

# Midodrine Hydrochloride 2.5 and 5 mg Tablets

## NEW ZEALAND DATA SHEET

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### 1 PRODUCT NAME

Midodrine Hydrochloride 2.5 and 5 mg tablets MEDICIANZ

### 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each Midodrine hydrochloride 2.5 mg tablet contains 2.5 mg midodrine hydrochloride.

Each Midodrine hydrochloride 5 mg tablet contains 5 mg midodrine hydrochloride.

Midodrine hydrochloride 5 mg tablet contains Sunset yellow lake.

For the full list of excipients, see section 6.1.

### 3 PHARMACEUTICAL FORM

Midodrine hydrochloride 2.5 mg tablets are white coloured round shaped, flat tablets debossed with 'M2' on one side and score line on another side.

Midodrine hydrochloride 5 mg tablets are orange coloured round shaped, flat tablets debossed with "M5" on one side and score line on another side.

### 4 CLINICAL PARTICULARS

#### 4.1 Therapeutic indications

Midodrine hydrochloride is indicated to attenuate symptoms of chronic orthostatic hypotension due to autonomic failure in patients with Bradbury-Eggleston or Shy-Drager syndromes and other medical disorders such as diabetes mellitus or Parkinson's disease.

Because midodrine can cause marked elevation of supine blood pressure, it should only be used in patients whose lives are considerably impaired despite standard clinical care including non-pharmacologic treatment, plasma volume expansion and lifestyle alterations.

The initiation of Midodrine hydrochloride therapy should be undertaken under close medical supervision in a controlled clinical setting.

#### 4.2 Dose and method of administration

##### Dose

##### Adults

Treatment with Midodrine hydrochloride tablets should be started under close medical supervision in a controlled clinical setting such as in hospital, in the clinic, or in the office. Hourly measurements of blood pressure (supine and sitting or standing, if possible) should be made for 3 hours following the first dose and also the second dose of a three times daily dosage regimen.

It is recommended that treatment begin at the lowest level and be titrated at intervals of three to several days until the optimal response is obtained. The tablets may be taken with food. Upon escalating the dosage, the supine and standing blood pressure should be closely monitored in hospital, in the clinic or in the office as for the initiation of therapy, that is, hourly for 3 hours following the first two doses.

The usual starting dose of Midodrine hydrochloride tablets is 2.5 mg three times daily. Single doses of 2.5, 5 and 10 mg have been successfully employed. Most patients are controlled at or below 30 mg per day given in three or four divided doses. Midodrine hydrochloride tablets can be given up to six times per day.

Dosing of midodrine should take place during daytime hours, when the patient needs to be upright, pursuing the activities of daily life. A suggested dosing schedule of 3 to 4-hour intervals is as follows: shortly before or upon arising in the morning, midday and late afternoon (at least 4 hours before bedtime to reduce the risk of supine hypertension). The supine and standing blood pressure should be monitored regularly during initial treatment (at least two times a week) and the use of midodrine should be stopped if supine hypertension increases excessively.

Some patients require a morning dose that is higher than that taken later in the day.

The maximum recommended dose should not exceed 30 mg daily.

During the period of close medical supervision, the patient or a relative should be trained to measure blood pressures. Supine and sitting blood pressures should be measured daily for at least a month after initiation of treatment and twice per week afterwards.

The administration of Midodrine hydrochloride tablets should be stopped and the attending physician notified immediately, if the blood pressure in either position increases above 180/100 mmHg.

## Special Populations

### Elderly Population

No specific studies have been performed addressing a possible dose-reduction in the elderly population.

### Renal Impairment

No specific studies have been performed addressing a possible dose-reduction in patients with renal impairment. Generally, Midodrine hydrochloride is contraindicated in patients with acute renal disease and severe renal impairment, see section 4.3.

### Hepatic impairment

No specific studies have been performed in this patient population.

### Paediatric population

In view of the lack of experience in children, this medicine is not recommended for patients under 18 years of age.

## *Method of Administration*

Oral use.

