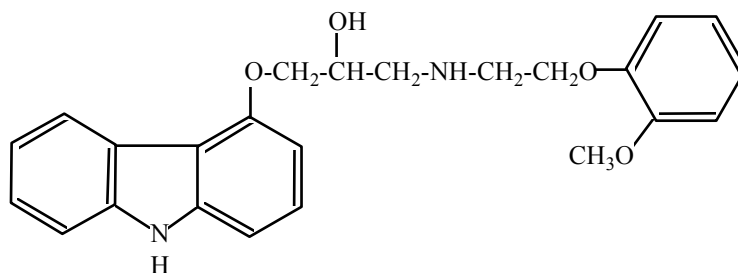


## NAME OF THE MEDICINE

**DILATREND<sup>®</sup>**

**Carvedilol**

**CAS 72956-09-3**



The chemical name of carvedilol is (±) -1-(9 H-carbazol-4-yloxy)-3-{{2-(2-methoxyphenoxy) ethyl}amino}propan-2-ol. It has molecular formula of C<sub>24</sub>H<sub>26</sub>N<sub>2</sub>O<sub>4</sub> and a molecular weight of 406.5.

## DESCRIPTION

Carvedilol is a white, crystalline powder and has low solubility in water (0.01 mg/mL). It is soluble in ethanol (22.7 mg/mL).

DILATREND tablets also contain lactose, sucrose, povidone, crospovidone, colloidal anhydrous silica, magnesium stearate, yellow iron oxide (6.25 mg and 12.5 mg tablets only), red iron oxide (3.125 mg and 12.5 mg tablets only) as excipients.

## PHARMACOLOGY

### Pharmacodynamics

Carvedilol is a dual action cardiovascular agent; a vasodilating, non-selective beta-blocking agent with antioxidant properties. Vasodilation has been shown to be mediated primarily by selective blockade of alpha<sub>1</sub>-adrenoreceptors.

Carvedilol is a racemic mixture. In animal models, both enantiomers have alpha-adrenergic receptor blocking properties. The beta-adrenergic receptor blocking properties are non-selective for beta<sub>1</sub>- and beta<sub>2</sub>-adenoreceptors and are associated with the laevorotatory enantiomer of carvedilol. Carvedilol has no intrinsic sympathomimetic activity and like propranolol, it has membrane-stabilizing properties. Carvedilol suppresses the renin-angiotensin-aldosterone system through beta-blockade.

The mechanism for the beneficial effects of carvedilol in congestive heart failure has not been established. Possible mechanisms include, neurohormonal inhibition, β-blockade, balanced vasodilation (reduced preload and afterload), antioxidant activity, potent anti-ischaemic activity,

and inhibition of neutrophil adhesion. Antioxidant activity and inhibition of neutrophil adhesion have been demonstrated in *in vitro* and *in vivo* animal models and in *in vitro* human models.

Carvedilol reduces the peripheral vascular resistance by vasodilation predominantly mediated through selective  $\alpha_1$  - antagonism and beta blockade prevents reflex tachycardia with the net result that heart rate is slightly decreased.

**In hypertensive patients, a reduction in blood pressure is not associated with a concomitant increase in total peripheral resistance, as observed with pure beta-blocking agents. Renal blood flow and renal function are maintained. Peripheral blood flow is maintained, therefore, cold extremities (often observed with drugs possessing beta-blocking activity) are rarely seen. Fluid retention does not occur.**

In studies that compared the acute haemodynamic effects of carvedilol to baseline measurements in patients with congestive heart failure, there were significant reductions in systemic blood pressure, pulmonary artery pressure, pulmonary capillary wedge pressure, and heart rate. Initial effects on cardiac output, stroke volume index and systemic vascular resistance were small and variable.

In terms of chronic haemodynamic effects (12 to 14 weeks) carvedilol significantly reduced systemic blood pressure, pulmonary artery pressure, right atrial pressure, systemic vascular resistance and heart rate while stroke volume index was increased.

In patients with ischaemic cardiomyopathy, long-term treatment (6 months) with carvedilol (6.25, 12.5 and 25mg) reduced left ventricular dimensions measured echocardiographically.

In patients with renal impairment, the autoregulatory blood supply is preserved and the glomerular filtration is unchanged during chronic treatment with carvedilol.

A normal ratio of high density lipoproteins to low density lipoproteins (HDL/LDL) is maintained. Serum electrolytes are also unaffected.

During one small randomized trial in patients with hypertension and non-insulin dependant diabetes carvedilol exerted no significant effect on fasting glucose, post-prandial glucose concentration and glycosylated haemoglobin A<sub>1</sub>. In another trial of non-insulin dependant diabetics, carvedilol did not significantly affect glucose tolerance test result. A third trial in hypertensive non-diabetic subjects with metabolic syndrome and baseline insulin resistance carvedilol demonstrated a modest but non-significant increase in insulin sensitivity. A fourth trial demonstrated a decrease in plasma glucose and insulin responses to a glucose load in hypertensive non insulin dependant diabetics.

## **Pharmacokinetics**

### **Absorption**

Carvedilol is rapidly and extensively absorbed following oral administration. Carvedilol is a substrate of the intestinal efflux transporter P-glycoprotein which plays a major role in the bioavailability of certain medicines. The absolute bioavailability of carvedilol is approximately 25%. Plasma levels peak approximately 1 hour after an oral dose. Carvedilol undergoes stereoselective first-pass metabolism with plasma levels of R(+)-carvedilol approximately 2 to 4-fold higher than S(-)-carvedilol following oral administration in healthy subjects. Plasma levels increase in a dose-proportional manner.

No data on the effect of food on carvedilol tablets exist. Studies carried out with the capsule formulation indicate that food does not affect the extent of bioavailability or the maximum plasma concentration, although the time to reach maximum plasma concentration is delayed.

### **Distribution**

Greater than 98% of carvedilol is bound to plasma proteins, primarily albumin. Carvedilol is highly lipophilic; the volume of distribution is approximately 2 L/kg and is increased in patients with liver disease. When used as directed, carvedilol is unlikely to accumulate during long-term treatment.

### **Metabolism**

In humans, carvedilol is extensively metabolized in the liver via oxidation and glucuronidation into a variety of metabolites which are mainly excreted in the bile. The first-pass effect after oral administration amounts to about 60-75%; enterohepatic circulation of carvedilol and/or its metabolites has been shown in animals.

The oxidative metabolism of carvedilol is stereoselective. The R(+) enantiomer is predominantly metabolized by CYP2D6 and CYP1A2, while the S(-) enantiomer is mainly metabolised by CYP2C9 and to a lesser extent by CYP2D6. Other CYP450 isoenzymes involved in the metabolism of carvedilol include CYP3A4, CYP2E1 and CYP2C19. The maximum plasma concentration of R-carvedilol is approximately 2 fold higher than that S-carvedilol. Although results from *in vitro* studies demonstrate that carvedilol has inhibitory potential against several P450s (CYP1A2, CYP2C9/8, CYP2C19, CYP3A and CYP2D6), it is important to note that the estimated IC<sub>50</sub> values (concentration of carvedilol required to produce 50% inhibition of the CYP450 isoenzymes) for the R(+) and S(-) enantiomers are substantially higher than their circulating peak plasma levels achieved during therapy.

The R(+) enantiomer is predominantly metabolised through hydroxylation.

