Prescribing Information as of August 2001 **CARDIZEM® SR** (diltiazem HCI) Sustained Release Capsules

DESCRIPTION

CARDIZEM® (diltiazem hydrochloride) is a calcium ion influx inhibitor (slow channel blocker or calcium antagonist). Chemically, diltiazem hydrochloride is 1,5-Benzothiazepin-4(5H)one,3-(acetyloxy)-5-[2-(dimethylamino) ethyl]-2, 3-dihydro-2-(4-methoxyphenyl)-,monohydrochloride, (+)-cis-. The chemical structure is:

> OCH • HCI ососн. **`**`o CH₂CH₂N(CH₃),

Diltiazem hydrochloride is a white to off-white crystalline powder with a bitter taste. It is soluble in water, methanol, and chloroform. It has a molecular weight of 450.98. Each CARDIZEM SR capsule contains either 60 mg, 90 mg, or 120 mg diltiazem nvdrochloride

Also contains: D&C Yellow #10, FD&C Blue #1, FD&C Red #40, FD&C Yellow #6, fumaric acid, povidone, starch, sucrose, talc titanium dioxide, and other ingredients. For oral administrati

CUINICAL PHARMACOLOGY

The therapeutic effects of CARDIZEM are believed to be related to its ability to inhibit the influx of calcium ions during membrane depolarization of cardiac and vascular smooth muscle

Mechanisms of Action CARDIZEM SR produces its antihypertensive effect primarily by relaxation of vascular smooth muscle and the resultant decrease in peripheral vascular resistance. The magnitude of blood pressure reduction is related to the degree of hypertension; thus hypertensive individuals experience an antihypertensive effect, whereas there is only a modest fall in blood pressure in normotensives.

Hemodynamic and Electrophysiologic Effects

Like other calcium antagonists, diltiazem decreases sinoatrial and atrioventricular conduction in isolated tissues and has a negative inotropic effect in isolated preparations. In the intact animal,

prolongation of the AH interval can be seen at higher doses. In man, diltiazem prevents spontaneous and ergonovine-provoked coronary artery spasm. It causes a decrease in peripheral vascular resistance and a modest fall in blood pressure in normotensive individuals and, in exercise tolerance studies in patients with ischemic heart disease, reduces the heart rate-blood pressure product for any given work load. Studies to date, primarily in patients with good ventricular function, have not revealed evidence of a negative inotropic effect; cardiac output, ejection fraction, and left ventricular end diastolic pressure have not been affected. Increased heart failure has, however, been reported in occasional patients with preexisting impairment of ventricula function. There are as yet few data on the interaction of diltiazem and beta-blockers in patients with poor ventricular function Resting heart rate is usually slightly reduced by diltiazem.

CARDIZEM SR produces antihypertensive effects both in the supin and standing positions. Postural hypotension is infrequently noted upon suddenly assuming an upright position. No reflex tachycar is associated with the chronic antihypertensive effects. CARDIZEM SR decreases vascular resistance, increases cardiac output (by increasing stroke volume), and produces a slight decrease or no change in heart rate. During dynamic exercise, increases in diastolic pressure are inhibited while maximum achievable systolic pressure is usually reduced. Heart rate at maximum exercise does not change or is slightly reduced. Chronic therapy with CARDIZEM produces no change or an increase in plasma catecholamines. No increased activity of the renin-angiotensin-aldosterone axis has been observed. CARDIZEM SR antagonizes the renal and periphera effects of angiotensin II. Hypertensive animal models respond to diltiazem with reductions in blood pressure and increased urinary output and natriuresis without a change in urinary sodium/potassium ratio.

Intravenous diltiazem in doses of 20 mg prolongs AH conduction time and AV node functional an

Chronic oral administration of CARDIZEM in doses of up to 360 mg/day has resulted in small increases in PR interval, and on occasion produces abnormal prolongation. (See WARNINGS.)

