



## Ritalin LA<sup>®</sup>

(methylphenidate hydrochloride)  
extended-release capsules



Rx only

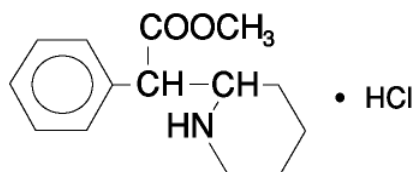
### Prescribing Information

## DESCRIPTION

Methylphenidate hydrochloride is a central nervous system (CNS) stimulant.

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules is an extended-release formulation of methylphenidate with a bi-modal release profile. Ritalin LA<sup>®</sup> uses the proprietary SODAS<sup>®</sup> (Spheroidal Oral Drug Absorption System) technology. Each bead-filled Ritalin LA capsule contains half the dose as immediate-release beads and half as enteric-coated, delayed-release beads, thus providing an immediate release of methylphenidate and a second delayed release of methylphenidate. Ritalin LA 10, 20, 30, and 40 mg capsules provide in a single dose the same amount of methylphenidate as dosages of 5, 10, 15, or 20 mg of Ritalin<sup>®</sup> tablets given b.i.d.

The active substance in Ritalin LA is methyl  $\alpha$ -phenyl-2-piperidineacetate hydrochloride, and its structural formula is



Methylphenidate hydrochloride USP is a white, odorless, fine crystalline powder. Its solutions are acid to litmus. It is freely soluble in water and in methanol, soluble in alcohol, and slightly soluble in chloroform and in acetone. Its molecular weight is 269.77.

**Inactive ingredients:** ammonio methacrylate copolymer, black iron oxide (10 and 40 mg capsules only), gelatin, methacrylic acid copolymer, polyethylene glycol, red iron oxide (10 and 40 mg capsules only), sugar spheres, talc, titanium dioxide, triethyl citrate, and yellow iron oxide (10, 30, and 40 mg capsules only).

## CLINICAL PHARMACOLOGY

### Pharmacodynamics

Methylphenidate hydrochloride, the active ingredient in Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules, is a central nervous system (CNS) stimulant. The mode of therapeutic action in Attention Deficit Hyperactivity Disorder (ADHD) is not known. Methylphenidate is thought to block the reuptake of norepinephrine and dopamine into the presynaptic neuron and increase the

release of these monoamines into the extraneuronal space. Methylphenidate is a racemic mixture comprised of the *d*- and *l*-threo enantiomers. The *d*-threo enantiomer is more pharmacologically active than the *l*-threo enantiomer.

## Pharmacokinetics

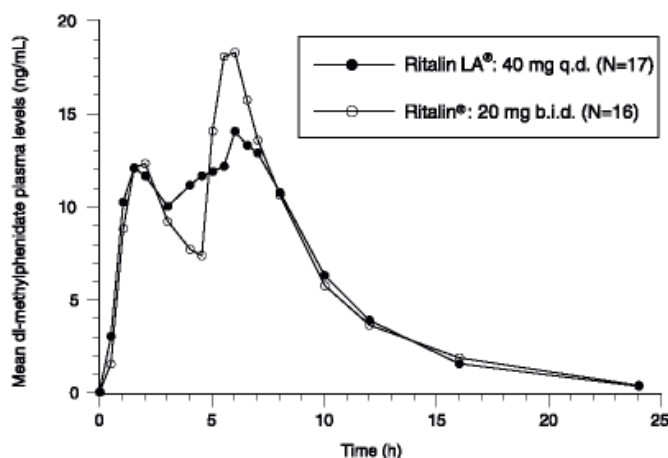
### Absorption

Ritalin LA produces a bi-modal plasma concentration-time profile (i.e., two distinct peaks approximately four hours apart) when orally administered to children diagnosed with ADHD and to healthy adults. The initial rate of absorption for Ritalin LA is similar to that of Ritalin tablets as shown by the similar rate parameters between the two formulations, i.e., initial lag time ( $T_{lag}$ ), first peak concentration ( $C_{max1}$ ), and time to the first peak ( $T_{max1}$ ), which is reached in 1-3 hours. The mean time to the interpeak minimum ( $T_{minip}$ ), and time to the second peak ( $T_{max2}$ ) are also similar for Ritalin LA given once daily and Ritalin tablets given in two doses 4 hours apart (see Figure 1 and Table 1), although the ranges observed are greater for Ritalin LA.

Ritalin LA given once daily exhibits a lower second peak concentration ( $C_{max2}$ ), higher interpeak minimum concentrations ( $C_{minip}$ ), and less peak and trough fluctuations than Ritalin tablets given in two doses given 4 hours apart. This is due to an earlier onset and more prolonged absorption from the delayed-release beads (see Figure 1 and Table 1).

The relative bioavailability of Ritalin LA given once daily is comparable to the same total dose of Ritalin tablets given in two doses 4 hours apart in both children and in adults.