### 4.3 Contraindications

Midodrine hydrochloride tablets are contraindicated in patients with:

- Severe organic heart disease (e.g. bradycardia, ischaemic heart disease, congestive heart failure, cardiac conduction disturbances or aortic aneurism)
- Hypertension
- Serious obliterative or spastic vascular disorders (e.g. cerebrovascular occlusions and spasms)
- Acute renal disease
- Severe renal impairment
- Hypertrophy of the prostate gland with residual urine volume increased
- Urinary retention
- Proliferative diabetic retinopathy
- Pheochromocytoma
- Hyperthyroidism
- Narrow-angle glaucoma
- Known hypersensitivity to any component of the product

### 4.4 Special warnings and precautions for use

#### Supine Hypertension

The most serious and frequent (see section 4.8) adverse reaction to Midodrine hydrochloride is marked elevation of supine arterial blood pressure (supine hypertension) which, if sustained, may cause stroke, myocardial infarction, congestive heart failure, renal insufficiency or similar disorders which individually or collectively may be fatal. Symptoms of supine hypertension are more frequently detected at the initiation of Midodrine hydrochloride therapy and during the titration period.

Systolic pressure of about 200 mm Hg was seen overall in about 13.4% of patients given 10 mg of midodrine hydrochloride. Systolic elevations of this degree were most likely to be observed in patients with relatively elevated pre-treatment systolic blood pressures (mean 170 mmHg).

There is no experience in patients with initial supine systolic pressure above 180 mm Hg, as those patients were excluded from the clinical trials. Use of midodrine hydrochloride in such patients is not recommended.

Sitting blood pressures were also elevated by midodrine hydrochloride therapy. It is essential to monitor supine and sitting blood pressures in patients maintained on midodrine.

Control of supine blood pressure has been obtained by an adjustment in Midodrine hydrochloride dosage with or without a 45-degree elevation of the patient's head. If supine hypertension persists, treatment with Midodrine hydrochloride should be discontinued, and appropriate therapy (e.g. phentolamine, a specific antagonist of midodrine pressor activity) instituted immediately.

To minimise the incidence of supine hypertension, instructions how to initiate midodrine therapy should strictly be followed (refer to section 4.2).

Patients should be cautioned to report symptoms of supine hypertension immediately.

Symptoms may include cardiac awareness, pounding in the ears, headache, blurred vision, etc. If these occur, the patient should discontinue the medicine and consult with the prescribing physician.

### Bradycardia

Bradycardia may occur after Midodrine hydrochloride tablets administration, primarily due to vagal reflex.

Midodrine hydrochloride tablets should not be administered in the presence of uncorrected tachyarrhythmias or ventricular fibrillation.

### Urinary retention

Midodrine hydrochloride may induce an increase in the tone of the internal sphincter of the urinary bladder which may lead to urinary retention. Midodrine hydrochloride also may affect the bladder trigone which may result in a delayed response to bladder filling. Initial signs of urinary retention are manifested clinically as hesitancy or change in frequency of micturition. Patients should be told to report promptly any indication of urinary retention (e.g. hesitancy or frequency of micturition) which may be a sign of urinary retention.

Midodrine hydrochloride should be used with caution in patients with urinary tract outflow obstruction, neurogenic bladder or similar conditions, since midodrine is eliminated by the kidneys and accumulation may occur in such patients.

### Drug abuse or dependence

There is no potential for drug abuse or dependence with midodrine.

### Paediatric population

Safety and effectiveness in children have not been established.

## 4.5 Interaction with other medicines and other forms of interaction

Simultaneous use of digitalis preparations is not recommended, since the bradycardia which occurs as a result of the use of midodrine is then potentiated and heart block may occur.

Midodrine is an inhibitor of Cytochrome P450 CYP2D6 and may, therefore, affect the metabolism of other medicines metabolised by this isozyme (e.g. perphenazine, amiodarone, metoclopramide). This may lead to increased systemic exposure and increased effects of these medicines.

Avoid the concomitant use of midodrine together with vasoconstrictor, sympathomimetic pressor agents and other medicines which cause hypertension (such as tricyclic antidepressants, antihistamines, thyroid hormones, MAO-inhibitors, as well as over the counter remedies) as this may cause excessive hypertension.

Midodrine may enhance or potentiate the possible hypertensive effects of corticosteroid preparations.

The effect of Midodrine hydrochloride may be antagonised by  $\alpha$ -adrenergic blocking drugs, such as prazosin and phentolamine. Concomitant use of Midodrine hydrochloride with alpha- or betareceptor blocking agents, which may reduce the heart rate, requires careful monitoring.

Midodrine hydrochloride may enhance or potentiate the blood-pressure raising effect of atropine.

### **Potential for drug interactions**

It is possible (although there is no supporting experimental evidence) that the high renal clearance of desglymidodrine (a base) is due to active tubular secretion by the base-secreting system also responsible for the secretion of such medicines as metformin, cimetidine, ranitidine, procainamide, triamterene, flecainide, and quinidine. Thus it is possible that midodrine might interact with these medicines.