Poor metabolisers of debrisoquine (a marker for CYP2D6) exhibited 2-to 3-fold higher plasma concentrations of R(+) carvedilol, compared to extensive metabolisers. In contrast, plasma levels for S(-) carvedilol were only increased by about 20-25% in poor metabolisers. As R(+) carvedilol is only responsible for alpha-blocking activity, it would be anticipated that, on average, poor metabolisers of debrisoquine would have greater alpha-blockade after carvedilol administration with little change in beta-blocking activity, compared to extensive metabolisers (see drug interactions).

The pharmacokinetics of carvedilol do not appear to be different in poor metabolisers of S-mephenytoin (patients deficient in CYP2C19).

Demethylation and hydroxylation at the phenol ring produces three active metabolites with beta-receptor blocking activity. Based on preclinical studies, the 4'-hydroxyphenol metabolite is approximately 13 times more potent than carvedilol for beta-blockade. Compared to carvedilol, the three active metabolites exhibit weak vasodilating activity. In humans, the concentrations of the three active metabolites are about 10 times lower than that of the parent substance. According to an *in vitro* study using rat brain homogenate, two of the hydroxy-carbazole metabolites of carvedilol are extremely potent antioxidants, demonstrating a 30 to 80 fold greater potency than carvedilol. Clinical significance remains to be established.

### **Elimination**

After oral administration, the elimination half-life of carvedilol is approximately 6 to 10 hours. Plasma clearance ranges from 500 to 700 mL/min. Elimination is mainly biliary, with the primary route of excretion being via the faeces. A minor portion is eliminated via the kidneys.

The pharmacokinetics of carvedilol are affected by age. AUC and T<sub>max</sub> values are increased in the elderly. Plasma levels of carvedilol are approximately 50% higher in the elderly compared to young subjects.

Steady-state plasma concentrations of both carvedilol enantiomers increased proportionally over the 6.25 to 50 mg dose range in patients with congestive heart failure. Compared to healthy subjects, congestive heart failure patients had increased mean AUC and C<sub>max</sub> values for both carvedilol enantiomers with up to 50% to 100% higher values observed in Class IV patients. The mean apparent terminal elimination half-life for carvedilol was similar to that observed in healthy subjects.

### **Pharmacokinetics in Special Populations**

#### *Patients with renal impairment*

In patients with hypertension and renal insufficiency, the area under plasma level-time curve, elimination half-life and maximum plasma concentration do not change significantly. Following a single dose (12.5mg) the mean  $\pm$  SD of AUCs on day 1 were 220 $\pm$ 120 in patients with renal impairment and 165 $\pm$ 83.5ng.h/mL in controls. Following multiple doses (25mg daily) and on day 9, the corresponding AUCs were 618  $\pm$  335 in patients with renal impairment and 413  $\pm$  247ng.h/mL in controls. Renal excretion of the unchanged drug decreases in the patients with renal insufficiency; however changes in pharmacokinetic parameters are modest for racemic carvedilol and R(+)-carvedilol.

Carvedilol is not eliminated during dialysis because it does not cross the dialysis membrane, probably due to its high plasma protein binding.

#### *Patients with hepatic impairment*



In patients with cirrhosis of the liver, the systemic availability of the drug is increased up to four fold because of a reduction in the first-pass effect (absolute bioavailability 18.6% in 19 controls and 82.5% in 5 patients). Therefore, carvedilol is contraindicated in patients with clinically manifest liver dysfunction (see Contraindications).

#### *Patients with heart failure*

In a study in 24 patients with heart failure, the clearance of R-and S-carvedilol was significantly lower than previously estimated in healthy volunteers. These results suggested that the pharmacokinetics of R-and S-carvedilol is significantly altered by heart failure.

#### *Geriatric use*

Age has no statistically significant effect on the pharmacokinetics of carvedilol in hypertensive patients. A study in elderly hypertensive patients showed that there was no significant difference in the adverse event profile compared to younger patients. Another study which included elderly patients with coronary heart disease showed no significant difference in the adverse events reported vs those reported by younger patients.

#### *Paediatric use*

There is limited data available on pharmacokinetics in people younger than 18 years of age.

### **Clinical Trials**

The use of this agent in congestive heart failure (CHF) patients has been shown to reduce cardiovascular hospitalisation, improve patient well-being, slow the progression of the disease and reduce the risk of death.

Four U.S. multicentre, double-blind, placebo-controlled studies enrolled 1094 patients (696 randomised to carvedilol) with New York Heart Association (NYHA) class II - III heart failure and ejection fraction  $<0.35$ . The vast majority was on digitalis, diuretics and an ACE-inhibitor at study entry. Patients were assigned to the studies based upon exercise ability. An Australia-New Zealand double-blind, placebo-controlled study randomised 415 patients (half to carvedilol) with less severe heart failure. All protocols excluded patients expected to undergo cardiac surgery during the 6 to 12 months of double-blind follow-up. All randomised patients had tolerated a 2-week course on carvedilol 6.25 mg b.i.d.

In each study, there was a primary end-point, either progression of heart failure (one U.S. study) or exercise tolerance (2 U.S. studies meeting enrolment goals and the Australia-New Zealand study). There were many secondary end-points specified in these studies, including NYHA classification, patient and physician global assessments, and cardiovascular hospitalisation. Death was not a specified end-point in any study, but it was analysed in all studies. Other analyses not prospectively planned included the sum of deaths and total or cardiovascular hospitalisations. In situations where the primary end-points of a trial do not show a significant benefit of treatment,

assignment of significance values to the other results is complex, and such values need to be interpreted cautiously.

**The results of the U.S. and Australia-New Zealand trials were as follows:**

*Slowing Progression of Heart Failure:* One U.S. multicentre study (366 subjects) had as its primary end-point the sum of cardiovascular mortality, cardiovascular hospitalisation and sustained increase in heart failure medications. Heart failure progression was reduced, during an average follow-up of 7 months, by 48% (p=0.008).

In the Australia-New Zealand study, death and total hospitalisations were reduced by about 25% over 18-24 months. In the three largest U.S. studies, death and total hospitalisations were reduced by 19%, 39% and 49%, these results being nominally statistically significant in the last two studies. The Australia- New Zealand results were statistically borderline.

*Functional Measures:* None of the multicentre studies had NYHA classification as a primary end-point, but all such studies had it as a secondary end-point. There was at least a trend toward improvement in NYHA class in all studies. Exercise tolerance was the primary end-point in 3 studies; in none was a statistically significant effect found.

*Subjective Measures:* Quality of life, as measured with a standard questionnaire (a primary end-point in one study), was unaffected by carvedilol. However, patients' and investigators' global assessments showed significant improvement in most studies.

*Mortality:* Mortality was not a planned endpoint in any study. Overall the results from four US studies are consistent with a beneficial effect of carvedilol on mortality due to the consistency of the results seen across different trials. However, the actual effect, size and statistical difference of this observation are difficult to define.

**Severe Congestive Heart Failure (COPERNICUS) Trial**

In a large, multi-centre, double-blind, placebo-controlled mortality trial (COPERNICUS), 2289 patients with stable, severe, CHF of ischaemic, or non-ischaemic origin, on standard therapy, were randomised to either carvedilol (1156 patients) or placebo (1133 patients). Patients had left ventricular systolic dysfunction with a mean ejection fraction of < 20%, sitting systolic blood pressure  $\geq$  85 mmHg, no more than trace edema of the peripheral limbs, no new pulmonary rales or ascites, optimisation of diuretic therapy and other established therapy such as ACE inhibitors and angiotensin-II antagonists, no recent unstable angina, cardiac surgery or ventricular arrhythmias and no recent use of intravenous positive inotropic or vasodilator agents (other than digitalis). The primary efficacy parameter was all-cause mortality and the secondary efficacy parameters were

defined as combined mortality or hospitalisations for heart failure, mortality or cardiovascular hospitalisations and mortality or all-cause hospitalisations. Interim analyses were conducted to determine whether the Data Safety Monitoring Board (DSMB) could recommend the study to be terminated early due to convincing evidence of benefit or harm. Deaths were classified as either cardiovascular or non-cardiovascular, and within the group of cardiovascular deaths as being due to left ventricular dysfunction or other cardiovascular causes.