Pharmacokinetics and Metabolism

Diltiazem is well absorbed from the gastrointestinal tract and is subject to an extensive first-pass effect, giving an absolute bioavailability (compared to intravenous administration) of about 40%. CARDIZEM undergoes extensive metabolism in which 2% to 4% of the unchanged drug appears in the urine. In vitro binding studies show CARDIŽEM is 70% to 80% bound to plasma proteins. Competitive in vitro ligand binding studies have also shown CARDIZEM binding is not altered by therapeutic concentrations of digoxin, hydrochlorothiazide, phenylbutazone propranolol, salicylic acid, or warfarin. The plasma elimination half-life following single or multiple drug administration is approximately 3.0 to 4.5 hours. Desacetyl diltiazem is also present in the plasma at levels of 10% to 20% of the parent drug and is 25% to 50% as potent a coronary vasodilator as diltiaze Minimum therapeutic plasma levels of CARDIZEM appear to be in the range of 50-200 ng/mL. There is a departure from linearity when dose strengths are increased; the half-life is slightly increased with dose. A study that compared patients with norma hepatic function to patients with cirrhosis found an increase in half-life and a 69% increase in bioavailability in the hepatically impaired patients. A single study in nine patients with severely impaired renal function showed no difference in the pharmacoki-netic profile of diltiazem compared to patients with normal renal

CARDIZEM SR Capsules. Diltiazem is absorbed from the capsule formulation to about 92% of a reference solution at steady-state. A single 120-mg dose of the capsule results in detectable plasma levels within two to three hours and peak plasma levels at six to 11 hours. The apparent elimination half-life after single or nultiple dosing is five to seven hours. A departure from linearit similar to that observed with the CARDIZEM tablet is observed As the dose of CARDIZEM SR capsules is increased from a daily dose of 120 mg (60 mg bid) to 240 mg (120 mg bid) daily, there is an increase in area-under-the-curve of 2.6 times. When the dose is increased from 240 mg to 360 mg daily, there is an increase in area-under-the-curve of 1.8 times. The average plasma levels of the capsule dosed twice daily at steady-state are equivalent to the tablet dosed four times daily when the same total daily dose is administered

INDICATIONS AND USAGE

CARDIZEM SR is indicated for the treatment of hypertension. It nay be used alone or in combination with other antihypertensive nedications, such as diuretics,

CONTRAINDICATIONS

CARDIZEM is contraindicated in (1) patients with sick sinus syndrome except in the presence of a functioning ventricular pacemaker, (2) patients with second- or third-degree AV block except in the presence of a functioning ventricular pacemaker, (3 patients with hypotension (less than 90 mm Hg systolic), (4 patients who have demonstrated hypersensitivity to the drug, and (5) patients with acute myocardial infarction and pulmonary ngestion documented by x-ray on admission

WARNINGS

. Cardiac Conduction. CARDIZEM prolongs AV node refractory periods without significantly prolonging sinus node recovery time, except in patients with sick sinus syndrome. This effect may rarely result in abnormally slow heart rates (particularly in patients with sick sinus syndrome) or second- or third-degree AV block (nine of 2,111 patients or 0.43%). Concomitant use of diltiazem with beta-blockers or digitalis may result in additive effects on cardiac conduction. A patient with Prinzmetal's angina developed periods of asystole (2 to 5 ADVERSE REACTIONS section.)

Congestive Heart Failure. Although diltiazem has a negative inotropic effect in isolated animal tissue preparations hemodynamic studies in humans with normal ventricular function have not shown a reduction in cardiac index nor consistent negative effects on contractility (d//dt). An acute study of oral diltiazem in patients with impaired ventricular function (ejection fraction 24% ± 6%) showed improvement in indices of ventricular function without significant decrease in contractile function (dp/dt). Experience with the use of CARDIZEM (diltiazem hydrochloride) in combination with beta-blockers in patients with impaired ventricular function is limited. Caution should be exercised when using this combi nation

3. Hypotension. Decreases in blood pressure associated with CARDIZEM therapy may occasionally result in sympto hypotension

SGOT, SGPT, and other phenomena consistent with acute hepatic injury have been noted. These reactions tended to occur early after therapy initiation (1 to 8 weeks) and have been reversible upon discontinuation of drug therapy. The relationship to CARDIZEM is uncertain in some cases, but probable in some. (See PRECAUTIONS.)