**Figure 1. Mean plasma concentration time-profile of methylphenidate after a single dose of Ritalin LA<sup>®</sup> 40 mg q.d. and Ritalin<sup>®</sup> 20 mg given in two doses four hours apart**



**Table 1. Mean  $\pm$  SD and range of pharmacokinetic parameters of methylphenidate after a single dose of Ritalin LA<sup>®</sup> and Ritalin<sup>®</sup> given in two doses 4 hours apart**

Population	Children		Adult Males	
	Ritalin <sup>®</sup> 10 mg & 10 mg	Ritalin LA <sup>®</sup> 20 mg	Ritalin <sup>®</sup> 10 mg & 10 mg	Ritalin LA <sup>®</sup> 20 mg
N	21	18	9	8
$T_{lag}$ (h)	0.24 $\pm$ 0.44	0.28 $\pm$ 0.46	1.0 $\pm$ 0.5	0.7 $\pm$ 0.2

	0 - 1	0 - 1	0.7 - 1.3	0.3 - 1.0
$T_{max1}$ (h)	$1.8 \pm 0.6$	$2.0 \pm 0.8$	$1.9 \pm 0.4$	$2.0 \pm 0.9$
	1 - 3	1 - 3	1.3 - 2.7	1.3 - 4.0
$C_{max1}$ (ng/mL)	$10.2 \pm 4.2$	$10.3 \pm 5.1$	$4.3 \pm 2.3$	$5.3 \pm 0.9$
	4.2 - 20.2	5.5 - 26.6	1.8 - 7.5	3.8 - 6.9
$T_{minip}$ (h)	$4.0 \pm 0.2$	$4.5 \pm 1.2$	$3.8 \pm 0.4$	$3.6 \pm 0.6$
	4 - 5	2 - 6	3.3 - 4.3	2.7 - 4.3
$C_{minip}$ (ng/mL)	$5.8 \pm 2.7$	$6.1 \pm 4.1$	$1.2 \pm 1.4$	$3.0 \pm 0.8$
	3.1 - 14.4	2.9 - 21.0	0.0 - 3.7	1.7 - 4.0
$T_{max2}$ (h)	$5.6 \pm 0.7$	$6.6 \pm 1.5$	$5.9 \pm 0.5$	$5.5 \pm 0.8$
	5 - 8	5 - 11	5.0 - 6.5	4.3 - 6.5
$C_{max2}$ (ng/mL)	$15.3 \pm 7.0$	$10.2 \pm 5.9$	$5.3 \pm 1.4$	$6.2 \pm 1.6$
	6.2 - 32.8	4.5 - 31.1	3.6 - 7.2	3.9 - 8.3
$AUC_{(0-\infty)}$	$102.4 \pm 54.6$	$86.6 \pm 64.0^a$	$37.8 \pm 21.9$	$45.8 \pm 10.0$
(ng/mL x h-1)	40.5 - 261.6	43.3 - 301.44	14.3 - 85.3	34.0 - 61.6
$t_{1/2}$ (h)	$2.5 \pm 0.8$	$2.4 \pm 0.7^a$	$3.5 \pm 1.9$	$3.3 \pm 0.4$
	1.8 - 5.3	1.5 - 4.0	1.3 - 7.7	3.0 - 4.2

<sup>a</sup> N = 15

### ***Dose Proportionality***

After oral administration of Ritalin LA 20 mg and 40 mg capsules to adults there is a slight upward trend in the methylphenidate area under the curve (AUC) and peak plasma concentrations ( $C_{max1}$  and  $C_{max2}$ ).

### ***Distribution***

Binding to plasma proteins is low (10%-33%). The volume of distribution was  $2.65 \pm 1.11$  L/kg for d-methylphenidate and  $1.80 \pm 0.91$  L/kg for l-methylphenidate.

### ***Metabolism***

The absolute oral bioavailability of methylphenidate in children was  $22 \pm 8\%$  for d-methylphenidate and  $5 \pm 3\%$  for l-methylphenidate, suggesting pronounced presystemic metabolism. Biotransformation of methylphenidate by the carboxylesterase CES1A1 is rapid and extensive leading to the main, de-esterified metabolite  $\alpha$ -phenyl-2-piperidine acetic acid (ritalinic acid). Only small amounts of hydroxylated metabolites (e.g., hydroxymethylphenidate and hydroxyritalinic acid) are detectable in plasma. Therapeutic activity is principally due to the parent compound.

### ***Elimination***

In studies with Ritalin LA and Ritalin tablets in adults, methylphenidate from Ritalin tablets is eliminated from plasma with an average half-life of about 3.5 hours, (range 1.3 - 7.7 hours). In children the average half-life is about 2.5 hours, with a range of about 1.5 - 5.0 hours. The rapid half-life in both children and adults may result in unmeasurable concentrations between the morning and

mid-day doses with Ritalin tablets. No accumulation of methylphenidate is expected following multiple once a day oral dosing with Ritalin LA. The half-life of ritalinic acid is about 3-4 hours.

The systemic clearance is  $0.40 \pm 0.12$  L/h/kg for d-methylphenidate and  $0.73 \pm 0.28$  L/h/kg for l-methylphenidate. After oral administration of an immediate release formulation of methylphenidate, 78%-97% of the dose is excreted in the urine and 1%-3% in the feces in the form of metabolites within 48-96 hours. Only small quantities (<1%) of unchanged methylphenidate appear in the urine. Most of the dose is excreted in the urine as ritalinic acid (60%-86%), the remainder being accounted for by minor metabolites.

### ***Food Effects***

Administration times relative to meals and meal composition may need to be individually titrated.

