or teratogenicity was observed in mice treated with 30 mg/kg/day (1.2 times exposure at the maximum recommended human dose [MRHD]). Administration of solifenacin succinate to pregnant mice, at doses of 100 mg/kg and greater (3.6 times exposure at the MRHD), during the major period of organ development resulted in reduced fetal body weights. Administration of 250 mg/kg/kg (7.9 times exposure at the MRHD) to pregnant mice resulted in an increased incidence of cleft palate. In utero and lactational exposures to maternal doses of solifenacin succinate of 100 mg/kg/day and greater (3.6 times exposure at the MRHD) resulted in reduced peripartum and postnatal survival, reductions in body weight gain, and delayed physical development (eye opening and vaginal patency). An increase in the percentage of male offspring was also observed in litters from offspring exposed to maternal doses of 250 mg/kg/day. No embryotoxic effects were observed in rats at up to 50 mg/kg/day (<1 times exposure at the MRHD) or in rabbits at up to 50 mg/kg/day (1.8 times exposure at the MRHD).

The effect of solifenacin succinate on labor and delivery in humans has not been studied. There were no effects on natural delivery in mice treated with 30 mg/kg/day (1.2 times exposure at the

MRHD). Administration of solifenacin succinate at 100 mg/kg/day (3.6 times exposure at the MRHD) or greater increased peripartum pup mortality.

**Nursing Women:** It is not known whether solifenacin is excreted in human milk. Because many drugs are excreted in human milk, Solifenacin Succinate Tablets should not be administered during nursing. A decision should be made whether to discontinue nursing or to discontinue Solifenacin Succinate Tablets in nursing mothers.

After oral administration of <sup>14</sup>C-solifenacin succinate to lactating mice, radioactivity was detected in maternal milk. There were no adverse observations in mice treated with 30 mg/kg/day (1.2 times exposure at the maximum recommended human dose [MRHD]). Pups of female mice treated with 100 mg/kg/day (3.6 times exposure at the MRHD) or greater revealed reduced body weights, postpartum pup mortality or delays in the onset of reflex and physical development during the lactation period.

## **ADVERSE REACTIONS**

### **Adverse Drug Reaction Overview**

Expected side effects of antimuscarinic agents are dry mouth, constipation, blurred vision (accommodation abnormalities), urinary retention, and dry eyes. The most common adverse events reported in patients treated with solifenacin succinate were dry mouth and constipation and the incidence of these side effects was higher in the 10 mg compared to the 5 mg dose group. Compared to twelve weeks of treatment with solifenacin succinate, the incidence and severity of adverse events were similar in patients who remained on drug for up to 12 months. The most frequent reason for discontinuation due to an adverse event was dry mouth, 1.5%.

### **Clinical Trial Adverse Drug Reactions**

*Because clinical trials are conducted under very specific conditions the adverse 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.*

Solifenacin succinate has been evaluated for safety in 1811 patients in randomized, placebo-controlled trials. In the four 12-week double-blind clinical trials, there were three intestinal serious adverse events in patients, all treated with solifenacin succinate 10 mg (one fecal impaction, one colonic obstruction, and one intestinal obstruction). The overall rate of serious adverse events in the double-blind trials was 2%.

Table 1 lists adverse events, regardless of causality, that were reported in randomized, placebo-controlled trials at an incidence greater than placebo and in 1% or more of patients treated with solifenacin succinate 5 or 10 mg once daily for up to 12 weeks.

**Table 1: Percentages of Patients with Treatment-Emergent Adverse Events Exceeding Placebo Rate and Reported by 1% or More Patients for Combined Pivotal Studies**

<b>SYSTEM ORGAN CLASS MedDRA Preferred Term</b>	<b>Placebo (%)</b>	<b>Solifenacin succinate 5 mg (%)</b>	<b>Solifenacin succinate 10 mg (%)</b>
Number of Patients	1216	578	1233
Number of Patients with Treatment-emergent AE	634	265	773
<b>Eye Disorders</b>			
Vision Blurred	1.8	3.8	4.8
Dry Eyes NOS	0.6	0.3	1.6
<b>Gastrointestinal Disorders</b>			
Dry Mouth	4.2	10.9	27.6
Constipation	2.9	5.4	13.4
Nausea	2.0	1.7	3.3
Dyspepsia	1.0	1.4	3.9
Abdominal Pain Upper	1.0	1.9	1.2
Vomiting NOS	0.9	0.2	1.1
<b>General Disorders And Administration Site Conditions</b>			
Fatigue	1.1	1.0	2.1
Edema Lower Limb	0.7	0.3	1.1
<b>Infections And Infestations</b>			
Urinary Tract Infection NOS	2.8	2.8	4.8
Influenza	1.3	2.2	0.9
Pharyngitis NOS	1.0	0.3	1.1
<b>Nervous System Disorders</b>			
Dizziness	1.8	1.9	1.8
<b>Psychiatric Disorders</b>			
Depression NOS	0.8	1.2	0.8
<b>Renal And Urinary Disorders</b>			
Urinary Retention	0.6	0	1.4
<b>Respiratory, Thoracic And Mediastinal Disorders</b>			
Cough	0.2	0.2	1.1
<b>Vascular Disorders</b>			
Hypertension NOS	0.6	1.4	0.5

One young male subject developed a reversible increase in hepatic enzymes following a single dose of solifenacin during a Phase I study. Although causality has not been established, special attention should be paid to subjects who develop abnormal liver function tests after starting solifenacin and consideration given to discontinuing treatment.

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

In addition to the adverse events observed in clinical trials, the following events have been reported in association with solifenacin succinate use in worldwide post-marketing experience,

although the frequency of events or a causal relationship with solifenacin succinate could not always be confirmed.

**General:** peripheral edema

**Cardiovascular:** atrial fibrillation, tachycardia, palpitations, Torsades de Pointes

**Eye Disorder:** glaucoma

**Gastrointestinal:** gastroesophageal reflux disease, ileus, stomach discomfort, vomiting

**Hepatobiliary:** liver disorders mostly characterized by abnormal liver function tests: AST (aspartate aminotransferase), ALT (alanine aminotransferase), GGT (gamma-glutamyl transferase)

**Immune System:** anaphylactic reaction and hypersensitivity reactions including rash, pruritus and urticaria

**Investigations:** electrocardiogram QT prolonged

**Metabolism and Nutrition:** decreased appetite and hyperkalemia

**Musculoskeletal and connective tissue disorders:** muscular weakness

**Nervous System:** dizziness, headache and somnolence

**Psychiatric:** confusional state, delirium, disorientation and hallucination

**Renal and Urinary:** renal impairment and urinary retention

**Respiratory, thoracic and mediastinal disorders:** dysphonia

**Skin and Subcutaneous Tissue:** angioedema with airway obstruction, exfoliative dermatitis, erythema multiforme

## **DRUG INTERACTIONS**

### **Overview**

Concomitant medication with other medicinal products with anticholinergic properties may result in more pronounced therapeutic effects and undesirable effects. An interval of approximately 1 week should be allowed after stopping treatment with Solifenacin Succinate Tablets (solifenacin succinate), before commencing other anticholinergic therapy.

The therapeutic effect of solifenacin may be reduced by concomitant administration of cholinergic receptor agonists. Solifenacin may reduce the effect of medicinal products that

stimulate the motility of the gastrointestinal tract, such as metoclopramide.

**Drugs Metabolized by Cytochrome P450:** At therapeutic concentrations, solifenacin does not inhibit CYP1A1/2, 2C9, 2C19, 2D6, or 3A4 derived from human liver microsomes.