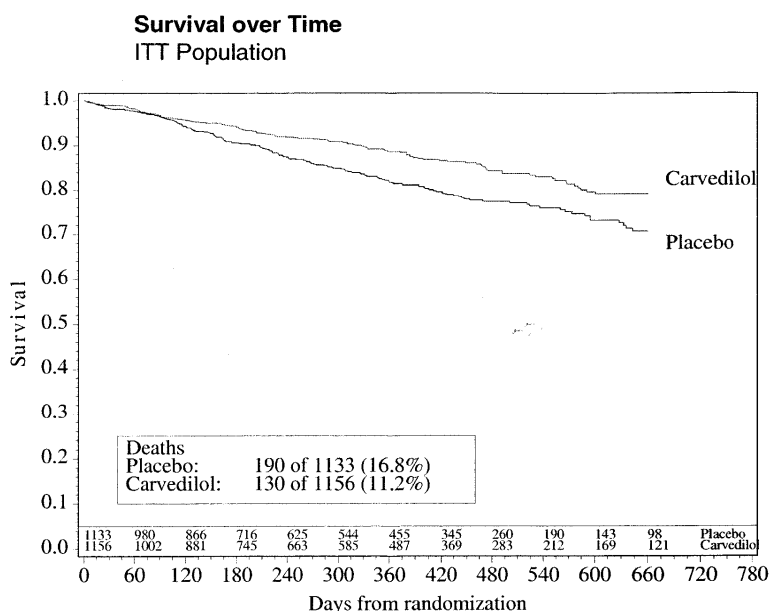
### Efficacy results

At the fourth interim analysis, the upper interim monitoring boundary was exceeded, indicating a statistically significant survival benefit for patients on carvedilol. As a result, the DSMB recommended early termination of the trial

### Primary Efficacy Parameter

The rate of survival was significantly higher in the patients receiving carvedilol than the placebo group. The benefit of carvedilol became apparent after about 100 days of treatment. All-cause mortality was reduced by 35% from 19.7% in the placebo group to 12.8% in the carvedilol group (Cox proportional hazards,  $p=0.00013$ ). The mortality benefit of carvedilol was consistent across all sub-populations investigated. The most frequent cause of death, sudden death, was reduced by 41% in the carvedilol group (5.3% vs 8.9%).

Figure 1-



### Secondary Efficacy Parameters

Hospitalisations due to worsening heart failure, cardiovascular hospitalisations and all hospitalisations were significantly reduced under carvedilol therapy. Thus, the combined risk of death or hospitalisation due to worsening heart failure was reduced by 31% ( $p=0.000004$ ), death or



cardiovascular hospitalisation by 27% (p=0.000023) and death or all hospitalisation by 24% (p=0.00004).

**Table 1- One-year Kaplan-Meier estimates of the incidences of the combined endpoints death or hospitalisations, hazard ratio estimates and log-rank p values.**

ITT Population

|   | Total Events Placebo | One-Year K-M Estimate Placebo | Total Events Carvedilol | One-Year K-M Estimate Carvedilol | Hazard Ratio (Carvedilol vs Placebo) (95% CI) | p Value (Log-Rank Test) | % Risk Reduction |
|---|----------------------|-------------------------------|-------------------------|----------------------------------|---|-------------------------|------------------|
| Death or hospitalisations for heart failure | 357                  | 0.379                         | 271                     | 0.255                            | 0.691 (0.590, 0.809)                          | 0.000004                | 31               |
| Death or cardiovascular hospitalisations    | 395                  | 0.417                         | 314                     | 0.302                            | 0.727 (0.627, 0.843)                          | 0.000023                | 27               |
| Death or all hospitalisations               | 507                  | 0.523                         | 425                     | 0.416                            | 0.764 (0.671, 0.869)                          | 0.000040                | 24               |

The majority of patients were hospitalised for cardiovascular reasons. Treatment with carvedilol resulted in lower rates for almost all cardiac hospitalisations (worsening heart failure, atrial and ventricular and tachyarrhythmias, myocardial infarction and unstable angina pectoris). The number of patients hospitalised for symptomatic bradycardia and symptomatic heart block were slightly higher in the carvedilol treated patients than placebo, although the total number of patients hospitalised was low (1.3% and 0.8% respectively for bradycardia and 0.3% and 0.1% respectively for heart block). The number of patients hospitalised for non-cardiovascular events was similar in both groups (placebo 11.2%, carvedilol 10.6%).

## INDICATIONS

DILATREND is indicated for the treatment of hypertension. Data have not been provided to support the use of this drug in renovascular disease.

**DILATREND is indicated for the treatment of patients with symptomatic mild to severe (NYHA Class II - IV) congestive heart failure (CHF) as an adjunct to conventional treatments (e.g. diuretics, digoxin, ACE inhibitors and vasodilators).**

## CONTRAINDICATIONS

DILATREND must not be used in patients with:

- New York Heart Association (NYHA) Class IV decompensated heart failure requiring intravenous inotropic support.
- Bronchial asthma (two cases of death from status asthmaticus have been reported in patients receiving single doses of carvedilol) or related bronchospastic conditions *including chronic obstructive pulmonary disease (COPD) with a bronchospastic component*.
- Allergic disorders (including Asthma and allergic rhinitis) which may suggest a predisposition to bronchospasm.
- Severe sinus bradycardia (less than 45 to 50 beats per minute) or sick sinus syndrome (unless a permanent pacemaker is in place).
- Shock (including cardiogenic and hypovolaemic shock)
- Second and third degree atrioventricular block.
- Known hypersensitivity to DILATREND.
- Hepatic impairment; DILATREND is contraindicated in patient with clinically manifest liver dysfunction
- Severe hypotension (systolic blood pressure <85 mmHg).

## PRECAUTIONS

**BETA BLOCKERS CAN CAUSE WORSENING HEART FAILURE. SINCE DILATREND HAS BETA-BLOCKING PROPERTIES, CARE MUST BE TAKEN DURING INITIATION AND UP-TITRATION OF THE DRUG IN HEART FAILURE PATIENTS, SINCE WORSENING HEART FAILURE HAS BEEN OBSERVED IN THIS PHASE OF TREATMENT. IN ORDER TO MINIMISE THE RISK OF THESE EVENTS, IT IS CRITICAL TO CAREFULLY FOLLOW THE RECOMMENDED DOSING FOR DILATREND IN PATIENTS WITH CONGESTIVE HEART FAILURE (SEE DOSAGE AND ADMINISTRATION).**

**Abrupt withdrawal:** In patients with heart failure, ischaemic heart disease or angina pectoris, abrupt cessation of therapy may lead to deterioration. There have been reports of severe exacerbation of angina, and of myocardial infarction or ventricular arrhythmias occurring in patients with angina pectoris, following abrupt discontinuation of beta-blocker therapy. Therefore, when discontinuing DILATREND in patients with angina pectoris the dosage should be gradually reduced over a period of about 2 weeks and the patient should be carefully observed. The same frequency of administration should be maintained. If angina markedly worsens or acute coronary insufficiency develops, re-institute DILATREND therapy promptly, at least temporarily.