When Ritalin LA was administered with a high fat breakfast to adults, Ritalin LA had a longer lag time until absorption began and variable delays in the time until the first peak concentration, the time until the interpeak minimum, and the time until the second peak. The first peak concentration and the extent of absorption were unchanged after food relative to the fasting state, although the second peak was approximately 25% lower. The effect of a high fat lunch was not examined.

There were no differences in the pharmacokinetics of Ritalin LA when administered with applesauce, compared to administration in the fasting condition. There is no evidence of dose dumping in the presence or absence of food.

For patients unable to swallow the capsule, the contents may be sprinkled on applesauce and administered (see DOSAGE AND ADMINISTRATION).

### ***Alcohol Effect***

Alcohol may exacerbate the adverse CNS effects of psychoactive drugs, including Ritalin. It is therefore advisable for patients to abstain from alcohol during treatment. An *in vitro* study was conducted to explore the effect of alcohol on the release characteristics of methylphenidate from the Ritalin LA® 40 mg capsule dosage form. At an alcohol concentration of 40% there was a 98% release of methylphenidate in the first hour. The results with the 40 mg capsule are considered to be representative of the other available capsule strengths.

### ***Special Populations***

**Age:** The pharmacokinetics of Ritalin LA was examined in 18 children with ADHD between 7 and 12 years of age. Fifteen of these children were between 10 and 12 years of age. The time until the between peak minimum, and the time until the second peak were delayed and more variable in children compared to adults. After a 20-mg dose of Ritalin LA, concentrations in children were approximately twice the concentrations observed in 18 to 35 year old adults. This higher exposure is almost completely due to the smaller body size and total volume of distribution in children, as apparent clearance normalized to body weight is independent of age.

**Gender:** There were no apparent gender differences in the pharmacokinetics of methylphenidate between healthy male and female adults when administered Ritalin LA.

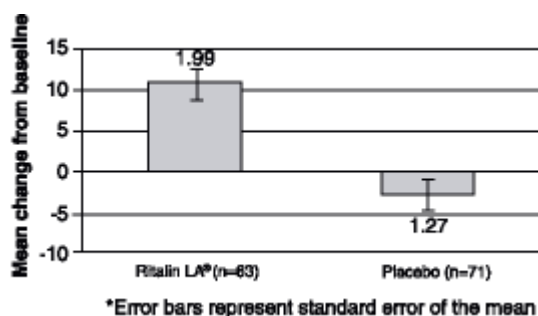
**Renal Insufficiency:** Ritalin LA has not been studied in renally-impaired patients. Renal insufficiency is expected to have minimal effect on the pharmacokinetics of methylphenidate since less than 1% of a radiolabeled dose is excreted in the urine as unchanged compound, and the major metabolite (ritalinic acid), has little or no pharmacologic activity.

**Hepatic Insufficiency:** Ritalin LA has not been studied in patients with hepatic insufficiency. Hepatic insufficiency is expected to have minimal effect on the pharmacokinetics of methylphenidate since it is metabolized primarily to ritalinic acid by nonmicrosomal hydrolytic esterases that are widely distributed throughout the body.

## CLINICAL STUDIES

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules was evaluated in a randomized, double-blind, placebo-controlled, parallel group clinical study in which 134 children, ages 6 to 12, with DSM-IV diagnoses of Attention Deficit Hyperactivity Disorder (ADHD) received a single morning dose of Ritalin LA in the range of 10-40 mg/day, or placebo, for up to 2 weeks. The doses used were the optimal doses established in a previous individual dose titration phase. In that titration phase, 53 of 164 patients (32%) started on a daily dose of 10 mg and 111 of 164 patients (68%) started on a daily dose of 20 mg or higher. The patient's regular schoolteacher completed the Conners ADHD/DSM-IV Scale for Teachers (CADS-T) at baseline and the end of each week. The CADS-T assesses symptoms of hyperactivity and inattention. The change from baseline of the (CADS-T) scores during the last week of treatment was analyzed as the primary efficacy parameter. Patients treated with Ritalin LA showed a statistically significant improvement in symptom scores from baseline over patients who received placebo. (See Figure 2.) This demonstrates that a single morning dose of Ritalin LA exerts a treatment effect in ADHD.

**Figure 2. CADS-T total subscale - Mean change from baseline\***



## INDICATIONS AND USAGE

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules is indicated for the treatment of Attention Deficit Hyperactivity Disorder (ADHD).

The efficacy of Ritalin LA in the treatment of ADHD was established in one controlled trial of children aged 6 to 12 who met DSM-IV criteria for ADHD (see CLINICAL PHARMACOLOGY).

A diagnosis of Attention Deficit Hyperactivity Disorder (ADHD; DSM-IV) implies the presence of hyperactive-impulsive or inattentive symptoms that caused impairment and were present before age 7 years. The symptoms must cause clinically significant impairment, e.g., in social, academic, or occupational functioning, and be present in two or more settings, e.g., school (or work) and at home.