PRECAUTIONS General

CARDIZEM (diltiazem hydrochloride) is extensively metabolized by the liver and excreted by the kidneys and in bile. As with any drug given over prolonged periods, laboratory parameters of renal and hepatic function should be monitored at regular intervals. The drug should be used with caution in patients with impaired renal or hepatic function. In subacute and chronic dog and rat studies designed to produce toxicity, high doses of diltiazem were associated with hepatic damage. In special subacute hepatic studies, oral doses of 125 mg/kg and higher in rats were associated with histological changes in the liver which were reversible when the drug was discontinued. In dogs, doses of 20 mg/kg were also associated with hepatic changes; however bernatological events (see ADVERSE REACTIONS section) may

be transient and may disappear despite continued use of CARDIZEM. However, skin eruptions progressing to ervthema multiforme and/or exfoliative dermatitis have also been infrequently reported. Should a dermatologic reaction persist, the drug should be discontinued.

Drug Interactions

Due to the potential for additive effects, caution and careful titration are warranted in patients receiving CARDIZEM concomitantly with any agents known to affect cardiac contractility and/or conduction. (See WARNINGS.) Pharmacologic studies indicate that there may be additive effects in prolonging AV conduction using beta-blockers or digitalis concomitantly with CARDIZEM, (See WARNINGS.)

As with all drugs, care should be exercised when treating patients with multiple medications. Diltiazem is both a substrate and an nhibitor of the cytochrome P-450 3A4 enzyme system. Other drugs that are specific substrates, inhibitors, or inducers of this enzyme system may have a significant impact on the efficacy and side effect profile of diltiazem. Patients taking other drugs that are substrates of CYP450 3A4, especially patients with renal and/or hepatic impairment, may require dosage adjustment when starting or stopping concomitantly administered diltiazem in order to maintain optimum therapeutic blood levels

Anesthetics. The depression of cardiac contractility, conductivity, and automaticity as well as the vascular dilation associated with anesthetics may be potentiated by calcium channel blockers. When used concomitantly, anesthetics and calcium blockers ould be titrated carefully

Benzodiazepines. Studies showed that diltiazem increased the AUC of midazolam and triazolam by 3-4 fold and the Cmax by 2fold, compared to placebo. The elimination half-life of midazolam and triazolam also increased (1.5-2.5 fold) during coadministration with diltiazem. These pharmacokinetic effects seen during diltiazem coadministration can result in increased clinical effects (e.g., prolonged sedation) of both midazolam and triazolam. Beta-blockers. Controlled and uncontrolled domestic studies suggest that concomitant use of CARDIZEM and beta-blockers is usually well tolerated, but available data are not sufficient to predict the effects of concomitant treatment in patients with left ventricular dysfunction or cardiac conduction abnormalities.

Administration of CARDIZEM (diltiazem hydrochloride) concomitantly with propranolol in five normal volunteers resulted in increased propranolol levels in all subjects and bioavailability of propranolol was increased approximately 50%. In vitro, propranolol appears to be displaced from its binding sites by diltiazem. If combination therapy is initiated or withdrawn in conjunction with propranolol, an adjustment in the propranolol dose may be varranted. (See WARNINGS.)

Buspirone. In nine healthy subjects, diltiazem significantly increased the mean buspirone AUC 5.5 fold and C_{max} 4.1 fold compared to placebo. The $T_{1/2}$ and T_{max} of buspirone were not significantly affected by diltiazem. Enhanced effects and increased toxicity of buspirone may be possible during concomi-tant administration with diltiazem. Subsequent dose adjustments may be necessary during co-administration, and should be based clinical assessment.

Carbamazepine. Concomitant administration of diltiazem with carbamazepine has been reported to result in elevated serum levels of carbamazepine (40 to 72% increase), resulting in toxicity in some cases. Patients receiving these drugs concurrently should be monitored for a potential drug interaction Cimetidine. A study in six hea thy volunteers has shown a s icant increase in peak diltiazem plasma levels (58%) and areainder-the-curve (53%) after a 1-week course of cimetidine at 1200 mg per day and a single dose of diltiazem 60 mg. Ranitidine produced smaller, nonsignificant increases. The effect may be mediated by cimetidine's known inhibition of hepatic cytochrome P-450, the enzyme system responsible for the first-pass metabolism of diltiazem. Patients currently receiving diltiazem therapy should be carefully monitored for a change in pharmacological

approximately 20%. In a study involving single oral doses of 300 mg of CARDIZEM in six normal volunteers, the average maximum PR prolongation was 14% with no instances of greater than first-degree AV block. Diltiazem-associated prolongation of the AH interval is not more pronounced in patients with firstdegree heart block. In patients with sick sinus syndrome, dilti azem significantly prolongs sinus cycle length (up to 50% in some cases).