**Prinzmetal Angina:** Agents with non-selective beta-blocking activity may provoke chest pain in patients with Prinzmetal's variant angina. There has been no clinical experience with carvedilol in these patients, although the alpha-blocking activity of carvedilol may prevent such symptoms. However, caution should be taken in the administration of carvedilol to patients suspected of having Prinzmetal's variant angina.



**Bradycardia:** In clinical trials, DILATREND caused bradycardia in about 2% of hypertensive patients and 9% of congestive heart failure patients. If pulse rate drops below 55 beats/minute, the dosage should be reduced.

**Hypotension:** Hypotension and postural hypotension occurred in 9.7% and syncope in 3.4% of congestive heart failure patients receiving DILATREND compared to 3.6% and 2.5% of placebo patients, respectively. The risk for these events was highest during the first 30 days of dosing, corresponding to the up-titration period and was a cause for discontinuation of therapy in 0.7% of DILATREND patients, compared to 0.4% of placebo patients.

To decrease the likelihood of syncope or excessive hypotension, treatment should be initiated with 3.125 mg b.i.d. for congestive heart failure patients. Dosage should then be increased slowly, according to recommendations in the DOSAGE AND ADMINISTRATION section, and the drug should be taken with food. During initiation of therapy, the patient should be cautioned to avoid situations such as driving or hazardous tasks, where injury could result should syncope occur.

**Labile Hypertension: DILATREND should be used with caution in patients with labile or secondary hypertension until further clinical experience is available.**

**Peripheral Vascular Disease:** Beta-blockers can precipitate or aggravate symptoms of arterial insufficiency in patients with peripheral vascular disease. Caution should be exercised in such individuals.

**Raynaud's phenomenon:** DILATREND should be used with caution in patients suffering from peripheral circulatory disorders (eg Raynaud's phenomenon) as there may be exacerbation of symptoms.

**Hypertensive Patients with Left Ventricular Failure:** In hypertensive patients who have congestive heart failure controlled with digitalis, diuretics and/or an angiotensin-converting enzyme inhibitor, DILATREND (carvedilol) may be used. However, since it is likely that such patients are dependent, in part, on sympathetic stimulation for circulatory support, it is recommended that dosing follow the instructions for patients with congestive heart failure.

**Psoriasis:** Patients with a history of psoriasis associated with  $\beta$ -blocker therapy should take DILATREND only after consideration of the risk-benefit ratio.

**Concomitant use of calcium channel blockers:** Careful monitoring of ECG and blood pressure is necessary in patients receiving concomitant therapy with calcium channel blockers of the verapamil or diltiazem type or other antiarrhythmic drugs ([see Drug Interactions](#))

**Hepatic Injury:** Mild hepatocellular injury, confirmed by rechallenge, has occurred rarely with DILATREND therapy.

In controlled studies of congestive heart failure, the incidence of liver function abnormalities reported as adverse experiences was 5.0% (38 of 765 patients) in patients receiving DILATREND and 4.6% (20 of 437 patients) in those receiving placebo. Three patients receiving carvedilol (0.4%) and two patients receiving placebo (0.5%) in placebo-controlled trials withdrew for abnormal hepatic function.



Hepatic injury has been reversible and has occurred after short-and/or long-term therapy with minimal clinical symptomatology. No deaths due to liver function abnormalities have been reported.

At the first symptom/sign of liver dysfunction (e.g. pruritus, dark urine, persistent anorexia, jaundice, right upper quadrant tenderness or unexplained “flu-like” symptoms) laboratory testing should be performed. If the patient has laboratory evidence of liver injury or jaundice, DILATREND should be stopped and not restarted.

**Renal Function:** Rarely, use of carvedilol in patients with congestive heart failure has resulted in deterioration of renal function. Patients at risk appear to be those with low blood pressure (systolic BP<100 mmHg), ischaemic heart disease and diffuse vascular disease, and/or underlying renal insufficiency. Renal function has returned to baseline when carvedilol was stopped. In patients with these risk factors it is recommended that renal function should be monitored during up-titration of DILATREND and the drug discontinued or dosage reduced if worsening of renal function occurs.

**Ocular Effects:** Animal studies have shown that carvedilol binds to the melanin of the uveal tract. The significance of this in humans is not known but periodic ophthalmic examinations are advisable while the patient is taking carvedilol.

Oculomucocutaneous syndrome whose signs include conjunctivitis sicca and psoriasiform rashes, and sclerosing serositis has occurred with the chronic use of one beta-adrenergic blocking agent, (practolol). This syndrome has not been observed in association with carvedilol or any other such agent. However, physicians should be alert to the possibility of such reactions and discontinue treatment in the event that they occur.

Wearers of contact lenses should bear in mind the possibility of reduced lacrimation.

**Diabetes and Hypoglycaemia:** Beta-blockers may mask some of the manifestations of hypoglycaemia, particularly tachycardia. Nonselective beta-blockers may potentiate insulin-induced hypoglycaemia and delay recovery of serum glucose levels. Patients subject to spontaneous hypoglycaemia, or diabetic patients receiving insulin or oral hypoglycaemic agents, should be cautioned about these possibilities and carvedilol should be used with caution. In congestive heart failure patients with diabetes, the use of DILATREND may lead to worsening hyperglycaemia, which responds to intensification of hypoglycaemic therapy. It is recommended that blood glucose be monitored when carvedilol dosing is initiated, adjusted or discontinued. (see Drug Interactions)

**Thyrotoxicosis:** Beta-adrenergic blockade may mask the clinical signs of hyperthyroidism such as tachycardia. Abrupt withdrawal of beta-blockade may be followed by an exacerbation of the symptoms of hyperthyroidism or may precipitate thyroid storm.

**Risk of Anaphylactic Reaction:** While taking beta-blockers, patients with a history of severe anaphylactic reaction to a variety of allergens may be more reactive to repeated challenge, either accidental, diagnostic or therapeutic. Such patients may be unresponsive to the usual doses of adrenaline used to treat allergic reaction.

**Non-allergic Bronchospasm (e.g., chronic bronchitis and emphysema):** Patients with bronchospastic disease should, in general not receive beta-blockers. DILATREND may be used with caution.

In clinical trials of patients with congestive heart failure, patients with bronchospastic disease were enrolled if they did not require oral or inhaled medication to treat their bronchospastic disease. In such patients, it is recommended that carvedilol be used with caution. The dosing recommendations should be followed closely and the dose should be lowered if any evidence of bronchospasm is observed during up-titration. ([see Drug Interactions](#))

**Anaesthesia and Major Surgery:** If DILATREND treatment is to be continued peri-operatively, particular care should be taken when anaesthetic agents which depress myocardial function, such as ether, cyclopropane, and trichlorethylene, are used. ([see Overdosage and Drug Interactions sections](#))

**Phaeochromocytoma:** In patients with this condition an alpha-blocking drug (eg phentolamine or phenoxybenzamine) should be administered before the beta-blocker to avoid exacerbation of hypertension. Although carvedilol has both alpha- and beta-blocking pharmacological activities, there is no experience with its use in this condition. Therefore, caution should be taken in the administration of carvedilol to patients suspected of having phaeochromocytoma.