The symptoms must not be better accounted for by another mental disorder. For the Inattentive Type, at least six of the following symptoms must have persisted for at least 6 months: lack of attention to details/careless mistakes; lack of sustained attention; poor listener; failure to follow through on tasks; poor organization; avoids tasks requiring sustained mental effort; loses things; easily distracted; forgetful. For the Hyperactive-Impulsive Type, at least six of the following symptoms must have persisted for at least 6 months: fidgeting/squirming; leaving seat; inappropriate running/climbing; difficulty with quiet activities; “on the go;” excessive talking; blurting answers; can’t wait turn; intrusive. The Combined Types requires both inattentive and hyperactive-impulsive criteria to be met.

### **Special Diagnostic Considerations**

Specific etiology of this syndrome is unknown, and there is no single diagnostic test. Adequate diagnosis requires the use not only of medical but of special psychological, educational, and social resources. Learning may or may not be impaired. The diagnosis must be based upon a complete history and evaluation of the child and not solely on the presence of the required number of DSM-IV characteristics.

### **Need for Comprehensive Treatment Program**

Ritalin LA is indicated as an integral part of a total treatment program for ADHD that may include other measures (psychological, educational, social) for patients with this syndrome. Drug treatment may not be indicated for all children with this syndrome. Stimulants are not intended for use in the child who exhibits symptoms secondary to environmental factors and/or other primary psychiatric disorders, including psychosis. Appropriate educational placement is essential and psychosocial intervention is often helpful. When remedial measures alone are insufficient, the decision to prescribe stimulant medication will depend upon the physician’s assessment of the chronicity and severity of the child’s symptoms.

### **Long-Term Use**

The effectiveness of Ritalin LA for long-term use, i.e., for more than 2 weeks, has not been systematically evaluated in controlled trials. Therefore, the physician who elects to use Ritalin LA for extended periods should periodically re-evaluate the long-term usefulness of the drug for the individual patient (see DOSAGE AND ADMINISTRATION).

## **CONTRAINDICATIONS**

### **Agitation**

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules is contraindicated in marked anxiety, tension, and agitation, since the drug may aggravate these symptoms.

### **Hypersensitivity to Methylphenidate**

Ritalin LA is contraindicated in patients known to be hypersensitive to methylphenidate or other components of the product.

### **Glaucoma**

Ritalin LA is contraindicated in patients with glaucoma.

## **Tics**

Ritalin LA is contraindicated in patients with motor tics or with a family history or diagnosis of Tourette's syndrome. (See ADVERSE REACTIONS.)

## **Monoamine Oxidase Inhibitors**

Ritalin LA is contraindicated during treatment with monoamine oxidase inhibitors, and also within a minimum of 14 days following discontinuation of treatment with a monoamine oxidase inhibitor (hypertensive crises may result).

## **WARNINGS**

### **Serious Cardiovascular Events**

#### ***Sudden Death and Pre-Existing Structural Cardiac Abnormalities or Other Serious Heart Problems***

##### ***Children and Adolescents***

Sudden death has been reported in association with CNS stimulant treatment at usual doses in children and adolescents with structural cardiac abnormalities or other serious heart problems. Although some serious heart problems alone carry an increased risk of sudden death, stimulant products generally should not be used in children or adolescents with known serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, or other serious cardiac problems that may place them at increased vulnerability to the sympathomimetic effects of a stimulant drug.

##### ***Adults***

Sudden death, stroke, and myocardial infarction have been reported in adults taking stimulant drugs at usual doses for ADHD. Although the role of stimulants in these adult cases is also unknown, adults have a greater likelihood than children of having serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, coronary artery disease, or other serious cardiac problems. Adults with such abnormalities should also generally not be treated with stimulant drugs.

#### ***Hypertension and Other Cardiovascular Conditions***

Stimulant medications cause a modest increase in average blood pressure (about 2-4 mmHg) and average heart rate (about 3-6 bpm), and individuals may have larger increases. While the mean changes alone would not be expected to have short-term consequences, all patients should be monitored for larger changes in heart rate and blood pressure. Caution is indicated in treating patients whose underlying medical conditions might be compromised by increases in blood pressure or heart rate, e.g., those with pre-existing hypertension, heart failure, recent myocardial infarction, or ventricular arrhythmia.

#### ***Assessing Cardiovascular Status in Patients being Treated with Stimulant Medications***

Children, adolescents, or adults who are being considered for treatment with stimulant medications should have a careful history (including assessment for a family history of sudden death or ventricular arrhythmia) and physical exam to assess for the presence of cardiac disease, and should receive further cardiac evaluation if findings suggest such disease (e.g., electrocardiogram and echocardiogram). Patients who develop symptoms such as exertional chest pain, unexplained syncope, or other

symptoms suggestive of cardiac disease during stimulant treatment should undergo a prompt cardiac evaluation.

## **Psychiatric Adverse Events**

### ***Pre-Existing Psychosis***

Administration of stimulants may exacerbate symptoms of behavior disturbance and thought disorder in patients with a pre-existing psychotic disorder.

### ***Bipolar Illness***

Particular care should be taken in using stimulants to treat ADHD in patients with comorbid bipolar disorder because of concern for possible induction of a mixed/manic episode in such patients. Prior to initiating treatment with a stimulant, patients with comorbid depressive symptoms should be adequately screened to determine if they are at risk for bipolar disorder; such screening should include a detailed psychiatric history, including a family history of suicide, bipolar disorder, and depression.