4. Acute Hepatic Injury. Mild elevations of transaminases with and without concomitant elevation in alkaline phosphatase and bilirubin have been observed in clinical studies. Such eleva tions were usually transient and frequently resolved even with continued diltiazem treatment. In rare instances, significant elevations in enzymes such as alkaline phosphatase. LDH.

CARDIZEM® SR (diltiazem HCI) **Sustained Release Capsules**

effect when initiating and discontinuing therapy with cimetidine. An adjustment in the diltiazem dose may be warranted.

Cyclosporine. A pharmacokinetic interaction between diltiazem and cyclosporine has been observed during studies involving renal and cardiac transplant patients. In renal and cardiac trans plant recipients, a reduction of cyclosporine dose ranging from 15% to 48% was necessary to maintain cyclosporine trough concentrations similar to those seen prior to the addition of dilti azem. If these agents are to be administered concurrently cyclosporine concentrations should be monitored, especially when diltiazem therapy is initiated, adjusted or discontinued. The effect of cyclosporine on diltiazem plasma concentrations has not been evaluated

Digitalis. Administration of CARDIZEM with digoxin in 24 healthy male subjects increased plasma digoxin concentra-tions approximately 20%. Another investigator found no increase in digoxin levels in 12 patients with coronary artery disease. Since there have been conflicting results regarding the effect of digoxin levels, it is recommended that digoxin levels be monitored when initiating, adjusting, and discontinuing CARDIZEM therapy to avoid possible over- or under-digitalization. (See WARNINGS.)

Lovastatin. In a ten-subject study, coadministration of diltiazem (120 mg bid, diltiazem SR) with lovastatin resulted in 3-4 times increase in mean lovastatin AUC and Cmax versus lovastatin alone; no change in pravastatin AUC and Cmax was observed during diltiazem coadministration. Diltiazem plasma levels were not significantly affected by lovastatin or pravastatin.

Quinidine. Diffuser significantly increases the AUC₍₀ $\rightarrow \infty$) of quinidine by 51%, T_{1/2} by 36%, and decreases its CL_{oral} by 33%. Monitoring for quinidine adverse effects may be warranted and the dose adjusted accordingly.

Rifampin. Coadministration of rifampin with diltiazem lowered the diltiazem plasma concentrations to undetectable levels. Coadministration of diltiazem with rifampin or any known CYP3A4 inducer should be avoided when possible, and alternative therapy considered.

Carcinogenesis, Mutagenesis, Impairment of Fertility A 24-month study in rats and a 21-month study in mice showed no evidence of carcinogenicity. There was also no mutagenic response in in vitro bacterial tests. No intrinsic effect on fertility was observed in rats.

Category C. Reproduction studies have been conducted in mice, rats, and rabbits. Administration of doses ranging from five to ten times greater (on a mg/kg basis) than the daily recommended therapeutic dose has resulted in embryo and fetal lethality. These doses, in some studies, have been reported to cause skeletal abnormalities. In the perinatal/postnatal studies, there was some reduction in early individual pup weights and survival rates There was an increased incidence of stillbirths at doses of 20 times the human dose or greater.

There are no well-controlled studies in pregnant women; therefore, use CARDIZEM in pregnant women only if the potential benefit justifies the potential risk to the fetus.

<u>Nursing Mothers</u> Diltiazem is excreted in human milk. One report suggests that concentrations in breast milk may approximate serum levels. If use of CARDIZEM is deemed essential, an alternative method of infant feeding should be instituted.

Pediatric Use

Safety and effectiveness in pediatric patients have not been established

Geriatric Use

Clinical studies of diltiazem did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. Other reported clinical experi-ence has not identified differences in responses between the elderly and younger patients. In general, dose selection for an elderly patient should be cautious, usually starting at the low end of the dosing range, reflecting the greater frequency of decreased nepatic, renal, or cardiac function, and of concomitant disease or other drug therapy.