### **Carcinogenicity**

Repeat dose toxicity studies showed an increase in the incidence of bile duct hyperplasia in rats at doses greater than 34mg/kg/day following 12 and 18 months dietary treatment with carvedilol, and in dogs receiving doses greater than 30mg/kg/day for 12 months. Focal hepatocellular hyperplasia was noted in rats at oral doses greater than 100mg/kg/day at 3 months and greater than 30mg/kg/day at 12 months of treatment with carvedilol. Hepatocellular hyperplasia was not noted in dogs at doses up to 300mg/kg/day. In addition, there was a small increase in the incidence of hepatic adenomas in rats receiving carvedilol at doses greater than 100mg/kg/day in the 18 month dietary study. There was no increase in the incidence of hepatic adenomas in the rat 2 year dietary carcinogenicity study, in which the average dose was 75mg/kg/day. Based on AUC, this dose showed a 9 to 15 fold higher systemic exposure when compared to a dose of 50mg/day in humans. A carcinogenicity study in mice was negative at dietary doses up to 200 mg/kg/day. Therefore, the carcinogenic risk to humans following long-term administration of carvedilol appears to be low.

### **Use During Pregnancy (Category C)**

There is no adequate clinical experience with carvedilol in pregnant women

Studies in rats have shown that carvedilol and/or its metabolites cross the placental barrier. Beta-blockers may cause bradycardia in the foetus and newborn infant. During the later stages of



pregnancy and parturition these drugs should therefore only be given after weighing the needs of the mother against the risk to the foetus.

Studies in rats and rabbits showed carvedilol was not teratogenic at doses up to 300 and 75 mg/kg/day, respectively. Carvedilol was embryotoxic and foetotoxic at doses greater than 60 mg/kg/day in rats and 15 mg/kg/day in rabbits. Maternal toxicity was noted in rats and rabbits at doses greater than 60 and 75 mg/kg/day, respectively.

### **Use in Lactation**

Carvedilol is excreted in breast milk, although the risk of affecting the child appears unlikely at therapeutic doses, the possibility of the consequences of alpha and beta blockage should be borne in mind. DILATREND must not be used during lactation unless the anticipated benefits outweigh the possible risks.

### **Use in children**

Safety and efficacy of DILATREND in patients younger than 18 years of age has not been established.

### **Use in the elderly**

In congestive heart failure trials of carvedilol worldwide, there were no notable differences in efficacy or the incidence of adverse events between older ( $\geq 65$  years) and younger patients. With the exception of dizziness (incidence 8.8% in the elderly vs. 6% in younger patients) there were no events in the world-wide hypertensive trial population for which the incidence in the elderly exceeded that in the younger population by greater than 2%.

### **Ability to Drive and Operate Machinery**

Individually varying reactions can impair alertness (e.g. patients' capacity for driving or operating machinery). This applies particularly when starting or changing treatment and in conjunction with alcohol.

### **Drug Interactions**

#### *Pharmacokinetic interactions*

Carvedilol is a substrate as well as an inhibitor of P-glycoprotein. Therefore the bioavailability of drugs transported by P-glycoprotein may be increased with concomitant administration of carvedilol. In addition, the bioavailability of carvedilol can be modified by inducers or inhibitors of P-glycoprotein.

Inhibitors as well as inducers of CYP2D6 and CYP2C9 can modify the systemic and/or presystemic metabolism of carvedilol stereoselectively, leading to increased or decreased plasma concentrations of R and S-carvedilol. Retrospective analysis of side effects in clinical trials showed that poor 2D6 metabolisers had a higher rate of dizziness during up-titration, presumably resulting from vasodilating effects of the higher concentrations of the alpha-blocking R(+) enantiomer (see Pharmacokinetics).

Some examples observed in patients or in healthy subjects are listed below but the list is not exhaustive.



*Digoxin:* Digoxin plasma concentrations are increased by about 15% when digoxin and carvedilol are administered concomitantly. Therefore, increased monitoring of digoxin is recommended when initiating, adjusting or discontinuing DILATREND (see Precautions, Pharmacodynamic interactions).

*Cyclosporin:* Two studies in renal and cardiac transplant patients receiving oral cyclosporin have shown an increase in cyclosporin plasma concentration following the initiation of carvedilol. It appears that carvedilol increases the absorption of cyclosporin (po) through inhibition of P-glycoprotein activity in the intestine. In an attempt to maintain therapeutic cyclosporin levels, an average 10-20% reduction of the cyclosporin dose was necessary. Therefore, due to wide interindividual variability of cyclosporin levels, it is recommended that cyclosporin concentrations are monitored closely after initiation of carvedilol therapy and that the dose of cyclosporin be adjusted as appropriate. In case of i.v administration of cyclosporin, no interaction with carvedilol is anticipated.

*Grapefruit Juice:* Simultaneous administration of a single dose of DILATREND and 300mL of grapefruit juice (an inhibitor of CYP3A4 and CYP1A2) increased the AUC of carvedilol by approximately 16%.

*Rifampicin:* In a study in 12 health subjects, rifampicin administration decreased the carvedilol plasma levels most likely by induction of P-glycoprotein leading to a decrease of the intestinal absorption of carvedilol and a decrease of the antihypertensive effect.

*Cimetidine:* The AUC of carvedilol was increased by 30% without associated increase in C<sub>max</sub> in healthy male subjects receiving concomitant cimetidine which is not a potent CYP2D6 inhibitor.

*Amiodarone:* In patients with heart failure, amiodarone decreased the clearance of S-carvedilol likely by inhibition of CYP2C9. The mean R-carvedilol plasma concentration was not altered. Consequently, there is a potential risk of increased  $\beta$ -blockade caused by a raised plasma S-carvedilol concentration.

*Fluoxetine:* In a randomized, cross-over study in 10 patients with heart failure, co-administration of fluoxetine, a strong inhibitor of CYP2D6, resulted in stereoselective inhibition of carvedilol metabolism with a 77% increase in mean R(+) enantiomer AUC. However, no difference in adverse events and no statistically significant differences in blood pressure and heart rate were noted. Care should be taken when carvedilol is combined with fluoxetine in clinically unstable patients.

### Pharmacodynamic interactions

*Insulin or oral hypoglycaemics:* Agents with beta-blocking properties may enhance the blood-sugar-reducing effect of insulin and oral hypoglycaemics. The signs of hypoglycaemia may be masked or attenuated (especially tachycardia) Therefore, in patients taking insulin or oral hypoglycaemics, regular monitoring of blood glucose is recommended. (see Precautions)

*Catecholamine Depleting Agents:* Patients treated with both carvedilol and a drug that can deplete catecholamines (e.g. reserpine and monoamine oxidase inhibitors) should be observed closely for signs of hypotension and/or severe bradycardia.



*Clonidine:* Concomitant administration of clonidine with agents with beta-blocking properties may potentiate blood-pressure and heart-rate-lowering effects. When concomitant treatment with agents with beta-blocking properties and clonidine is to be terminated, the beta-blocking agent should be discontinued first. Clonidine therapy can then be discontinued several days later by gradually decreasing the dosage.

*Calcium channel blockers:* Isolated cases of conduction disturbance (rarely with haemodynamic compromise) have been observed when carvedilol and diltiazem were co-administered. As with other drugs with beta-blocking activity, if DILATREND is to be administered orally with calcium channel blockers of the verapamil or diltiazem type, it is recommended that ECG and blood pressure be monitored.

**Antiarrhythmic Drugs:** Care should be taken when prescribing beta-blockers with antiarrhythmic drugs. Interactions have been reported during concomitant beta-blocker therapy with the Class IA agents disopyramide, and less frequently quinidine; Class IB agents, tocainide, mexiletine and lignocaine; the Class IC agent, flecainide; the Class III agent, amiodarone; and the Class IV antiarrhythmic agents.