### ***Emergence of New Psychotic or Manic Symptoms***

Treatment emergent psychotic or manic symptoms, e.g., hallucinations, delusional thinking, or mania in children and adolescents without a prior history of psychotic illness or mania can be caused by stimulants at usual doses. If such symptoms occur, consideration should be given to a possible causal role of the stimulant, and discontinuation of treatment may be appropriate.

In a pooled analysis of multiple short-term, placebo-controlled studies, such symptoms occurred in about 0.1% (4 patients with events out of 3,482 exposed to methylphenidate or amphetamine for several weeks at usual doses) of stimulant-treated patients compared to 0 in placebo-treated patients.

### ***Aggression***

Aggressive behavior or hostility is often observed in children and adolescents with ADHD, and has been reported in clinical trials and the postmarketing experience of some medications indicated for the treatment of ADHD including methylphenidate. Although there is no systematic evidence that stimulants cause aggressive behavior or hostility, patients beginning treatment for ADHD should be monitored for the appearance of or worsening of aggressive behavior or hostility.

## **Long-Term Suppression of Growth**

Careful follow-up of weight and height in children ages 7 to 10 years who were randomized to either methylphenidate or non-medication treatment groups over 14 months, as well as in naturalistic subgroups of newly methylphenidate-treated and non-medication treated children over 36 months (to the ages of 10 to 13 years), suggests that consistently medicated children (i.e., treatment for 7 days per week throughout the year) have a temporary slowing in growth rate (on average, a total of about 2 cm less growth in height and 2.7 kg less growth in weight over 3 years), without evidence of growth rebound during this period of development. In the double-blind placebo-controlled study of Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules, the mean weight gain was greater for patients receiving placebo (+1.0 kg) than for patients receiving Ritalin LA (+0.1 kg). Published data are inadequate to determine whether chronic use of amphetamines may cause a similar suppression of growth, however, it is anticipated that they likely have this effect as well. Therefore, growth should be monitored during treatment with stimulants, and patients who are not growing or gaining height or weight as expected may need to have their treatment interrupted.

## Seizures

There is some clinical evidence that stimulants may lower the convulsive threshold in patients with prior history of seizures, in patients with prior EEG abnormalities in absence of seizures, and, very rarely, in patients without a history of seizures and no prior EEG evidence of seizures. In the presence of seizures, the drug should be discontinued.

## Visual Disturbance

Difficulties with accommodation and blurring of vision have been reported with stimulant treatment.

## Use in Children Under Six Years of Age

Ritalin LA should not be used in children under six years of age, since safety and efficacy in this age group have not been established.

## Drug Dependence

Ritalin LA should be given cautiously to patients with a history of drug dependence or alcoholism. Chronic abusive use can lead to marked tolerance and psychological dependence with varying degrees of abnormal behavior. Frank psychotic episodes can occur, especially with parenteral abuse. Careful supervision is required during withdrawal from abusive use, since severe depression may occur. Withdrawal following chronic therapeutic use may unmask symptoms of the underlying disorder that may require follow-up.

## PRECAUTIONS

### Hematologic Monitoring

Periodic CBC, differential, and platelet counts are advised during prolonged therapy.

### Information for Patients

Prescribers or other health professionals should inform patients, their families, and their caregivers about the benefits and risks associated with treatment with methylphenidate and should counsel them in its appropriate use. A patient Medication Guide is available for Ritalin LA. The prescriber or health professional should instruct patients, their families, and their caregivers to read the Medication Guide and should assist them in understanding its contents. Patients should be given the opportunity to discuss the contents of the Medication Guide and to obtain answers to any questions they may have. The complete text of the Medication Guide is reprinted at the end of this document.

Patients should be advised to avoid alcohol while taking RITALIN LA. Consumption of alcohol while taking RITALIN LA may result in a more rapid release of the dose of methylphenidate.

### Drug Interactions

Methylphenidate is metabolized primarily by de-esterification (nonmicrosomal hydrolytic esterases) to ritalinic acid and not through oxidative pathways.

The effects of gastrointestinal pH alterations on the absorption of methylphenidate from Ritalin LA have not been studied. Since the modified release characteristics of Ritalin LA are pH dependent, the coadministration of antacids or acid suppressants could alter the release of methylphenidate.

Methylphenidate may decrease the effectiveness of drugs used to treat hypertension. Because of possible effects on blood pressure, methylphenidate should be used cautiously with pressor agents.

As an inhibitor of dopamine reuptake, methylphenidate may be associated with pharmacodynamic interactions when coadministered with direct and indirect dopamine agonists (including DOPA and tricyclic antidepressants) as well as dopamine antagonists (antipsychotics, e.g., haloperidol).

Case reports suggest a potential interaction of methylphenidate with coumarin anticoagulants, anticonvulsants (e.g., phenobarbital, phenytoin, primidone), and tricyclic drugs (e.g., imipramine, clomipramine, desipramine) but pharmacokinetic interactions were not confirmed when explored at higher sample sizes. Downward dose adjustment of these drugs may be required when given concomitantly with methylphenidate. It may be necessary to adjust the dosage and monitor plasma drug concentrations (or, in the case of coumarin, coagulation times), when initiating or discontinuing concomitant methylphenidate.