## **4.6 Fertility, pregnancy and lactation**

### **Pregnancy**

There is no data on the use of Midodrine hydrochloride in pregnant women. Animal studies are insufficient with respect to reproductive toxicity, see section 5.3. It is, therefore, not advisable to use Midodrine hydrochloride in women aiming to become pregnant. Any woman getting pregnant during treatment should be withdrawn from the treatment immediately upon pregnancy being confirmed.

### **Breast-feeding**

It is not known if Midodrine hydrochloride is excreted in human milk. Therefore, Midodrine hydrochloride should not be used during lactation.

### **Fertility**

Refer to section 5.3.

## **4.7 Effects on ability to drive and use machines**

Midodrine hydrochloride have negligible influence on the ability to drive and use machines. However, patients who experience dizziness or light-headedness should refrain from driving or operating machinery.

## **4.8 Undesirable effects**

In the placebo-controlled studies, adverse events regardless of causality were reported in 40.4% of the patients on midodrine 10 mg three times per day compared to 18.6% on placebo. In placebo-controlled trials, the rate of discontinuation of patients on midodrine 10 mg three times per day due to adverse events, regardless of causality, was 15.8% compared to 0% on placebo. Discontinuation due to urinary disturbance, pilomotor reactions and supine hypertension were the reasons for premature withdrawal that were more common on midodrine.

Very common (>1/10); Common (>1/100, <1/10); Uncommon (>1/1000, <1/100); rare (>1/10.000, <1/1.000); Very rare (<1/10.000). Not known (cannot be estimated from the available data).

### Psychiatric disorders

Uncommon: Sleep disorders, insomnia, restlessness, excitability, irritability

Not known: Anxiety, confusional state

### Nervous system disorders

Common: Paraesthesia

Uncommon: Headache

### Cardiac disorders

Uncommon: Reflex bradycardia.

Rare: Tachycardia

### Vascular disorders

Common: Supine hypertension (BP above or equal to 180/110 mmHg) with daily doses above 30 mg

Uncommon: Supine hypertension (BP above or equal to 180/110 mmHg) with daily doses up to 7.5 mg

Unknown frequency: Peripheral ischaemia

### Gastrointestinal disorders

Common: Nausea, heartburn, stomatitis

Not known: Abdominal pain, discomfort, vomiting, diarrhoea

### Hepato-biliary disorders

Rare: Hepatic function abnormal, raised liver enzymes

### Renal and urinary disorders

Very common: Dysuria (13%)

Common: Urinary retention (6%)

Uncommon: Urinary urgency

### Skin and subcutaneous tissue disorders

Very common: Pilo-erection (goosebumps) (13%)

Common: Pruritus, chills, flushing, skin rash

Although a causal relationship has not been identified, there have been cases of serious skin reactions, including Stevens Johnson Syndrome, associated with the use of midodrine.

### Laboratory Interactions

No information known

## Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicine is important. It allows continued monitoring of the benefit/risk balance of the medicine. Healthcare professionals are asked to report any suspected reactions <https://nzphvc.otago.ac.nz/reporting/>

## 4.9 Overdose

### Symptoms

Overdose symptoms are those seen as undesirable effects, particularly hypertension, piloerection (goosebumps), and sensation of coldness, bradycardia and urinary retention.

### Treatment

Besides basic life support recommended general treatment based on the pharmacology of Midodrine hydrochloride includes induced emesis and administration of alpha-sympatholytic medicines (e.g. nitroprusside, phentolamine, nitroglycerin). Bradycardia and bradycardic conduction defects can be counteracted by atropine. The active metabolite Desglymidodrine is dialyzable.

For advice on the management of overdose please contact the National Poisons Centre on 0800 POISON (0800 764766).

## 5 PHARMACOLOGICAL PROPERTIES

### 5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Cardiac therapy, adrenergic and dopaminergic agents; ATC code: C01CA17

#### Mechanism of action

The sympathomimetic agent midodrine is a prodrug that is converted to its pharmacologically active metabolite desglymidodrine after oral administration.

Desglymidodrine is a selective postsynaptic alpha1 adrenergic receptor stimulant devoid of myocardial beta adrenoreceptor activity. The actions of midodrine on the cardiovascular and other organ systems are essentially identical with those of other alpha-adrenergic receptor stimulants such as phenylephrine or methoxamine.