**CYP 3A4 Inhibitors:** In vitro drug metabolism studies have shown that solifenacin is a substrate of CYP3A4. Inducers or inhibitors of CYP3A4 may alter solifenacin pharmacokinetics. Therefore, the dose of solifenacin should be maintained at, or dropped to, 5 mg daily while patients are taking a potent CYP3A4 inhibitor such as ketoconazole, clarithromycin, erythromycin, diclofenac, nefazodone, verapamil and others.

### **Drug-Drug Interactions**

Solifenacin is metabolised by CYP3A4. Simultaneous administration of ketoconazole (200 mg/day), a potent CYP3A4 inhibitor, resulted in a two-fold increase of the AUC of solifenacin, while ketoconazole at a dose of 400 mg/day resulted in a three-fold increase of the AUC of solifenacin. Therefore, the maximum dose of Solifenacin Succinate Tablets should be restricted to 5 mg, when used simultaneously with ketoconazole or therapeutic doses of other potent CYP3A4 inhibitors. Table 2 shows the investigated potential drug-drug interactions.

**Table 2: Investigated Potential Drug-Drug Interactions**

<b>Drug Name</b>	<b>Ref</b>	<b>Effect</b>	<b>Clinical Comment</b>
Digoxin	CT	No significant effect on pharmacokinetics of digoxin in healthy subjects.	
Ketoconazole	CT	↑ solifenacin The mean C <sub>max</sub> and AUC of solifenacin increased by 1.5 and 2.7-fold, respectively.	It is recommended not to exceed a 5 mg daily dose of Solifenacin Succinate Tablets when administered with therapeutic doses of ketoconazole or other potent CYP3A4 inhibitors.
Oral Contraceptives (OCP)	CT	No significant effect on plasma concentration of combined OCPs (ethinyl estradiol/levonorgestrel)	
Warfarin	CT	No significant effect on pharmacokinetics of R-warfarin or S-warfarin	

CT= Clinical Trial

**Drug-Food Interactions:** Co-ingestion of grapefruit juice with Solifenacin Succinate Tablets may increase the serum level of solifenacin.

**Drug-Herb Interactions:** Interactions with herbal products have not been established and caution should be taken if such agents are used by patients.

**Drug-Laboratory Test Interactions:** Interactions with laboratory tests have not been investigated.

## **DOSAGE AND ADMINISTRATION**

### **Dosing considerations:**

#### ***Dose Adjustment in Renal Impairment:***

For patients with severe renal impairment ( $CL_{cr} < 30$  mL/min), a daily dose of Solifenacin Succinate Tablets (solifenacin succinate) greater than 5 mg is not recommended. Solifenacin Succinate Tablets is contraindicated in dialysis dependent patients (see CONTRAINDICATIONS).

#### ***Dose Adjustment in Hepatic Impairment:***

For patients with moderate hepatic impairment (Child-Pugh B), a daily dose of Solifenacin Succinate Tablets greater than 5 mg is not recommended. Use of Solifenacin Succinate Tablets in patients with severe hepatic impairment (Child Pugh C) is not recommended.

#### ***Dose Adjustment with CYP3A4 Inhibitors:***

When administered with therapeutic doses of ketoconazole or other potent CYP3A4 inhibitors, a daily dose of Solifenacin Succinate Tablets should be maintained at, or dropped to, 5 mg daily.

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

The recommended dose of Solifenacin Succinate Tablets is 5 mg once daily. If the 5 mg dose is well tolerated, the dose may be increased to 10 mg once daily.

Solifenacin Succinate Tablets should be taken with liquids and swallowed whole. Solifenacin Succinate Tablets can be administered with or without food, without regard to meals.

The maximum effect can be determined after 4 weeks at the earliest.

### **Missed dose**

If a dose is missed, the next tablet should be taken as planned. Doses should not be doubled to make up for a missed dose.

## **OVERDOSAGE**

**Acute:** Overdosage with Solifenacin Succinate Tablets (solifenacin succinate) can potentially result in severe anticholinergic effects and should be treated accordingly. The highest dose of solifenacin succinate accidentally given to a single patient was 280 mg in a 5-hour period, resulting in mental status changes. The patient was given charcoal treatment and recovered without sequelae.

**Chronic:** Intolerable anticholinergic side effects (fixed and dilated pupils, blurred vision, failure of heel-to-toe exam, tremors and dry skin) occurred on day 3 in normal volunteers taking 50 mg

daily (5 times the maximum recommended therapeutic dose) and resolved within 7 days following discontinuation of drug.

**Treatment of Overdosage:** In the event of overdose with Solifenacin Succinate Tablets treat with gastric lavage and appropriate supportive measures. ECG monitoring is also recommended.

For management of a suspected drug overdose, contact your regional Poison Control Centre.

## ACTION AND CLINICAL PHARMACOLOGY

### **Mechanism of Action**

Muscarinic receptors play an important role in several major cholinergically mediated functions, including contractions of urinary bladder smooth muscle and stimulation of salivary secretion. Solifenacin is a competitive muscarinic receptor antagonist with selectivity for the urinary bladder over salivary glands in vitro and in vivo (mice, rats and monkeys). In cells isolated from rats and monkeys, solifenacin inhibited carbachol-induced intracellular calcium mobilization more potently in bladder smooth muscle cells than in salivary gland cells. The bladder selectivity of solifenacin in monkeys is significantly greater than those of other antimuscarinics as illustrated by selectivity ratios (bladder/salivary gland) of 2.1, 0.51, 0.65, 0.46 and 0.61 for solifenacin, oxybutynin, tolterodine, darifenacin and atropine, respectively. In anesthetized rats, solifenacin is also more potent in inhibiting carbachol-induced increases in intravesical pressure than in inhibiting salivary secretion. Although other antimuscarinics also showed some tissue selectivity, the selectivity ratio of solifenacin (6.5) estimated from its potency to inhibit urinary bladder and salivary gland was the greatest among all antimuscarinics tested (1.0 to 2.4).

### **Pharmacokinetics**

**Table 3: Summary of Pharmacokinetic Parameters in the Normal Population**

Solifenacin Dose	C <sub>max</sub> ng/mL	t <sub>1/2</sub> (h)	AUC <sub>0-24h</sub> ng•h/mL
5mg od	32.3 (11.2)	64.4 (18.6)	637 (239)
10mg od	62.9 (23.1)	60.9 (17.1)	1236 (459)

Data are expressed as mean (SD)

**Absorption:** After oral administration of solifenacin succinate to healthy volunteers, peak plasma levels (C<sub>max</sub>) of solifenacin are reached within 3 to 8 hours after administration, and at steady state ranged from 32.3 to 62.9 ng/mL for the 5 and 10 mg solifenacin succinate tablets, respectively. The absolute bioavailability of solifenacin is approximately 90%, and plasma concentrations of solifenacin are proportional to the dose administered.

**Effect of food:** There is no significant effect of food on the pharmacokinetics of solifenacin.

**Distribution:** Solifenacin is approximately 98% (in vivo) bound to human plasma proteins, principally to  $\alpha_1$ -acid glycoprotein. Solifenacin is highly distributed to non-CNS tissues, having a mean steady-state volume of distribution of 600L.

**Metabolism:** Solifenacin is extensively metabolized in the liver. The primary pathway for elimination is by way of CYP3A4; however, alternate metabolic pathways exist. The primary metabolic routes of solifenacin are through *N*-oxidation of the quinuclidin ring and 4*R*-hydroxylation of tetrahydroisoquinoline ring. One pharmacologically active metabolite (4*R*-hydroxy solifenacin), occurring at low concentrations and unlikely to contribute significantly to clinical activity, and three pharmacologically inactive metabolites (*N*-glucuronide and the *N*-oxide and 4*R*-hydroxy-*N*-oxide of solifenacin) have been found in human plasma after oral dosing.