*Antihypertensives:* As with other agents with  $\beta$ -blocking activity, carvedilol may potentiate the effect of other concomitantly administered drugs that are anti-hypertensive in action (eg  $\alpha$ 1-receptor antagonists) or have hypotension as part of their adverse effect profile.

*Anaesthetic agents:* Careful monitoring of vital signs is recommended during anaesthesia due to the synergistic negative inotropic and hypotensive effects of carvedilol and anaesthetic drugs (see Precautions).

*NSAIDs:* The concurrent use of nonsteroidal anti-inflammatory drugs (NSAIDs) and beta-adrenergic blockers may result in an increase in blood pressure and lower blood pressure control.

*Beta-agonist Bronchodilators:* Non-cardioselective beta blockers oppose the bronchodilator effects of beta-agonist bronchodilators. Careful monitoring of patients is recommended.

*Digoxin:* The combined use of beta-blockers and digoxin may result in additive prolongation of atrioventricular (AV) conduction time (see Precautions, Pharmacokinetic Interactions).

### **Effects on laboratory tests**

Carvedilol does not affect laboratory tests.

## **ADVERSE EFFECTS**

DILATREND is well tolerated by most patients. Most of the adverse reactions are transient and occur at the beginning of treatment. Adverse reactions are related to the pharmacological effects and to the dose.

DILATREND has been evaluated for safety in mild to moderate congestive heart failure in more than 1900 patients worldwide of whom 1300 participated in U.S. clinical trials. Approximately 54% of the total treated population received DILATREND for at least 6 months and 20% received DILATREND for at least 12 months. The adverse experience profile of DILATREND in



congestive heart failure patients was consistent with the pharmacology of the drug and the health status of the patients. In U.S. clinical trials comparing DILATREND in daily doses up to 100 mg (n=765) to placebo (n=437), 5.4% of DILATREND patients discontinued for adverse experiences vs 8.0% of placebo patients. Generally, the overall incidence of adverse experiences in U.S. placebo-controlled trials was not related to dose. However, there was an increased incidence of dizziness, abnormal vision (primary blurry vision), and bradycardia, with increasing dose.

### **More Common Events (occurring with a frequency of >1%)**

#### **Events occurring with a frequency $\geq 2\%$**

Table 2 shows adverse events in U.S. placebo-controlled clinical trials of congestive heart failure patients that occurred with an incidence of 2% or more regardless of causality and were more frequent in drug-treated patients than placebo-treated patients. Median study medication exposure was 6.33 months for DILATREND and placebo patients.

In addition to the events in Table 2, asthenia, cardiac failure, flatulence, anorexia, dyspepsia, palpitation, extrasystoles, hyperkalaemia, arthritis, angina pectoris, insomnia, depression, anaemia, viral infection, dyspnoea, coughing, respiratory disorder, rhinitis, rash and leg cramps were also reported, but rates were equal to, or more common in placebo-treated patients.

**Table 2- Adverse Events in U.S. Placebo-Controlled Congestive Heart Failure Trials  
Frequency  $\geq 2\%$ , in DILATREND Treated Patients, Regardless of Causality**

|                                   | Adverse Reactions                    |                                    |
|-----------------------------------|--------------------------------------|------------------------------------|
|                                   | DILATREND<br>(n=765)<br>% occurrence | Placebo<br>(n=437)<br>% occurrence |
| <b>Autonomic Nervous System</b>   |                                      |                                    |
| Sweating increased                | 2.9                                  | 2.1                                |
| <b>Body as a Whole</b>            |                                      |                                    |
| Fatigue                           | 23.9                                 | 22.4                               |
| Chest Pain                        | 14.4                                 | 14.2                               |
| Pain                              | 8.6                                  | 7.6                                |
| Injury                            | 5.9                                  | 5.5                                |
| Drug level increased              | 5.1                                  | 3.7                                |
| Oedema generalised                | 5.1                                  | 2.5                                |
| Oedema dependent                  | 3.7                                  | 1.8                                |
| Fever                             | 3.1                                  | 2.3                                |
| Oedema legs                       | 2.2                                  | 0.2                                |
| <b>Cardiovascular</b>             |                                      |                                    |
| Bradycardia                       | 8.8                                  | 0.9                                |
| Hypotension                       | 8.5                                  | 3.4                                |
| Syncope                           | 3.4                                  | 2.5                                |
| Hypertension                      | 2.9                                  | 2.5                                |
| AV block                          | 2.9                                  | 0.5                                |
| Angina pectoris aggravated        | 2.0                                  | 1.1                                |
| <b>Central Nervous System</b>     |                                      |                                    |
| Dizziness                         | 32.4                                 | 19.2                               |
| Headache                          | 8.1                                  | 7.1                                |
| Paraesthesia                      | 2.0                                  | 1.8                                |
| <b>Gastrointestinal</b>           |                                      |                                    |
| Diarrhoea                         | 11.8                                 | 5.9                                |
| Nausea                            | 8.5                                  | 4.8                                |
| Abdominal pain                    | 7.2                                  | 7.1                                |
| Vomiting                          | 6.3                                  | 4.3                                |
| <b>Haematology</b>                |                                      |                                    |
| Thrombocytopenia                  | 2.0                                  | 0.5                                |
| <b>Metabolic</b>                  |                                      |                                    |
| Hyperglycaemia                    | 12.2                                 | 7.8                                |
| Weight increase                   | 9.7                                  | 6.9                                |
| Gout                              | 6.3                                  | 6.2                                |
| BUN increased                     | 6.0                                  | 4.6                                |
| NPN increased                     | 5.8                                  | 4.6                                |
| Hypercholesterolaemia             | 4.1                                  | 2.5                                |
| Dehydration                       | 2.1                                  | 1.6                                |
| Hypervolaemia                     | 2.0                                  | 0.9                                |
| <b>Musculoskeletal</b>            |                                      |                                    |
| Back Pain                         | 6.9                                  | 6.6                                |
| Arthralgia                        | 6.4                                  | 4.8                                |
| Myalgia                           | 3.4                                  | 2.7                                |
| <b>Resistance Mechanism</b>       |                                      |                                    |
| Upper respiratory tract infection | 18.3                                 | 17.6                               |
| Infection                         | 2.2                                  | 0.9                                |
| <b>Respiratory</b>                |                                      |                                    |
| Sinusitis                         | 5.4                                  | 4.3                                |
| Bronchitis                        | 5.4                                  | 3.4                                |
| Pharyngitis                       | 3.1                                  | 2.7                                |
| <b>Urinary/Renal</b>              |                                      |                                    |
| Urinary tract infection           | 3.1                                  | 2.7                                |
| Haematuria                        | 2.9                                  | 2.1                                |
| <b>Vision</b>                     |                                      |                                    |
| Vision abnormal                   | 5.0                                  | 1.8                                |

The following adverse events were reported more frequently with DILATREND in placebo-controlled trials in patients with congestive heart failure:

**Events occurring with frequency of  $>1\%$  to  $<2\%$**

**Body as a Whole:** Peripheral oedema, allergy, sudden death, malaise, hypovolaemia.

**Cardiovascular System:** Fluid overload, and postural hypotension.

**Central and Peripheral Nervous System:** Hyperaesthesia and vertigo.

**Gastrointestinal:** Melaena and periodontitis.

**Liver and Biliary System:** AST and ALT increased.

**Haematology:** Purpura, prothrombin decreased.

**Metabolic and Nutritional:** Hyperuricaemia, hypoglycaemia, hyponatraemia, increased alkaline phosphatase, glycosuria.

**Psychiatric:** Somnolence.

**Reproductive, male:** Impotence.

**Urinary System:** Abnormal renal function, albuminuria.

**Less Common >0.1% to ≤1%**

The following adverse events were reported as possibly or probably related in worldwide open or controlled trials with DILATREND in patients with hypertension or congestive heart failure.