ADVERSE REACTIONS

Serious adverse reactions have been rare in studies carried out to date, but it should be recognized that patients with impaired ventricular function and cardiac conduction abnormalities have

adverse reactions seen in angina studies that were not observed in hypertension studies. In all hypertensive patients studied (over 900), the most common adverse events were edema (9%) headache (8%), dizziness (6%), asthenia (5%), sinus bradycardia (3%), flushing (3%), and first-degree AV block (3%). Only edema and perhaps bradycardia and dizziness were dose related The most common events observed in clinical studies (over 2,100 patients) of angina patients and hypertensive patients (ie, greater than 1%) edema (5.4%), headache (4.5%), dizziness (1.34%), asthenia (2.8%), first-degree AV block (1.8%), flushing (1.7%), nausea (1.6%), bradycardia (1.5%), and rash (1.5%).

Double Blind Placebo Controlled Hypertension Trials

Adverse	Diltiazem n = 315 # pts (%)	Placebo n = 211 # pts (%)
headache	38 (12%)	17 (8%)
AV block first degree	24 (7.6%)	4 (1.9%)
dizziness	22 (7%)	6 (2.8%)
edema	19 (6%)	2 (0.9%)
bradycardia	19 (6%)	3 (1.4%)
ECG abnormality	13 (4.1%)	3 (1.4%)
asthenia	10 (3.2%)	1 (0.5%)
constipation	5 (1.6%)	2 (0.9%)
dyspepsia	4 (1.3%)	1 (0.5%)
nausea	4 (1.3%)	2 (0.9%)
palpitations	4 (1.3%)	2 (0.9%)
polyuria	4 (1.3%)	2 (0.9%)
somnolence alk phos increase	4 (1.3%) 3 (1%)	1 (0.5%)
hypotension	3 (1%)	1 (0.5%)
insomnia	3 (1%)	1 (0.5%)
rash	3 (1%)	1 (0.5%)
AV block second degree	3 (1%) 2 (0.6%)	

In addition, the following events were reported infrequently (less than 1%) with CARDIZEM SR Capsules or CARDIZEM Tablets or have been observed in angina or hypertension trials.

Cardiovascular: Angina, arrhythmia, second- or third-degree AV block (see conduction warning), bundle branch block, congestive heart failure, syncope, tachycardia, ventricular extrasystoles Nervous System: Abnormal dreams, amnesia, depression, gait

abnormality, hallucinations, nervousness, paresthesia, personality change, tremor

Gastroinfestinal: Anorexia, diarrhea, dry mouth, dysgeusia, mild elevations of SGOT, SGPT, and LDH (see hepatic warnings), Dermatological: Petechiae, photosensitivity, pruritus, urticaria

Other: Amblyopia, CPK increase, dyspnea, epistaxis, eye irrita tion, hyperglycemia, hyperuricemia, impotence, muscle cramps, nasal congestion, nocturia, osteoarticular pain, sexual difficulties, tinnitus

The following postmarketing events have been reported infre-quently in patients receiving CARDIZEM: allergic reactions, alopecia, angioedema (including facial or periorbital edema), asystole, erythema multiforme (including Stevens-Johnson syndrome, toxic epidermal necrolysis), extrapyramidal symptoms, gingival hyperplasia, hemolytic anemia, increased bleeding time, leukopenia, purpura, retinopathy, myopathy, and thrombocytopenia. There have been observed cases of a generalized rash, some characterized as leukocytoclastic vasculitis. In addition, events such as myocardial infarction have been observed which are not readily distinguishable from the natural history of the disease in these patients. A definitive cause and effect relationship between these events and CARDIZEM therapy cannot yet be established. Exfoliative dermatitis (proven by rechallenge) has also been reported.