**Excretion:** Following the administration of 10 mg of <sup>14</sup>C-solifenacin succinate to healthy volunteers, 69.2 % of the radioactivity was recovered in the urine and 22.5 % in the feces over 26 days. Less than 15% (as mean value) of the dose was recovered in the urine as intact solifenacin. The major metabolites identified in urine were *N*-oxide of solifenacin, 4*R*-hydroxy solifenacin and 4*R*-hydroxy-*N*-oxide of solifenacin, and in feces 4*R*-hydroxy solifenacin. The elimination half-life of solifenacin following chronic dosing is approximately 45 - 68 hours.

### **Special Populations and Conditions**

**Geriatrics:** Multiple dose studies of solifenacin succinate in elderly volunteers (65 to 80 years) showed that C<sub>max</sub>, AUC and t<sub>1/2</sub> values were 20 – 25% higher as compared to the younger volunteers (18 to 55 years) (see INDICATIONS AND CLINICAL USE).

**Pediatrics:** The pharmacokinetics of solifenacin have not been established in pediatric patients.

**Gender:** The pharmacokinetics of solifenacin are not significantly influenced by gender.

**Renal Insufficiency:** Solifenacin Succinate Tablets (solifenacin succinate) should be used with caution in patients with renal impairment. There is a 2.1-fold increase in AUC and 1.6-fold increase in t<sub>1/2</sub> of solifenacin in patients with severe renal impairment. Doses of Solifenacin Succinate Tablets greater than 5 mg are not recommended in patients with severe renal impairment (CL<sub>cr</sub> < 30 mL/min) (see WARNINGS AND PRECAUTIONS and DOSAGE AND ADMINISTRATION). Solifenacin Succinate Tablets is contraindicated in dialysis dependent patients (see CONTRAINDICATIONS).

**Hepatic Insufficiency:** Solifenacin Succinate Tablets should be used with caution in patients with reduced hepatic function. There is a 2-fold increase in the t<sub>1/2</sub> and 35% increase in AUC of solifenacin in patients with moderate hepatic impairment. Doses of Solifenacin Succinate Tablets greater than 5 mg are not recommended in patients with moderate hepatic impairment (Child-Pugh B). Solifenacin Succinate Tablets is not recommended for patients with severe hepatic impairment (Child-Pugh C) (see WARNINGS AND PRECAUTIONS and DOSAGE AND ADMINISTRATION).

### **Cardiac Electrophysiology**

The effect of 10 mg and 30 mg solifenacin succinate on the QT interval was evaluated at the time of peak plasma concentration of solifenacin in a multi-dose, randomized, double-blind, placebo and positive-controlled (moxifloxacin 400 mg) trial. Patients were randomized to one of two

treatment groups after receiving placebo and moxifloxacin sequentially. One group (n=51) went on to complete 3 additional sequential periods of dosing with solifenacin 10, 20 and 30 mg while the second group (n=25) in parallel completed a sequence of placebo and moxifloxacin. Study subjects were female volunteers aged 19 to 79 years. The 30 mg dose of solifenacin succinate (three times the highest recommended dose) was chosen for use in this study because this dose results in a solifenacin exposure that covers those observed upon co-administration of 10 mg solifenacin succinate with potent CYP3A4 inhibitors (e.g., ketoconazole, 400 mg). Due to the sequential dose escalating nature of the study, baseline EKG measurements were separated from the final QT assessment (of the 30 mg dose level) by 33 days.

The median difference from baseline in heart rate associated with the 10 and 30 mg doses of solifenacin succinate compared to placebo was -2 and 0 beats/minute, respectively. Because a significant period effect on QTc was observed, QTc effects were analyzed utilizing the parallel placebo control arm rather than the pre-specified intra-patient analysis. Representative results are shown in Table 4.

**Table 4: QTc changes in msec (90% CI) from Baseline at Tmax (relative to placebo)**

Drug/Dose	Fridericia method (using median difference)
Solifenacin 10 mg	0 (-5,5)
Solifenacin 30 mg	7 (2,12)

Results displayed are those derived from the parallel design portion of the study and represent the comparison of Group 1 to time-matched placebo effects in Group 2.

The effect of moxifloxacin on the QT interval was evaluated in 3 different sessions of the trial. All subjects received moxifloxacin in Session 1 while only those subjects in the placebo/moxifloxacin group received moxifloxacin in Sessions 3 and 5. The placebo subtracted mean changes (90% CI) for moxifloxacin in the three sessions (1, 3 and 5) were 11 (7, 14), 12 (8, 17), and 16 (12, 21), respectively.

The QT interval prolonging effect appeared greater for the 30 mg compared to the 10 mg dose of solifenacin. The lower limit of the 90% confidence interval was greater than zero in the 30 mg dose of solifenacin. This study was not designed to draw direct statistical conclusions between the drugs or the dose levels.

The effect of solifenacin on QTc interval change in male has not been investigated, and caution should be taken in extrapolating the findings of this study to male subjects.

**STORAGE AND STABILITY**

Store between 15°C – 30°C.

## DOSAGE FORMS, COMPOSITION AND PACKAGING

Solifenacin Succinate Tablets (solifenacin succinate) are supplied as round shaped, biconvex film-coated tablets, available in bottles of 90 tablets and blister packages of 30 (2×15) tablets as follows:

strength	5 mg	10 mg
color	light yellow	light pink
debossed	5	10

Each Solifenacin Succinate Tablet, containing 5 or 10 mg of solifenacin succinate is formulated for oral administration. In addition to the active ingredient solifenacin succinate, each Solifenacin Succinate Tablet also contains the following inert ingredients: sodium stearyl fumarate , lactose monohydrate, pvp k30 (povidon), pregelatinised starch, purified water, hpmc 2910 / hypromellose, talc, macrogol, titanium dioxide with iron oxide yellow (5 mg) or iron oxide red (10 mg).

## PART II: SCIENTIFIC INFORMATION

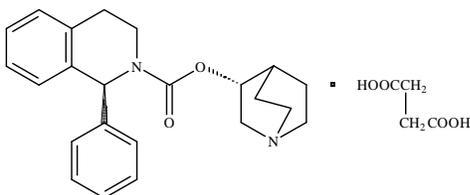
### PHARMACEUTICAL INFORMATION

**Proper name:** Solifenacin Succinate

**Molecular Formula:** C<sub>23</sub>H<sub>26</sub>N<sub>2</sub>O<sub>2</sub>·C<sub>4</sub>H<sub>6</sub>O<sub>4</sub>

**Molecular Weight:** 480.55 g/mol

**Structural Formula:**



**Physicochemical Properties:**

Chemically, solifenacin succinate is butanedioic acid, compounded with (1*S*)-(3*R*)-1-azabicyclo[2.2.2]oct-3-yl 3,4-dihydro-1-phenyl-2(1*H*)-isoquinolinecarboxylate (1:1).

Solifenacin succinate is a white to pale-yellowish-white crystal or crystalline powder.

**Solubility:**

It is freely soluble at room temperature in water, glacial acetic acid, dimethyl sulfoxide, and methanol.

## CLINICAL TRIALS

### Comparative Bioavailability Study

Two bioequivalence studies were conducted:

#### (1) Study No. SLI-P2-524:

Study No. SLI-P2-524 was a single dose, crossover, comparative bioavailability study of 1 x Solifenacin Succinate Tablets (solifenacin succinate) 5 mg (MDA inc., Canada) and 1 x VESICARE<sup>®</sup> (solifenacin succinate) 5 mg Tablets (Astellas Pharma Canada Inc.) conducted in 16 healthy male and female volunteers under fasting conditions. The results are tabulated below.