Methylphenidate is not metabolized by cytochrome P450 to a clinically relevant extent. Inducers or inhibitors of cytochrome P450 are not expected to have any relevant impact on methylphenidate pharmacokinetics. Conversely, the d- and l- enantiomers of methylphenidate did not relevantly inhibit cytochrome P450 1A2, 2C8, 2C9, 2C19, 2D6, 2E1 or 3A.

Methylphenidate coadministration did not increase plasma concentrations of the CYP2D6 substrate desipramine.

An interaction with the anticoagulant ethylbiscoumacetate in 4 subjects was not confirmed in a subsequent study with a higher sample size (n=12).

Other specific drug-drug interaction studies with methylphenidate have not been performed *in vivo*.

### **Carcinogenesis/Mutagenesis/Impairment of Fertility**

In a lifetime carcinogenicity study carried out in B6C3F1 mice, methylphenidate caused an increase in hepatocellular adenomas and, in males only, an increase in hepatoblastomas, at a daily dose of approximately 60 mg/kg/day. This dose is approximately 30 times and 4 times the maximum recommended human dose on a mg/kg and mg/m<sup>2</sup> basis, respectively. Hepatoblastoma is a relatively rare rodent malignant tumor type. There was no increase in total malignant hepatic tumors. The mouse strain used is sensitive to the development of hepatic tumors, and the significance of these results to humans is unknown.

Methylphenidate did not cause any increases in tumors in a lifetime carcinogenicity study carried out in F344 rats; the highest dose used was approximately 45 mg/kg/day, which is approximately 22 times and 5 times the maximum recommended human dose on a mg/kg and mg/m<sup>2</sup> basis, respectively.

In a 24-week carcinogenicity study in the transgenic mouse strain p53+/-, which is sensitive to genotoxic carcinogens, there was no evidence of carcinogenicity. Male and female mice were fed diets containing the same concentration of methylphenidate as in the lifetime carcinogenicity study; the high-dose groups were exposed to 60-74 mg/kg/day of methylphenidate.

Methylphenidate was not mutagenic in the *in vitro* Ames reverse mutation assay or in the *in vitro* mouse lymphoma cell forward mutation assay. Sister chromatid exchanges and chromosome aberrations were increased, indicative of a weak clastogenic response, in an *in vitro* assay in cultured Chinese Hamster Ovary (CHO) cells. Methylphenidate was negative *in vivo* in males and females in the mouse bone marrow micronucleus assay.

Methylphenidate did not impair fertility in male or female mice that were fed diets containing the drug in an 18-week Continuous Breeding study. The study was conducted at doses up to 160 mg/kg/day, approximately 80-fold and 8-fold the highest recommended dose on a mg/kg and mg/m<sup>2</sup> basis, respectively.

## **Pregnancy**

### ***Pregnancy Category C***

In studies conducted in rats and rabbits, methylphenidate was administered orally at doses of up to 75 and 200 mg/kg/day, respectively, during the period of organogenesis. Teratogenic effects (increased incidence of fetal spina bifida) were observed in rabbits at the highest dose, which is approximately 40 times the maximum recommended human dose (MRHD) on a mg/m<sup>2</sup> basis. The no effect level for embryo-fetal development in rabbits was 60 mg/kg/day (11 times the MRHD on a mg/m<sup>2</sup> basis). There was no evidence of specific teratogenic activity in rats, although increased incidences of fetal skeletal variations were seen at the highest dose level (7 times the MRHD on a mg/m<sup>2</sup> basis), which was also maternally toxic. The no effect level for embryo-fetal development in rats was 25 mg/kg/day (2 times the MRHD on a mg/m<sup>2</sup> basis). When methylphenidate was administered to rats throughout pregnancy and lactation at doses of up to 45 mg/kg/day, offspring body weight gain was decreased at the highest dose (4 times the MRHD on a mg/m<sup>2</sup> basis), but no other effects on postnatal development were observed. The no effect level for pre- and postnatal development in rats was 15 mg/kg/day (equal to the MRHD on a mg/m<sup>2</sup> basis).

Adequate and well-controlled studies in pregnant women have not been conducted. Ritalin LA should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

## **Nursing Mothers**

It is not known whether methylphenidate is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised if Ritalin LA is administered to a nursing woman.

## **Pediatric Use**

Long-term effects of methylphenidate in children have not been well established. Ritalin LA should not be used in children under six years of age (see WARNINGS).

In a study conducted in young rats, methylphenidate was administered orally at doses of up to 100 mg/kg/day for 9 weeks, starting early in the postnatal period (Postnatal Day 7) and continuing through sexual maturity (Postnatal Week 10). When these animals were tested as adults (Postnatal Weeks 13-14), decreased spontaneous locomotor activity was observed in males and females previously treated with 50 mg/kg/day (approximately 6 times the maximum recommended human dose [MRHD] on a mg/m<sup>2</sup> basis) or greater, and a deficit in the acquisition of a specific learning task was seen in females exposed to the highest dose (12 times the MRHD on a mg/m<sup>2</sup> basis). The no effect level for juvenile neurobehavioral development in rats was 5 mg/kg/day (half the MRHD on a mg/m<sup>2</sup> basis). The clinical significance of the long-term behavioral effects observed in rats is unknown.