OVERDOSAGE OR EXAGGERATED RESPONSE

The oral LD₅₀'s in mice and rats range from 415 to 740 mg/kg and from 560 to 810 mg/kg, respectively. The intravenous LD₅₀'s in these species were 60 and 38 mg/kg, respectively. The oral LD₅₀ in dogs is considered to be in excess of 50 mg/kg, while ethality was seen in monkeys at 360 mg/kg

The toxic dose in man is not known. Due to extensive metabolism, blood levels after a standard dose of diltiazem can vary over tenfold, limiting the usefulness of blood levels in overdose cases. here have been reports of diltiazem o se in amoui

also frequently utilized to treat heart block. Fluids and vasopressors were used to maintain blood pressure and in cases of cardiac failure inotropic agents were administered. In addition, some patients received treatment with ventilatory support, gastric lavage, activated charcoal, and/or intravenous calcium The effectiveness of intravenous calcium administration to reverse the pharmacological effects of diltiazem overdose has been inconsistent. In a few reported cases, overdose with calcium channel blockers associated with hypotension and bradycardia that was initially refractory to atropine became more responsive to atropine after the patients received intravenous calcium. In some cases intravenous calcium has been administered (1 g calcium chloride or 3 g calcium gluconate) over 5 minutes, and repeated every 10-20 minutes as necessary. Calcium gluconate has also been administered as a continuous infusion at a rate of 2 g per hour for 10 hours. Infusions of calcium for 24 hours or more may be required. Patients should be monitored for signs of hypercalcemia

In the event of overdose or exaggerated response, appropriate supportive measures should be employed in addition to gastrointestinal decontamination. Diltiazem does not appear to be removed by peritoneal or hemodialysis. Limited data suggest that plasmapheresis or charcoal hemoperfusion may hasten dilitazem elimination following overdose. Based on the known pharmacological effects of diltiazem and/or reported clinical experiences the following measures may be considered

Bradycardia: Administer atropine (0.60 to 1.0 mg). If there is no response to vagal blockade, administer isoproterenol cautious high-Degree AV Block: Treat as for bradycardia above. Fixed high-degree AV block should be treated with cardiac pacing. Cardiac Failure: Administer inotropic agents (isoproterenol, dopamine, or dobutamine) and diuretics.

Hypotension: Vasopressors (eg, dopamine or levarterenol bitar-

Actual treatment and dosage should depend on the severity of the clinical situation and the judgment and experience of the treating physician

DOSAGE AND ADMINISTRATION

Dosages must be adjusted to each patient's needs, starting with 60 to 120 mg twice daily. Maximum antihypertensive effect is usually observed by 14 days of chronic therapy; therefore dosage adjustments should be scheduled accordingly. Although individual patients may respond to lower doses, the usual optimum dosage range in clinical trials was 240 to 360 mg/day. CARDIZEM SR has an additive antihypertensive effect when used other antihypertensive agents. Therefore, the dosage of CARDIZEM SR or the concomitant antihypertensives may need to be adjusted when adding one to the other. See WARNINGS and PRECAUTIONS regarding use with beta-blockers

HOW SUPPLIED

CARDIZEM® SR

Strength	Quantity	NDC Number	Description
60 mg	100 btl	64455-777-47	lvory/brown capsule imprinted with CARDIZEM logo on one end and CARDIZEM SR 60 mg on the other
90 mg	100 btl	64455-778-47	Gold/brown capsule imprinted with CARDIZEM logo on one end and CARDIZEM SR 90 mg on the other
120 mg	100 btl	64455-779-47	Caramel/brown capsule imprinted with CARDIZEM logo on one end and CARDIZEM SR 120 mg on the other

Storage Conditions: Store at 25°C (77°F); excursions permitted to 15-30°C (59-86°F) [see USP Controlled Room Temperature]. Avoid excessive hum

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Republic of Ireland Aventis Pharma Inc. Laval, Quebec, Canada H7L 4A8

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usually been excluded from these studies. The adverse events described below represent events observed in clinical studies of hypertensive patients receiving either CARDIZEM Tablets or CARDIZEM SR Capsules as well as experi- ences observed in studies of angina and during marketing. The most common events in hypertension studies are shown in a table with rates in placebo patients shown for comparison. Less common events are listed by body system; these include any	patients recovered and in cases with a ratal outcome, the majority involved multiple drug ingestion. Events observed following diltiazem overdose included brady- cardia, hypotension, heart block, and cardiac failure. Most reports of overdose described some supportive medical measure and/or drug treatment. Bradycardia fraquently reported favor-	Biovail Pharmaceuticals, Inc. Morrisville, NC 27560 USA	
common events are listed by body system; these include any			