#### SUMMARY TABLE OF THE COMPARATIVE BIOAVAILABILITY DATA

Solifenacin (1 x 5 mg) From measured data Geometric Mean Arithmetic Mean (CV %)				
Parameter	Test*	Reference†	% Ratio of Geometric Means	90% Confidence Interval
AUC <sub>0-72</sub> (ng·h/mL)	318.51 334.70 (32.50)	309.28 321.93 (29.10)	102.99	91.39 - 116.06
AUC <sub>∞</sub> (ng·h/mL)	451.86 487.74 (38.80)	440.63 481.67(40.90)	102.55	88.17 - 119.28
C <sub>max</sub> (ng/mL)	9.71 10.19 (33.70)	9.43 9.77 (26.80)	102.99	90.69 - 116.97
T <sub>max</sub> <sup>§</sup> (h)	6.00 (3.00 – 9.00)	5.25 (3.00 – 8.00)		
T <sub>1/2</sub> <sup>ε</sup> (h)	39.67 (25.70)	42.91(40.60)		

\* Solifenacin Succinate Tablets (solifenacin succinate) 5 mg (MDA inc., Canada)

† VESICARE<sup>®</sup> (solifenacin succinate) 5 mg Tablets of Astellas Pharma Canada Inc., were purchased in Canada

§ Expressed as the median (range)

ε Expressed as the arithmetic mean (CV%) only

**(2) Study No. SLI-P2-516:**

Study No. SLI-P2-516 was a single dose, crossover, comparative bioavailability study of 1 x Solifenacin Succinate Tablets (solifenacin succinate) 10 mg (MDA inc., Canada) and 1 x VESICARE<sup>®</sup> (solifenacin succinate) 10 mg tablets (Astellas Pharma Canada Inc.) conducted in 15 healthy male and female volunteers under fasting conditions. The results are tabulated below.

**SUMMARY TABLE OF THE COMPARATIVE BIOAVAILABILITY DATA**

Solifenacin (1 x 10 mg) From measured data Geometric Mean Arithmetic Mean (CV %)				
Parameter	Test*	Reference <sup>†</sup>	% Ratio of Geometric Means	90% Confidence Interval
AUC <sub>0-72</sub> (ng·h/mL)	631.59 659.46 (32.00)	606.64 637.17 (35.00)	104.11	99.09 - 109.39
AUC <sub>∞</sub> (ng·h/mL)	995.39 1085.89 (48.60)	937.39 1032.96 (53.40)	106.19	99.08 - 113.80
C <sub>max</sub> (ng/mL)	18.28 18.60 (26.30)	18.14 18.75 (27.20)	100.78	94.35 - 107.64
T <sub>max</sub> <sup>§</sup> (h)	6.00 (3.00 - 7.50)	6.50 (4.00 - 10.07)		
T <sub>1/2</sub> <sup>ε</sup> (h)	51.21 (32.00)	48.70 (28.70)		

\* Solifenacin Succinate Tablets (solifenacin succinate) 10 mg (MDA inc., Canada)

<sup>†</sup> VESICARE<sup>®</sup> (solifenacin succinate) 10 mg Tablets of Astellas Pharma Canada Inc., were purchased in Canada

<sup>§</sup> Expressed as the median (range)

<sup>ε</sup> Expressed as the arithmetic mean (CV%) only

## Study demographics and trial design

**Table 5: Summary of patient demographics in pivotal clinical trials**

Study #	Trial design	Dosage, route of administration and duration	Study subjects (n)	Mean age	Gender (%)															
905-CL-015	Randomized, double-blind, placebo-controlled, parallel-group, fixed dose	Placebo, 5 & 10 mg solifenacin and 4 mg tolterodine 12 week	Total :1077 Placebo: 267 Solifenacin 5mg: 279, 10mg: 268, Tolterodine: 263	Placebo: 58 Solifenacin 5mg: 58 10mg: 57 Tolterodine: 57	<table border="0"> <tr> <td></td> <td><u>F</u></td> <td><u>M</u></td> </tr> <tr> <td>Placebo:</td> <td>76</td> <td>24</td> </tr> <tr> <td>Solifenacin 5mg:</td> <td>73</td> <td>27</td> </tr> <tr> <td>10mg:</td> <td>71</td> <td>29</td> </tr> <tr> <td>Tolterodine</td> <td>80</td> <td>20</td> </tr> </table>		<u>F</u>	<u>M</u>	Placebo:	76	24	Solifenacin 5mg:	73	27	10mg:	71	29	Tolterodine	80	20
	<u>F</u>	<u>M</u>																		
Placebo:	76	24																		
Solifenacin 5mg:	73	27																		
10mg:	71	29																		
Tolterodine	80	20																		
905-CL-018	"	Placebo, 5 & 10 mg solifenacin 12 week	Total: 907 Placebo: 301 5mg: 299 10mg: 307	Placebo: 56 5mg: 55 10mg: 56	<table border="0"> <tr> <td>Placebo:</td> <td>81</td> <td>19</td> </tr> <tr> <td>5mg:</td> <td>83</td> <td>17</td> </tr> <tr> <td>10mg:</td> <td>82</td> <td>18</td> </tr> </table>	Placebo:	81	19	5mg:	83	17	10mg:	82	18						
Placebo:	81	19																		
5mg:	83	17																		
10mg:	82	18																		
905-CL-013	"	Placebo, 10 mg solifenacin 12 week	Total: 672 Placebo: 332 10mg: 340	Placebo: 59 10mg: 58	<table border="0"> <tr> <td>Placebo:</td> <td>83</td> <td>17</td> </tr> <tr> <td>10mg:</td> <td>80</td> <td>20</td> </tr> </table>	Placebo:	83	17	10mg:	80	20									
Placebo:	83	17																		
10mg:	80	20																		
905-CL-014	"	"	Total: 634 Placebo: 316 10mg: 318	Placebo: 60 10mg: 60	<table border="0"> <tr> <td>Placebo:</td> <td>82</td> <td>18</td> </tr> <tr> <td>10mg:</td> <td>83</td> <td>17</td> </tr> </table>	Placebo:	82	18	10mg:	83	17									
Placebo:	82	18																		
10mg:	83	17																		

Solifenacin succinate was evaluated in four twelve-week, double-blind, randomized, placebo-controlled, parallel group, multicenter clinical trials for the treatment of overactive bladder in patients having symptoms of urinary frequency, urgency and/or urge or mixed incontinence (with a predominance of urge) [Table 5]. Study 015 also included a tolterodine group. Entry criteria required that patients have symptoms of overactive bladder for  $\geq 3$  months duration. These studies involved 3027 patients (1811 on solifenacin succinate and 1216 on placebo), and approximately 90% of these patients completed the 12-week studies. Two of the four studies evaluated the 5 and 10 mg solifenacin succinate doses and the other two evaluated only the 10 mg dose. All patients completing the 12-week studies were eligible to enter an open label, long term extension study and 81% of patients enrolling completed the additional 40-week treatment period. The majority of patients were Caucasian (93%) and female (80%) with a mean age of 58 years.

The primary endpoint in all four trials was the mean change from baseline to 12 weeks in number of micturations/24 hours. Secondary endpoints included mean change from baseline to 12 weeks in number of incontinence episodes/24 hours, and mean volume voided per micturition. The efficacy of solifenacin succinate was similar across patient age and gender. The mean reduction in the number of micturations per 24 hours was significantly greater with solifenacin succinate 5 mg (2.3;  $p < 0.001$ ) and solifenacin succinate 10 mg (2.7;  $p < 0.001$ ) compared to placebo, (1.4).

The mean reduction in the number of incontinence episodes per 24 hours was significantly greater with solifenacin succinate 5 mg (1.5;  $p < 0.001$ ) and solifenacin succinate 10 mg (1.8;  $p < 0.001$ ) treatment groups compared to placebo (1.1). The mean increase in the volume voided per micturition was significantly greater with solifenacin succinate 5 mg

(32.3 mL; p<0.001) and solifenacin succinate 10 mg (42.5 mL; p<0.001) compared with placebo (8.5 mL).