## **ADVERSE REACTIONS**

The clinical program for Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules consisted of six studies: two controlled clinical studies conducted in children with ADHD aged 6-12 years and four clinical pharmacology studies conducted in healthy adult volunteers. These studies

included a total of 256 subjects; 195 children with ADHD and 61 healthy adult volunteers. The subjects received Ritalin LA in doses of 10-40 mg per day. Safety of Ritalin LA was assessed by evaluating frequency and nature of adverse events, routine laboratory tests, vital signs, and body weight.

Adverse events during exposure were obtained primarily by general inquiry and recorded by clinical investigators using terminology of their own choosing. Consequently, it is not possible to provide a meaningful estimate of the proportion of individuals experiencing adverse events without first grouping similar types of events into a smaller number of standardized event categories. In the tables and listings that follow, MEDRA terminology has been used to classify reported adverse events. The stated frequencies of adverse events represent the proportion of individuals who experienced, at least once, a treatment-emergent adverse event of the type listed. An event was considered treatment emergent if it occurred for the first time or worsened while receiving therapy following baseline evaluation.

## **Adverse Events in a Double-Blind, Placebo-Controlled Clinical Trial with Ritalin LA**

### ***Treatment-Emergent Adverse Events***

A placebo-controlled, double-blind, parallel-group study was conducted to evaluate the efficacy and safety of Ritalin LA in children with ADHD aged 6-12 years. All subjects received Ritalin LA for up to 4 weeks, and had their dose optimally adjusted, prior to entering the double-blind phase of the trial. In the two-week double-blind treatment phase of this study, patients received either placebo or Ritalin LA at their individually-titrated dose (range 10 mg-40 mg).

The prescriber should be aware that these figures cannot be used to predict the incidence of adverse events 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 clinical 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 adverse event incidence rate in the population studied.

Adverse events with an incidence >5% during the initial four-week single-blind Ritalin LA titration period of this study were headache, insomnia, upper abdominal pain, appetite decreased, and anorexia.

Treatment-emergent adverse events with an incidence >2% among Ritalin LA-treated subjects, during the two-week double-blind phase of the clinical study, were as follows:

Preferred term	Ritalin LA <sup>®</sup> <u>N=65</u> N (%)	Placebo <u>N=71</u> N (%)
Anorexia	2 (3.1)	0 (0.0)
Insomnia	2 (3.1)	0 (0.0)

### ***Adverse Events Associated with Discontinuation of Treatment***

In the two-week double-blind treatment phase of a placebo-controlled parallel-group study in children with ADHD, only one Ritalin LA-treated subject (1/65, 1.5%) discontinued due to an adverse event (depression).

In the single-blind titration period of this study, subjects received Ritalin LA for up to 4 weeks. During this period a total of six subjects (6/161, 3.7%) discontinued due to adverse events. The adverse events leading to discontinuation were anger (in 2 patients), hypomania, anxiety, depressed mood, fatigue, migraine and lethargy.

#### ***Adverse Events with Other Methylphenidate HCl Dosage Forms***

Nervousness and insomnia are the most common adverse reactions reported with other methylphenidate products. In children, loss of appetite, abdominal pain, weight loss during prolonged therapy, insomnia, and tachycardia may occur more frequently; however, any of the other adverse reactions listed below may also occur.

Other reactions include:

***Cardiac:*** angina, arrhythmia, palpitations, pulse increased or decreased, tachycardia

***Gastrointestinal:*** abdominal pain, nausea

***Immune:*** hypersensitivity reactions including skin rash, urticaria, fever, arthralgia, exfoliative dermatitis, erythema multiforme with histopathological findings of necrotizing vasculitis, and thrombocytopenic purpura.

***Metabolism/Nutrition:*** anorexia, weight loss during prolonged therapy

***Nervous System:*** dizziness, drowsiness, dyskinesia, headache, rare reports of Tourette's syndrome, toxic psychosis

***Vascular:*** blood pressure increased or decreased; cerebrovascular vasculitis; cerebral occlusions; cerebral hemorrhages and cerebrovascular accidents

Although a definite causal relationship has not been established, the following have been reported in patients taking methylphenidate:

***Blood/Lymphatic:*** leukopenia and/or anemia

***Hepatobiliary:*** abnormal liver function, ranging from transaminase elevation to hepatic coma

***Psychiatric:*** transient depressed mood, aggressive behavior

***Skin/Subcutaneous:*** scalp hair loss

Very rare reports of neuroleptic malignant syndrome (NMS) have been received, and, in most of these, patients were concurrently receiving therapies associated with NMS. In a single report, a ten-year-old boy who had been taking methylphenidate for approximately 18 months experienced an NMS-like event within 45 minutes of ingesting his first dose of venlafaxine. It is uncertain whether this case represented a drug-drug interaction, a response to either drug alone, or some other cause.

## **DRUG ABUSE AND DEPENDENCE**

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules, like other products containing methylphenidate, is a Schedule II controlled substance. (See WARNINGS for boxed warning containing drug abuse and dependence information.)

## **OVERDOSAGE**

### **Signs and Symptoms**

Signs and symptoms of acute overdose, resulting principally from overstimulation of the central nervous system and from excessive sympathomimetic effects, may include the following: vomiting, agitation, tremors, hyperreflexia, muscle twitching, convulsions (may be followed by coma), euphoria, confusion, hallucinations, delirium, sweating, flushing, headache, hyperpyrexia, tachycardia, palpitations, cardiac arrhythmias, hypertension, mydriasis, and dryness of mucous membranes.