**Cardiovascular:** Peripheral ischaemia, tachycardia.

**Central and Peripheral Nervous System:** Hypokinesia.

**Gastrointestinal:** Hyperbilirubinaemia, increased hepatic enzymes (0.2% of hypertension patients and 0.4% of congestive heart failure patients were discontinued from therapy because of increases in hepatic enzymes; see PRECAUTIONS, Hepatic Injury).

**General:** Substernal chest pain, oedema.

**Psychiatric:** Sleep disorder, aggravated depression, impaired concentration, abnormal thinking, paranoia, emotional lability.

**Respiratory System:** Asthma (see CONTRAINDICATIONS).

**Reproductive, Male:** decreased libido.

**Skin and Appendages:** Pruritus, rash erythematous, rash maculopapular, rash psoriaform, photosensitivity reaction.

**Special Senses:** Tinnitus.

**Urinary System:** Micturition frequency.

**Autonomic Nervous System:** Dry mouth, sweating increased.

**Metabolic and Nutritional:** Hypokalaemia, diabetes mellitus, hypertriglyceridaemia.

**Haematology:** Anaemia, leucopenia.

The following events were reported in  $\leq 0.1\%$  of patients (all clinical trials) and are potentially important: complete AV block, bundle branch block, myocardial ischaemia, cerebrovascular disorder, convulsions, migraine, neuralgia, paresis, anaphylactoid reaction, alopecia, exfoliative dermatitis, amnesia, GI haemorrhage, bronchospasm, pulmonary oedema, decreased hearing, respiratory alkalosis, increased BUN, decreased HDL, pancytopenia, and atypical lymphocytes.

#### **Adverse events in severe congestive heart failure**

The overall safety and tolerability of DILATREND in the COPERNICUS study in patients with severe CHF was found to be in good agreement with the established safety profile for patients with mild and moderate CHF.

The incidence of serious adverse events was lower in the carvedilol (39.0%) than in the placebo (45.5%) group, and the rate of withdrawal from treatment due to adverse events was also lower in the carvedilol (9.5%) than in the placebo (11.3%) group.

The most frequently occurring serious adverse events were cardiovascular disorders, the incidences of which were lower in the carvedilol (26.3%) than in the placebo group (34.2%). Among cardiovascular disorders, worsening heart failure was the most commonly reported serious adverse event. During initiation of treatment the risk of worsening heart failure was similar in the two groups, but with continued treatment the risk of worsening heart failure decreased in the carvedilol group resulting in a slightly lower overall incidence in the carvedilol group (26%) compared with the placebo group (31.5%). The risk of experiencing vasodilatory events such as dizziness, hypotension and syncope was highest during initiation of carvedilol treatment and the risk decreased with continued treatment. Within the body system “body as a whole” the most frequently reported serious adverse event was sudden death and the incidence was lower in the carvedilol group.

**Table 3- Adverse events in the COPERNICUS trial occurring with a frequency  $\geq 2\%$**

|                                | Adverse Events                        |                                      |
|--------------------------------|---------------------------------------|--------------------------------------|
|                                | DILATREND<br>(n=1156)<br>% occurrence | Placebo<br>(n= 1133)<br>% occurrence |
| <b>Body as a Whole</b>         |                                       |                                      |
| Asthenia                       | 10.9                                  | 9.4                                  |
| Sudden death                   | 3.9                                   | 6.1                                  |
| Abdominal pain                 | 2.2                                   | 3.0                                  |
| Infection                      | 2.5                                   | 2.4                                  |
| Pain in extremity              | 2.1                                   | 2.5                                  |
| Back pain                      | 2.9                                   | 1.4                                  |
| Accidental injury              | 1.7                                   | 2.0                                  |
| <b>Cardiovascular System</b>   |                                       |                                      |
| Heart failure                  | 26.0                                  | 31.5                                 |
| Hypotension                    | 13.9                                  | 8.2                                  |
| Chest Pain                     | 6.8                                   | 7.6                                  |
| Bradycardia                    | 10.3                                  | 2.7                                  |
| Syncope (including presyncope) | 7.6                                   | 5.0                                  |
| Angina pectoris                | 5.5                                   | 4.1                                  |
| Atrial fibrillation            | 2.2                                   | 4.3                                  |
| Ventricular tachycardia        | 1.6                                   | 3.9                                  |
| Hypertension                   | 2.6                                   | 2.2                                  |
| Unstable angina pectoris       | 2.0                                   | 2.7                                  |
| AV block first degree          | 2.3                                   | 1.6                                  |
| Peripheral vascular disorder   | 1.6                                   | 2.4                                  |
| Myocardial infarct             | 1.6                                   | 2.2                                  |
| Ventricular fibrillation       | 1.0                                   | 2.1                                  |
| <b>Nervous System</b>          |                                       |                                      |
| Dizziness                      | 24.1                                  | 16.8                                 |
| Headache                       | 4.8                                   | 3.0                                  |
| <b>Gastrointestinal</b>        |                                       |                                      |
| Diarrhoea                      | 4.8                                   | 3.1                                  |
| Nausea                         | 3.8                                   | 3.3                                  |
| <b>Haematology</b>             |                                       |                                      |
| Anaemia                        | 2.4                                   | 2.0                                  |
| <b>Metabolic</b>               |                                       |                                      |
| Weight gain                    | 11.7                                  | 10.7                                 |
| Peripheral oedema              | 7.0                                   | 6.4                                  |
| Generalised oedema             | 6.0                                   | 4.9                                  |
| Hyperglycaemia                 | 4.5                                   | 3.3                                  |
| Gout                           | 3.5                                   | 2.7                                  |
| Hypokalaemia                   | 2.5                                   | 3.4                                  |
| Hyperkalaemia                  | 3.3                                   | 1.9                                  |
| Creatinine increased           | 2.9                                   | 1.4                                  |
| Diabetes mellitus              | 2.0                                   | 1.7                                  |
| <b>Musculoskeletal System</b>  |                                       |                                      |
| Muscle cramps                  | 2.0                                   | 1.2                                  |
| <b>Respiratory System</b>      |                                       |                                      |
| Upper respiratory infection    | 13.6                                  | 12.6                                 |
| Dyspnea                        | 11.2                                  | 11.0                                 |
| Bronchitis                     | 5.2                                   | 4.5                                  |
| Cough increased                | 4.5                                   | 4.2                                  |
| Lung oedema                    | 3.5                                   | 4.1                                  |
| Lung disorder                  | 4.0                                   | 3.2                                  |
| Pneumonia                      | 3.2                                   | 3.9                                  |
| <b>Urinogenital System</b>     |                                       |                                      |
| Kidney function abnormal       | 2.1                                   | 2.3                                  |
| Urinary tract infection        | 1.6                                   | 2.4                                  |
| <b>Vision</b>                  |                                       |                                      |
| Blurred vision                 | 2.8                                   | 2.2                                  |
| <b>Skin and appendages</b>     |                                       |                                      |
|                                | 7.1                                   | 6.9                                  |

## **Post-marketing Experience**

*Metabolism and Nutrition Disorders – Class Effect:* Due to the  $\beta$ -blocking properties, it is also possible for latent diabetes mellitus to become manifest, manifest diabetes to be aggravated, and blood glucose counter-regulation to be inhibited.