The results for the primary and secondary endpoints in the four individual 12-week clinical studies of solifenacin succinate are reported in Tables 6 through 9.

**Table 6: Mean Change from Baseline to Endpoint for Solifenacin Succinate (5 mg and 10 mg daily) and Placebo: 905-CL-015**

Parameter	Placebo (N=253) Mean (SE)	Solifenacin Succinate 5mg (N=266) Mean (SE)	Solifenacin Succinate 10mg (N=264) Mean (SE)	Tolterodine (N=250) Mean (SE)
Urinary Frequency (Number of Micturitions / 24 hours)*				
Baseline	12.2 (0.26)	12.1 (0.24)	12.3 (0.24)	12.1
Reduction	1.2 (0.21)	2.2 (0.18)	2.6 (0.20)	1.9
P value vs. placebo		<0.001	<0.001	<0.05
Number of Incontinence Episodes / 24 hours**				
Baseline	2.7 (0.23)	2.6 (0.22)	2.6 (0.23)	2.3
Reduction	0.8 (0.18)	1.4 (0.15)	1.5 (0.18)	1.1
P value vs. placebo		<0.01	<0.01	N.S.
Volume Voided per micturition [mL]**				
Baseline	143.8 (3.37)	149.6 (3.35)	147.2 (3.15)	147.0
Increase	7.4 (2.28)	32.9 (2.92)	39.2 (3.11)	24.4
P value vs. placebo		<0.001	<0.001	<0.001

\*Primary endpoint

\*\*Secondary endpoint

**Table 7: Mean Change from Baseline to Endpoint for Solifenacin Succinate (5 mg and 10 mg daily) and Placebo: 905-CL-018**

Parameter	Placebo (N=281) Mean (SE)	Solifenacin Succinate 5mg (N=286) Mean (SE)	Solifenacin Succinate 10mg (N=290) Mean (SE)
Urinary Frequency (Number of Micturitions / 24 hours)*			
Baseline	12.3 (0.23)	12.1 (0.23)	12.1 (0.21)
Reduction	1.7 (0.19)	2.4 (0.17)	2.9 (0.18)
P value vs. placebo		<0.001	<0.001
Number of Incontinence Episodes / 24 hours**			
Baseline	3.2 (0.24)	2.6 (0.18)	2.8 (0.20)
Reduction	1.3 (0.19)	1.6 (0.16)	1.6 (0.18)
P value vs. placebo		<0.01	0.016
Volume Voided per micturition [mL]**			
Baseline	147.2 (3.18)	148.5 (3.16)	145.9 (3.42)
Increase	11.3 (2.52)	31.8 (2.94)	36.6 (3.04)
P value vs. placebo		<0.001	<0.001

\*Primary endpoint

\*\*Secondary endpoint

**Table 8: Mean Change from Baseline to Endpoint for Solifenacin Succinate (10 mg daily) and Placebo: 905-CL-013**

Parameter	Placebo (N=309) Mean (SE)	Solifenacin Succinate 10mg (N=306) Mean (SE)
Urinary Frequency (Number of Micturitions / 24 hours)* Baseline Reduction P value vs. placebo	11.5 (0.18) 1.5 (0.15)	11.7 (0.18) 3.0 (0.15) <0.001
Number of Incontinence Episodes / 24 hours** Baseline Reduction P value vs. placebo	3.0 (0.20) 1.1 (0.16)	3.1 (0.22) 2.0 (0.19) <0.001
Volume Voided per micturition [mL]** Baseline Increase P value vs. placebo	190.3 (5.48) 2.7 (3.15)	183.5 (4.97) 47.2 (3.79) <0.001

\*Primary endpoint

\*\*Secondary endpoint

**Table 9: Mean Change from Baseline to Endpoint for Solifenacin Succinate (10 mg daily) and Placebo: 905-CL-014**

Parameter	Placebo (N=295) Mean (SE)	Solifenacin Succinate 10mg (N=298) Mean (SE)
Urinary Frequency (Number of Micturitions / 24 hours)* Baseline Reduction P value vs. placebo	11.8 (0.18) 1.3 (0.16)	11.5 (0.18) 2.4 (0.15) <0.001
Number of Incontinence Episodes / 24 hours** Baseline Reduction P value vs. placebo	2.9 (0.18) 1.2 (0.15)	2.9 (0.17) 2.0 (0.15) <0.001
Volume Voided per micturition [mL]** Baseline Increase P value vs. placebo	175.7 (4.44) 13.0 (3.45)	174.1 (4.15) 46.4 (3.73) <0.001

\*Primary endpoint

\*\*Secondary endpoint

## DETAILED PHARMACOLOGY

### Animal Pharmacology

Solifenacin is a competitive muscarinic receptor antagonist. In radioligand binding assay, solifenacin has a high affinity for the human muscarinic M<sub>3</sub> receptor, with an affinity constant (K<sub>i</sub> value) of 9.9 nM. It has marginal selectivity for the muscarinic M<sub>3</sub> receptor over the M<sub>1</sub> receptor (2.4 times) and moderate selectivity for the muscarinic M<sub>3</sub> receptor over the M<sub>2</sub> receptor (12 times). Solifenacin does not show any affinity for various other receptors and ion channels except for the

sigma receptor and sodium channel site 2, but the affinity for these sites are 100- fold or more lower than that for the muscarinic M<sub>3</sub> receptor. In strips of rat and guinea pig urinary bladder, solifenacin competitively antagonized carbachol-induced contractile responses in a concentration-dependent manner. In anesthetized rats, solifenacin increased maximum bladder capacity and decreased maximum intravesical pressure in a dose-dependent manner.

In studies to assess the tissue selectivity of solifenacin using cells isolated from rats and monkeys, solifenacin inhibited carbachol-induced increases in cytosolic-free calcium ion levels ([Ca<sup>2+</sup>]<sub>i</sub>) more potently in bladder smooth muscle cells than in salivary gland cells. Further, the bladder selectivity of solifenacin in monkeys was significantly greater than that of other antimuscarinics as illustrated by selectivity ratios (bladder/salivary gland) of 2.1, 0.51, 0.65 and 0.46 for solifenacin, oxybutynin, tolterodine and darifenacin, respectively. In anesthetized mice, solifenacin did not inhibit carbachol-induced salivary secretion at doses which potently inhibited carbachol-induced increases in intravesical pressure. Moreover, intravenously administered solifenacin was significantly more potent in inhibiting carbachol-induced increases in intravesical pressure (ID<sub>30</sub> = 0.023 mg/kg) than in inhibiting salivary secretion (ID<sub>30</sub> = 0.15 mg/kg) in anesthetized rats, with the bladder selectivity of 6.5. The bladder selectivity of tolterodine estimated from its potency to inhibit urinary bladder and salivary gland was 2.4, whereas oxybutynin (1.1) and darifenacin (1.2) did not show functional selectivity for urinary bladder.

Effects on the respiratory and cardiovascular system have been investigated. In the electrophysiological studies, solifenacin and tolterodine inhibited the potassium current in Chinese hamster ovary (CHO) cells expressing the *human ether-a-go-go-related gene* (hERG) using a whole-cell patch clamp technique, with IC<sub>50</sub> values of 0.27 and 0.0089 μM, respectively. The IC<sub>50</sub> value for solifenacin is 78 times higher than the maximum unbound human plasma concentration (C<sub>max, u</sub>) at the maximum recommended human dose (MRHD). However, solifenacin at concentrations up to 0.3 μM (87 times higher than the C<sub>max, u</sub> at the MRHD) had no effect on action potential parameters in dog Purkinje fibers and guinea pig papillary muscles. Further, *in vivo* studies using anesthetized dogs demonstrated that intravenous administered solifenacin increased respiration rate, decreased blood pressure and left ventricular pressure and prolonged PR interval at 1 mg/kg or higher doses, however it had no effect on the QT interval at doses up to 3 mg/kg. At a dose of 10 mg/kg, complete atrioventricular block was observed in 4 of 5 animals and one of the 4 animals died.