### **Poison Control Center**

Consult with a Certified Poison Control Center regarding treatment for up-to-date guidance and advice.

### **Recommended Treatment**

As with the management of all overdose, the possibility of multiple drug ingestion should be considered.

When treating overdose, practitioners should bear in mind that there is a prolonged release of methylphenidate from Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules.

Treatment consists of appropriate supportive measures. The patient must be protected against self-injury and against external stimuli that would aggravate overstimulation already present. Gastric contents may be evacuated by gastric lavage as indicated. Before performing gastric lavage, control agitation and seizures if present and protect the airway. Other measures to detoxify the gut include administration of activated charcoal and a cathartic. Intensive care must be provided to maintain adequate circulation and respiratory exchange; external cooling procedures may be required for hyperpyrexia.

Efficacy of peritoneal dialysis or extracorporeal hemodialysis for methylphenidate overdose has not been established; also, dialysis is considered unlikely to be of benefit due to the large volume of distribution of methylphenidate.

## **DOSAGE AND ADMINISTRATION**

### **Administration of Dose**

Ritalin LA<sup>®</sup> (methylphenidate hydrochloride) extended-release capsules is for oral administration once daily in the morning. Ritalin LA may be swallowed as whole capsules or alternatively may be administered by sprinkling the capsule contents on a small amount of applesauce (see specific instructions below). Ritalin LA and/or their contents should not be crushed, chewed, or divided.

The capsules may be carefully opened and the beads sprinkled over a spoonful of applesauce. The applesauce should not be warm because it could affect the modified release properties of this formulation. The mixture of drug and applesauce should be consumed immediately in its entirety. The drug and applesauce mixture should not be stored for future use. Patients should be advised to avoid alcohol while taking Ritalin LA.

### **Dosing Recommendations**

Dosage should be individualized according to the needs and responses of the patients.

### ***Initial Treatment***

The recommended starting dose of Ritalin LA is 20 mg once daily. Dosage may be adjusted in weekly 10 mg increments to a maximum of 60 mg/day taken once daily in the morning, depending on tolerability and degree of efficacy observed. Daily dosage above 60 mg is not recommended. When in the judgement of the clinician a lower initial dose is appropriate, patients may begin treatment with Ritalin LA 10 mg.

### ***Patients Currently Receiving Methylphenidate***

The recommended dose of Ritalin LA for patients currently taking methylphenidate b.i.d. or sustained release (SR) is provided below.

<b>Previous Methylphenidate Dose</b>	<b>Recommended Ritalin LA<sup>®</sup> Dose</b>
5 mg methylphenidate-b.i.d.	10 mg q.d.
10 mg methylphenidate b.i.d. or 20 mg methylphenidate-SR	20 mg q.d.
15 mg methylphenidate b.i.d.	30 mg q.d.
20 mg methylphenidate b.i.d. or 40 mg of methylphenidate-SR	40 mg q.d.
30 mg methylphenidate b.i.d. or 60 mg methylphenidate-SR	60 mg q.d.

For other methylphenidate regimens, clinical judgment should be used when selecting the starting dose. Ritalin LA dosage may be adjusted at weekly intervals in 10 mg increments.

Daily dosage above 60 mg is not recommended.

### **Maintenance/Extended Treatment**

There is no body of evidence available from controlled trials to indicate how long the patient with ADHD should be treated with Ritalin LA. It is generally agreed, however, that pharmacological treatment of ADHD may be needed for extended periods. Nevertheless, the physician who elects to use Ritalin LA for extended periods in patients with ADHD should periodically re-evaluate the long-term usefulness of the drug for the individual patient with trials off medication to assess the patient's functioning without pharmacotherapy. Improvement may be sustained when the drug is either temporarily or permanently discontinued.

### **Dose Reduction and Discontinuation**

If paradoxical aggravation of symptoms or other adverse events occur, the dosage should be reduced, or, if necessary, the drug should be discontinued. If improvement is not observed after appropriate dosage adjustment over a one-month period, the drug should be discontinued.

### **HOW SUPPLIED**

Ritalin LA capsules 10 mg: white/light brown (imprinted NVR R10)

Bottles of 100.....NDC 0078-0424-05

Ritalin LA capsules 20 mg: white (imprinted NVR R20)

Bottles of 100.....NDC 0078-0370-05

Ritalin LA capsules 30 mg: yellow (imprinted NVR R30)

Bottles of 100.....NDC 0078-0371-05

Ritalin LA capsules 40 mg: light brown (imprinted NVR R40)

Bottles of 100.....NDC 0078-0372-05

Store at 25°C (77°F), excursions permitted 15°C-30°C (59°F-86°F). [See USP controlled room temperature]

Dispense in tight container (USP).

Ritalin LA<sup>®</sup> is a trademark of Novartis AG.

SODAS<sup>®</sup> is a registered trademark of Elan Pharma International Ltd.

This product is covered by US patents including US 5,837,284 and 6,228,398.

## REFERENCE

American Psychiatric Association. Diagnosis and Statistical Manual of Mental Disorders. 4th edition. Washington DC: American Psychiatric Association 1994.