*Renal and Urinary Disorders:* Isolated cases of urinary incontinence in women, which resolved upon discontinuation of the medication, have been reported.

*Skin and Subcutaneous Tissue Disorders:* Alopecia.

## **DOSAGE AND ADMINISTRATION**

### **Hypertension:**

Once daily dosing is recommended.

Adults: The recommended dose for initiation of therapy is 12.5 mg once a day for the first 2 days. Thereafter the recommended dosage is 25 mg once a day. If necessary, the dosage may subsequently be increased at intervals of at least two weeks up to the recommended maximum daily dose of 50 mg given once a day or in divided doses (twice daily).

Elderly: The recommended dose for initiation of therapy is 12.5 mg once daily, which has provided satisfactory control in some patients. If the response is inadequate, the dose may be titrated at intervals of at least two weeks up to the recommended maximum daily dose.

Carvedilol can be combined with other anti-hypertensive agents, thiazide diuretics in particular.

### **Symptomatic Congestive Heart Failure:**

#### **Dosage must be individualised and closely monitored by a physician during up-titration.**

For patients receiving digitalis, diuretics and ACE inhibitors, dosing of these agents should be stabilised prior to initiation of DILATREND

It is recommended that DILATREND be taken with food to slow the rate of absorption and to reduce the risk of orthostatic effects. The tablets should be swallowed with sufficient fluid.

The recommended starting dose is 3.125 mg twice daily for 2 weeks. If this dose is tolerated, the dosage may subsequently be increased, at intervals of not less than two weeks, to 6.25 mg twice daily, followed by 12.5 mg twice daily, then 25 mg twice daily. Dosing should be increased to the highest level tolerated by the patient.

The recommended maximum daily dose is 25 mg twice daily in patients with mild or moderate CHF weighing less than 85 kg. In patients with mild or moderate CHF weighing more than 85 kg, the recommended maximum daily dose is 50 mg twice daily. For all patients with severe CHF the recommended maximum daily dose is 25 mg twice daily.

For severe CHF, before commencement of therapy, patients should be fully clinically evaluated to ensure that they have sitting systolic blood pressure  $\geq$  85 mmHg, no more than trace edema of the



peripheral limbs, no new pulmonary rales or ascites, optimisation of diuretic therapy and other established therapy such as ACE inhibitors and angiotensin-II antagonists, no recent unstable angina, cardiac surgery or ventricular arrhythmias and no recent use of intravenous positive inotropic or vasodilator agents (other than digitalis).

Before each dose increase, the patient should be evaluated by the physician for symptoms of worsening heart failure, vasodilation or bradycardia. If either heart failure or vasodilation occurs the dose of DILATREND should not be increased until symptoms of heart failure or vasodilation have been stabilised.

If bradycardia (pulse rate < 55 beats/minute) occurs the dose of DILATREND should be reduced.

Transient worsening of heart failure or fluid retention should be treated with increased doses of diuretics. Occasionally it may be necessary to lower the dose of DILATREND or temporarily discontinue DILATREND. If DILATREND is discontinued for more than two weeks, therapy should be recommenced at 3.125 mg twice daily and up titrated in line with the above dosing recommendations. Such episodes do not preclude subsequent successful titration of carvedilol.

Symptoms of vasodilatation may be managed initially by a reduction in the dose of diuretics. If symptoms persist the dose of ACE inhibitor (if used) may be reduced, followed by a reduction in the dose of DILATREND if necessary.

**Hepatic Dysfunction:** Since plasma levels have been shown to be increased in patients with cirrhosis, DILATREND is not recommended in patients with significant liver disease.

**Renal Dysfunction:** Dosage adjustments are not required for mild to moderate impairment, however, in patients with underlying renal insufficiency, renal function should be monitored during up-titration of DILATREND and the drug discontinued or dosage reduced if worsening of renal function occurs.

## OVERDOSAGE

### Symptoms

Cases of overdosage with DILATREND alone or in combination with other drugs have been reported. Quantities ingested in some cases exceeded 1000 mg. Symptoms experienced included low blood pressure and heart rate. Standard supportive treatment was provided and individuals recovered.

In the event of overdosage, there may be severe hypotension, bradycardia, heart failure, cardiogenic shock and cardiac arrest. There may also be respiratory problems, bronchospasm, vomiting, disturbed consciousness and generalised seizures.

### Treatment

Treatment of overdose should consist of general supportive measures.

In the event of overdosage, patients should be placed supine to improve the blood supply to the brain. In severe cases, hospitalisation is necessary. In addition to general procedures, the vital parameters must be monitored and corrected, if necessary, under intensive care conditions. Supportive measures to be considered include atropine (0.5-2 mg i.v.) for excessive bradycardia; glucagon (1 to 10 mg i.v. initially, then 2 to 5 mg/h for long term infusion) to support cardiovascular function; and sympathomimetics such as dobutamine, isoprenaline, orciprenaline or



adrenaline, dosed according to body weight and effect. If positive inotropic effect is required, phosphodiesterase inhibitors (PDE) eg milrinone should be considered.

Carvedilol is not removed by haemodialysis.

In the case of drug resistant bradycardia, pacemaker therapy should be initiated.

If peripheral vasodilation dominates the intoxication profile then vasopressors or noradrenaline should be administered with continuous monitoring of the circulatory conditions.

In the case of bronchospasm, beta-sympathomimetics (as aerosol or, if ineffective, also intravenously) or aminophylline intravenously should be given.

In the event of seizures, slow intravenous injection of diazepam or clonazepam is recommended.

NOTE: In the event of severe intoxication with symptoms of shock, supportive treatment with antidotes must be continued for a sufficiently long period of time since prolonged elimination half-life and redistribution of carvedilol from deeper compartments can be expected. Duration of antidote therapy is dependent upon severity of overdose. Supportive measures should therefore be continued until the patient is stabilised.

Contact the Poisons Information Centre for advice on management of overdose.

## PRESENTATION AND STORAGE CONDITIONS

**DILATREND 3.125 mg:** Pale pink, round, biconvex tablet, diameter 7.0 mm, with bilateral scoreline, imprinted with BM on one side and K1 on the other. Available in blister packs of 30.

**DILATREND 6.25 mg:** Yellow, round, biconvex tablet, diameter 7.0 mm, with bilateral scoreline, imprinted with BM on one side and F1 on the other. Available in blister packs of 60.

**DILATREND 12.5 mg:** Pale peach, round, biconvex tablet, diameter 7.0 mm, with bilateral scoreline, imprinted with BM on one side and H3 on the other. Available in blister packs of 60.

**DILATREND 25 mg:** White to pale yellowish beige, round, biconvex tablet, diameter 7.0 mm, with bilateral scoreline, imprinted with BM on one side and D5 on the other. Available in blister packs of 60.

DILATREND 6.25 mg, 12.5 mg and 25 mg tablets should be stored below 30°C and 3.125 mg tablets below 25°C. DILATREND tablets should be protected from light and high humidity. Since the tablets discolour when exposed to light, they should be kept in their original packaging. **Under no circumstances should tablets be used later than the expiry date which is clearly printed on the carton and blister labels.**

## Disposal of Medicines

The release of medicines into the environment should be minimised. Medicines should not be disposed of via wastewater and disposal through household waste should be avoided. Unused or expired medicine should be returned to a pharmacy for disposal.

## SPONSOR

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