Effects of orally administered solifenacin on the central nervous system, pupil size, gastrointestinal system and urinary excretion have been investigated. Solifenacin did not markedly affect the behavior of mice at doses up to 30 mg/kg. In mice and rabbits, solifenacin induced mydriasis, which is attributed to the primary action on muscarinic receptor, at 10 mg/kg or higher doses. Solifenacin at 3 mg/kg or higher doses induced emesis in dogs. However, solifenacin at doses up to 30 mg/kg did not affect gastrointestinal transit in mice and was not irritating to the gastric mucosa of rats. Solifenacin at doses up to 30 mg/kg had no effects on urine volume or electrolyte excretion in saline-loaded rats.

## TOXICOLOGY

**Table 10: Key Toxicological Findings in Experimental Animals with Solifenacin Succinate and Respective Multiples of Human Exposure at the Maximum Recommended Therapeutic Dose**

Species/ Duration	Key Findings	Dose (mg/kg)	Multiples of Systemic Exposure Compared to Clinical	
			C <sub>max</sub>	AUC
<b>Repeat-Dose Toxicity</b>				
Mouse, 13 weeks	Underactivity, ataxia, tremor, prostration, Death	250 (male)	24.5	12.9
		250 (female)	23.1	13.1
Mouse, 26 weeks	Injuries in the mucosa of the small intestine	100 (male)	8.4	3.4
		100 (female)	7.0	2.4
Rat, 4 weeks	Decreased body weight gain and food Consumption	25 (male)	<1	<1
		25 (female)	<1	<1
Rat, 26 weeks	Wet/yellow staining on perigenital area, high ALP and phosphorus, low ALT and cholesterol	10 (male)	<1	<1
		10 (female)	<1	<1
Dog, 4 weeks	Salivation, vomiting, tremor, decreased locomotor activity, decreased body weight and food consumption, ECG changes	30 (male)	19.1	12.1
		30 (female)	11.8	8.1
Dog, 13 weeks	Salivation, vomiting, ataxia, prostration, tremor, convulsion, abnormal gait/posture, abnormal respiration, ECG changes	18 (male)	5.3	2.5
		Low uterine weight, uterine immaturity	3 (female)	<1
Dog, 52 weeks	Salivation, vomiting, ECG changes	20 (male)	11.8	6.0
		20 (female)	9.9	5.7
<b>Genotoxicity</b>				
Rat, Single	No clastogenicity	1000 (male)	8.2	4.9
<b>Carcinogenicity</b>				
Mouse, 2 years	No carcinogenicity	200 (male)	11.9	5.0
		200 (female)	14.4	9.0
Rats, 2 years	No carcinogenicity	20 (male)	<1	<1
		15 (female)	<1	<1
<b>Reproductive and developmental Toxicity</b>				
Mouse, Pregnant	Low maternal and fetal body weights, an increase in peripartum pup mortality, delays in pup development	100 (female)	11.9	3.6
Rabbit, Pregnant	No effects on embryo-fetal development	50 (female)	4.9	1.8
<b>Human PK data at the proposed maximum recommended therapeutic dose (10 mg/day) for comparison:</b>				
Human (steady state)		10	1	1

## Single-Dose Toxicity

Single-dose toxicity studies were conducted in rats and dogs. The approximate lethal doses were considered to be 1000 mg/kg for male rats, 500 mg/kg for female rats and 60 mg/kg for dogs. The results are shown in Table 11.

**Table 11: Results of Single-Dose Toxicity Studies with Solifenacin Succinate**

Species	Route	Dose (mg/kg/day)	No. of Animals	Duration	Findings
Rat (F344)	Oral (gavage)	Males: 0, 250, 500, 1000, 2000  Females: 0, 125, 250, 500, 1000	5/sex	1 Day	$\geq 125$ : Mydriasis. $\geq 250$ : Body weight loss or decreased body weight gain in males and females. Decreased locomotor activity in females. 500 : 1 female died. $\geq 500$ : Decreased locomotor activity in males. Small thymus in females. 1000 : 2 males and 4 females died. Prone position and ocular discharge in males and females. Salivation and chronic convulsion in females. 2000 : 5 males died. Prone position, lateral position, salivation, twitching, clonic convulsion, edema and necrosis in the glandular mucosa of the stomach.
Dog (Beagle)	Oral (capsule)	0, 10, 30, 60	1/sex	1 Day	$\geq 10$ : Vomiting and retching in the male and female. 30 : Mucous stool in the male. 60 : The female died. Twitching, mydriasis, abnormal gait, urinary incontinence and tonic convulsion in the female that died.

## Repeat-Dose Toxicity

Repeat-dose toxicity studies were conducted in mice, rats and dogs. Based on the results of metabolism studies, it became clear that the mouse, dog and human have a similar metabolic profile. Thus the mouse and dog are considered to be appropriate species for the toxicological evaluation of solifenacin succinate. The results are summarized in Table 12.

**Table 12: Results of Repeat-Dose Toxicity Studies with Solifenacin Succinate**

Species, Strain, Number/Sex	Dose (mg/kg/day) Route Duration of Treatment	Findings (at mg/kg/day)	No-adverse-effect-level (NOAEL) (mg/kg/day)
<p>Mouse (CD-1) 12 (main)</p> <p>6 (recovery)</p>	<p>0, 30, 100, 250, 400 Oral (gavage) 13 weeks</p> <p>0, 250, 400 Oral (gavage) 13 weeks followed by 5 weeks recovery</p>	<p>≥30 : Mydriasis in males. 250 : 1 female died. ≥250 : Underactivity, ataxia, tremor and prostration in males. Mydriasis, low submandibular gland and spleen weights in females. 400 : 5 males and 6 females died. Hunched posture, piloerection and abnormal respiration in males and females. Decreased body weight gain, low triglyceride and high relative liver weight in males. Underactivity, ataxia, tremor, prostration, convulsion, low glucose, high relative kidney weight, follicular degeneration, reduced corpora lutea and uterine atrophy in females. All changes reversed during the recovery period.</p>	100
<p>Mouse (CD-1) 15</p>	<p>0, 10, 30, 100, 200 Oral (gavage) 26 weeks</p>	<p>100 : Inflammation of the ileum in males and females. Epithelial regeneration and erosion of the duodenum in females. 200 : Pigment deposition in the Harderian gland, epithelial regeneration of the duodenum, ulcer of the ileum in males and females. Low total protein and albumin, mobilization of Kupffer cells in the liver, ulcer and inflammation of the jejunum in males. High plasma sodium, low plasma potassium and erosion of the duodenum in females.</p>	30
<p>Rat (F344) 12 (main)</p> <p>6 (recovery)</p>	<p>0, 5, 10, 25, 50 Oral (gavage) 4 weeks</p> <p>0, 25, 50 Oral (gavage) 4 weeks followed by 4 weeks recovery</p>	<p>≥10 : Mydriasis and abnormal respiratory sound in males and females. Salivation in males. ≥25 : Decreased food consumption in males and females. Decreased body weight gain in males. Salivation, soiled fur around the urethral orifice and a soiled coat around the nose and mouth in females. 50 : 1 female died. Decreased body weight gain and water consumption in females. All changes recovered or tended to recover during the recovery period.</p>	10

**Table 12: Results of Repeat-Dose Toxicity Studies with Solifenacin Succinate (Continued)**

Species, Strain, Number/Sex	Dose (mg/kg/day) Route Duration of Treatment	Findings (at mg/kg/day)	NOAEL (mg/kg/Day)
Rat (F344) 15-18 (main)  6 (recovery)	Male: 0, 3, 10, 30, 100/75* Female: 0, 3, 10, 30, 60/45* Oral (gavage) 26 weeks  Male: 0, 30, 100/75* Female: 0, 30, 60/45* Oral (gavage) 26 weeks followed by 10 weeks recovery  *reduced from week 14	≥3 : Mydriasis in females. ≥10 : Salivation and wet/yellow staining on perigenital area in males and females. Mydriasis in males. High ALP and phosphorus, low ALT and cholesterol in females. 30 : 5 females died. ≥30 : Decreased body weight gain and high adrenal weight in males and females. Decreased food consumption, high ALP and low ALT in males. Respiratory noises, high WBC, neutrophil, lymphocyte and urine pH, low AST, phospholipid and total protein, follicular degeneration and uterine atrophy in females. 60/45 : 15 females died. Piloerection, decreased food consumption, high platelet, low glucose and albumin. 100/75 : 1 male died. Respiratory noises, high phosphorus, low AST, cholesterol, triglyceride, phospholipid, urine volume, urine potassium and spleen weights. All changes recovered or tended to recover during the recovery period.	3
Dog (Beagle) 3	0, 1, 3, 10, 30 Oral (capsule) 4 weeks	≥10 : Vomiting in males and females. 30 : Mydriasis, salivation, decreased locomotor activity, decreased body weight and food consumption, ECG changes (increased amplitude of P-wave, prolongation of P-wave, PR, QRS, QT and QTc intervals) and thymic involution in males and females. Tremor and high kidney weight, surface mucous cell swelling in the fundic region of the stomach in males.	3
Dog (Beagle) 3-4	0, 3, 6, 12, 25/18* Oral (capsule) 13 weeks *reduced from week 7	≥3 : Low uterine weight and uterine immaturity in females. 25/18 : Salivation, vomiting, ataxia, prostration, tremor, convulsion, abnormal gait/posture, abnormal respiration and ECG changes (prolongation of P-wave, PR and QTc intervals) in males and females. Transiently high hematocrit and hemoglobin in males and urea nitrogen in females.	Male : 12 Female : Not established
Dog (Beagle) 4	0, 3, 6, 12, 20 Oral (capsule) 52 weeks	20 : Salivation, vomiting, ECG changes (prolongation of P-wave, PR, QRS, QT and QTc intervals) in males and females. Perivascular lymphoid accumulation, edema, transitional cell hyperplasia and vacuolation in the submucosa or submucosa/muscle layer in the urinary bladder in females.	12

## Genotoxicity

The genotoxic potential of solifenacin succinate was evaluated in both *in vitro* and *in vivo* studies. Solifenacin succinate was not mutagenic or clastogenic in the *in vitro* and *in vivo* studies. The results are shown in Table 13.

**Table 13: Results of Genotoxicity Studies with Solifenacin Succinate**

Study Type	Species or Cell Type	Dose Levels	Results
<i>In vitro</i> bacterial mutagenicity	<i>S. typhimurium</i> TA98, TA100, TA1535, TA1537 <i>E. coli</i> WP2uvrA	0, 5-1250 µg/plate	Negative
<i>In vitro</i> clastogenicity	Human blood lymphocytes	0, 20.97-160 µg/mL	Negative
<i>In vivo</i> clastogenicity	Bone marrow erythrocytes of F344 rats	0, 250, 500, 1000 mg/kg	Negative

## Carcinogenicity

The carcinogenic potential of solifenacin succinate was evaluated in mice and rats. Administration of solifenacin succinate for up to 104 weeks in mice and rats did not produce significant increases in any tumor type in either males or females. The results are shown in Table 14.

**Table 14: Results of Carcinogenicity Studies with Solifenacin Succinate**

Species, Strain Number/Sex	Dose (mg/kg/day) Duration of Treatment	Results
Mouse (CD-1) 70	0, 10, 30, 100, 200 Oral (gavage) 2 years	≥100 : Increased mortality, low body weight and decreased food consumption in males and females. No increases in any type of tumor in males or females.
Rat (F344) 60	Males: 0, 3, 10, 20 Females: 0, 3, 7.5, 15 Oral (gavage) 2 years	≥10 : Low body weight in males and females. 15 : Increased mortality in females. 20 : Decreased food consumption in males. No increases in any type of tumor in males or females.

## Reproductive and Developmental Toxicity

Reproductive and developmental toxicity studies were conducted in mice, rats and rabbits to assess the effects of solifenacin succinate on fertility and early embryonic development, embryo-fetal development and prenatal/postnatal development, including maternal function. The results are summarized in Table 15.

**Table 15: Results of Reproductive and Developmental Toxicity Studies with Solifenacin Succinate**

Study Type	Species, Strain, Number /Sex	Doses (mg/kg/day) Route Duration of Treatment	Important Findings (at mg/kg/day)	No-adverse-effect-level (NOAEL) (mg/kg/Day)
Segment I Fertility and early embryonic development	Mouse (CD-1) 24 males and 24 females	0, 30, 100, 250 Oral (gavage) Males: 4 weeks prior to and during mating Females: 2 weeks prior to and during mating through Gestation day 6	≥100 : Decreased food consumption in males. 250 : 3 males and 2 females died. No adverse effects on fertility of males or females, or early embryonic development.	F <sub>0</sub> males: 30 F <sub>0</sub> females: 100 F <sub>1</sub> litters: 250
	Rat (SD) 20 males	0, 5, 15, 50 Oral (gavage) 4 weeks prior to and during mating	50 : Mydriasis. No adverse effects on fertility or early embryonic development.	F <sub>0</sub> males: 50 F <sub>1</sub> litters: 50
	Rat (SD) 20 females	0, 15, 50, 100 Oral (gavage) 2 weeks prior to and during mating through Gestation day 7	≥15 : Mydriasis. 100 : Decreased body weight gain and food consumption. No adverse effects on fertility or early embryonic development.	F <sub>0</sub> females: 50 F <sub>1</sub> litters: 100
Segment II Embryo-fetal development	Mouse (CD-1) 24 females	0, 30, 100, 250 Oral (gavage) Gestation day 6-15	≥30 : Decreased maternal food consumption. ≥100 : Decreased maternal body weight gain and low fetal body weight. 250 : 5 females died. An increase in the incidence of fetuses with cleft palate.	F <sub>0</sub> females: <30 F <sub>1</sub> litters: 30
	Mouse (CD-1) 24 females (Additional study)	0, 250 Oral (gavage) Gestation day 6-9, 10-15, 6-15	250 : No increase in the incidence of fetuses with cleft palate in any dosing period.	F <sub>0</sub> females: <250 F <sub>1</sub> litters: 250
	Rat (SD) 20 females	0, 5, 15, 50 Oral (gavage) Gestation day 7-17	≥15 : Mydriasis. 50 : No maternal toxicity or adverse effects on embryo-fetal development.	F <sub>0</sub> females: 50 F <sub>1</sub> litters: 50
	Rabbit (NZW) 20 females	0, 10, 25, 50 Oral (gavage) Gestation day 6-18	50 : Decreased maternal food consumption, no adverse effects on embryo-fetal development.	F <sub>0</sub> females: 25 F <sub>1</sub> litters: 50
Segment III Prenatal and postnatal development	Mouse (CD-1) 24-30 females	0, 30, 100, 250 Oral (gavage) Gestation day 6 to Lactation day 20	100 : 3 females died. ≥100 : Decreased maternal food consumption, increased peripartum pup mortality, low pup body weight, delays in eye opening and vaginal patency. 250 : 9 females died. Increased postpartum pup mortality, delays in surface righting and pinna unfolding.	F <sub>0</sub> females: 30 F <sub>1</sub> males: 30 F <sub>1</sub> females: 30

## **Local Tolerance and Other Studies**

Solifenacin succinate was irritating to the eyes of rabbits. The severity of ocular irritation was dose-dependent. Ocular findings were reduced if the eyes were rinsed immediately after exposure. Solifenacin succinate did not cause dermal or vascular/perivascular irritation in rabbits. Solifenacin succinate was not antigenic in the delayed type skin reaction assay in guinea pigs and did not induce hemolysis in human peripheral blood.

## REFERENCES

1. VESICARE<sup>®</sup> (solifenacin succinate) 5 mg and 10 mg Tablets Product Monograph by Astellas Pharma Canada Inc. (Control No. 165886); Date of Revision: September 19, 2013.

**PART III: CONSUMER INFORMATION****Pr Solifenacin Succinate Tablets**

Solifenacin succinate

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

**ABOUT THIS MEDICATION****What the medication is used for:**

Solifenacin Succinate Tablets is used in the treatment of overactive bladder in adults with symptoms of frequent and urgent need to urinate (urinary frequency, urinary urgency) with urine leakage (urge urinary incontinence).

**What it does:**

Solifenacin Succinate Tablets is a urinary antispasmodic medication that helps to relax the smooth muscle of the bladder which leads to reduce the symptoms caused by overactive bladder.

**When it should not be used:**

You should not take Solifenacin Succinate Tablets:

- If you are not able to empty your bladder (also called urinary retention).
- If you have End-Stage Kidney Disease and require dialysis.
- If you are not able to empty your stomach (also called gastroparesis).
- If you have narrow-angle glaucoma (high pressure and pain in the eyes).
- If you are allergic to solifenacin succinate or any of the other ingredients in Solifenacin Succinate Tablets. See ‘What the non-medicinal ingredients are’

**What the medicinal ingredient is:**

The medicinal ingredient in Solifenacin Succinate Tablets is ‘solifenacin succinate’.

**What the non-medicinal ingredients are:**

Each Solifenacin Succinate Tablet contains the following inert ingredients: sodium stearyl fumarate, lactose monohydrate, pvp k30 (povidon), pregelatinised starch, purified water, hpmc 2910 / hypromellose, talc, macrogol, titanium dioxide with iron oxide yellow (5 mg Solifenacin Succinate Tablets) or iron oxide red (10 mg Solifenacin Succinate Tablets).

**What dosage form it comes in:**

Solifenacin Succinate Tablets is available in 5 and 10 mg tablets.

**WARNINGS AND PRECAUTIONS**

Before you use Solifenacin Succinate Tablets, talk to your doctor or pharmacist if you:

- Have stomach problems affecting passage and digestion of food, or severe constipation.
- Have glaucoma.
- Have difficulty urinating, or weak urine stream.
- Have heart disease
- Have a rare heart problem called QT/QTc prolongation or family history of QT/QTc prolongation.
- Have kidney or liver problems.
- Have reduced ability to sweat.
- Are pregnant or planning to become pregnant. Women who might get pregnant should use an effective birth control method while taking Solifenacin Succinate Tablets.
- Are breastfeeding or plan to breastfeed.

Solifenacin Succinate Tablets should not be given to children or adolescents.

Solifenacin Succinate Tablets may cause blurred vision and drowsiness. Do not drive a car or operate any machinery, or engage in any activities that requires accurate vision and full attention.

In hot weather, Solifenacin Succinate Tablets can cause heat prostration (fever and heat stroke due to decreased sweating). Do not stay long in a hot environment while taking the drug. If you have any symptoms of heat prostration, keep yourself cool and drink a lot of water.

Angioedema (the symptoms include swelling of face or tongue, difficulty breathing) and anaphylactic reactions (the symptoms include hives, difficulty breathing, abdominal cramps, rapid heartbeat and feeling faint), which could be life-threatening, have been reported in some patients taking solifenacin succinate. If you experience any of these symptoms, stop taking Solifenacin Succinate Tablets and see your doctor immediately.

**INTERACTIONS WITH THIS MEDICATION**

Before and while taking Solifenacin Succinate Tablets you should tell your doctor about your other medications, even if the medicine you bought without prescription including vitamins and herbal supplements.

Solifenacin succinate is known to have drug interactions with the following drugs: Drug known to prolong the QT/QTc interval and/or cause torsade de pointes, drugs that decrease electrolyte levels, anticholinergic drugs, drugs that stimulate the motility of the gut such as metoclopramide, ketoconazole, clarithromycin, erythromycin, diclofenac, nefazodone, verapamil.

Drinking grapefruit juice with Solifenacin Succinate Tablets may increase your blood level of solifenacin.

**PROPER USE OF THIS MEDICATION**

**Usual Dose:**

5 mg daily. The daily dose may be increased to 10 mg following consultation with your doctor. Swallow the tablet whole with water.

Solifenacin Succinate Tablets tablets can be taken with or without food.

**Over dose:**

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.

**Missed Dose:**

If a dose is missed, the next tablet should be taken as planned. Doses should not be doubled to make up for a missed dose.

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

The following side effects have been reported in clinical trials with solifenacin succinate:

Most common side effects: dry mouth and constipation  
Common side effects: dry eyes, urinary retention, blurred vision, nausea, abdominal pain, indigestion, urinary tract infection.

The following sides effects have been reported with the use of solifenacin succinate in worldwide post-marketing experience, although the frequency of events or a causal relationship with solifenacin succinate could not always be confirmed :

acid reflux, angioedema (swelling of face or tongue, difficulty breathing), anaphylactic reactions (hives, difficulty breathing, abdominal cramps, rapid heartbeat and feeling faint), decreased appetite, delirium, dizziness, fast or irregular heartbeat, feeling sleepy, glaucoma, hallucination, headache, high potassium levels, hypersensitivity reactions, intestinal blockage, itchiness, kidney ailment, liver problems, muscle weakness, voice disorder, severe skin scaling and redness, itching (exfoliative dermatitis), severe skin rash, itchiness and fever (erythema multiforme), swelling in the lower limbs and vomiting.

Tell your doctor or pharmacist if you have any side effects while taking Solifenacin Succinate Tablets. This includes any side effects not listed above.

**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 seek immediate emergency medical attention
		Only if severe	In all cases	
Rare	Abdominal pain	✓		
	Constipation for more than 3 days		✓	
	Urinary retention		✓	
Very rare	Swelling of the face or tongue, difficulty breathing			✓
	Fast or irregular heartbeat			✓
	Anaphylactic reactions (severe allergic reactions)			✓

**HOW TO STORE IT**

Keep Solifenacin Succinate Tablets and all other medications out of the reach of children.

Store between 15°C – 30°C.

Do not keep medicine that is out of date or that you no longer need.

**REPORTING SUSPECTED SIDE EFFECTS**

You can report any suspected adverse reactions associated with the use of health products to the Canada Vigilance Program by one of the following 3 ways:

- Report online at [www.healthcanada.gc.ca/medeffect](http://www.healthcanada.gc.ca/medeffect)
- Call toll-free at 1-866-234-2345
- Complete a Canada Vigilance Reporting Form and:
  - Fax toll-free to 1-866-678-6789, or
  - Mail to: Canada Vigilance Program  
Health Canada  
Postal Locator 0701E  
Ottawa, ON  
K1A 0K9

Postage paid labels, Canada Vigilance Reporting Form and the adverse reaction reporting guidelines are available on the MedEffect™ Canada Web site at [www.healthcanada.gc.ca/medeffect](http://www.healthcanada.gc.ca/medeffect).

*NOTE: Should you require information related to the management of side effects, contact your health professional. The Canada Vigilance Program does not provide medical advice.*

**MORE INFORMATION**

This document plus the full product monograph, prepared for health professionals can be found by contacting MDA inc., at 1-855-819-0505.

This leaflet was prepared by MDA inc..

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