The most prominent effects of midodrine are on the cardiovascular system, consisting of a rise in systolic and diastolic blood pressures, accompanied by a marked reflex bradycardia. The increase in blood pressure is due almost entirely to a constriction mainly of the smaller veins and to a lesser extent of the arterioles, i.e. due to an increase in peripheral resistance.

Midodrine slightly decreases cardiac output and renal blood flow.

Acting on the urinary system, midodrine increases the tone of the internal bladder sphincter and delays the emptying of the bladder.

## 5.2 Pharmacokinetic properties

After oral administration, midodrine is rapidly and almost completely absorbed, achieving maximum plasma concentrations ( $C_{max}$ ) of about 0.01 mg/L within 30 minutes after a 2.5 mg dose. Desglymidodrine reaches peak plasma concentrations (0.027 mg/L) about 1 hour after a 5 to 10 mg oral dose of midodrine in fasted patients with orthostatic hypotension. The absolute bioavailability of midodrine (as desglymidodrine) is 93% after oral administration.

AUC and  $C_{max}$  increase proportionally over the dose range of 2.5 to 22.5 mg.

Administration with food increases the AUC by approximately 25% and the  $C_{max}$  decreases by approximately 30%. The pharmacokinetics of desglymidodrine is not affected.

The distribution of midodrine in humans has not been established.

Midodrine and desglymidodrine binding to plasma proteins is less than 30%. Studies in animals show that desglymidodrine is distributed in the target organs. There is diffusion across the blood brain barrier, placenta and into human milk.

Midodrine is extensively metabolized via enzymatic cleavage in various tissues (including the liver) to the active moiety desglymidodrine.

Midodrine is extensively and rapidly cleared from plasma after oral administration (elimination half-life of 0.49 h), whereas desglymidodrine is cleared more slowly (elimination half-life of 2 to 3 h).

Midodrine and desglymidodrine are nearly completely (approximately 91% of the administered dose) excreted in the urine within 24 h, about 40 – 60% as the active metabolite, 2- 5% as non-metabolised midodrine, and the rest as pharmacologically inactive metabolites. Accumulation has not been observed. Faecal elimination of midodrine or desglymidodrine is insignificant.

To date, there is no data on the pharmacokinetics of midodrine or its metabolite desglymidodrine in elderly patients or in patients with renal and/or hepatic impairment.

## 5.3 Preclinical safety data

Experiments, both *in-vitro* and *in-vivo*, in several species of animal such as rats, dogs and cats have shown that midodrine and desglymidodrine have alpha-receptor agonist activity that is mediated peripherally with no significant CNS activity involved.

### Acute toxicity

The acute toxicity of midodrine is as follows:

LD <sub>50</sub> mg/kg			
	Mouse	Rat	Dog
Intravenous	107.7	17.69	-
Intraperitoneal	199.9	25.55	-
Subcutaneous	196.6	30.18	-



Oral	675.0	32.90	126.0-159.0
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The toxicity pattern is identical in all 3 animal species and is characterised by exophthalmus, piloerection, dyspnoea, salivation and tonoclonic spasms.

#### Subacute toxicity

Rats given midodrine orally at doses of 5, 10 and 20 mg/kg/day for up to 20 days exhibited changes, that were not dose dependent, in the myocardium comprising foci of degenerative myocardial fibres and an increase in connective tissue cells. Liver changes were also observed that were dose dependent.

#### Chronic toxicity

Two studies in rats given midodrine orally at doses of 0.3, 1, 5 and 20mg /kg/day for six months showed little difference between treated animals or controls except slight fatty infiltration of the liver in males dosed at 5 mg/kg. Two studies in dogs given oral doses of up to 27 mg/kg/day for 6 months showed little difference between treated animals and controls at low to medium doses except for piloerection, mydriasis and vomiting which disappeared with continued treatment. At the highest dose used decreased food intake and decreased weight gain associated with a decrease in heart and spleen weight was noted. Lung, liver and kidney weight increased.

Pharmacology safety studies and repeat-dose toxicity studies in animals did not reveal safety concerns for humans at the recommended dose levels. The preclinical tests conducted revealed that midodrine is non-teratogenic and non-mutagenic.

In carcinogenic trials in rats, an increased tumour incidence in the testicular interstitial cells was observed; the relevance of this for humans is however, unclear. However, increased rate of embryo resorption, reduced foetal body weight in rats and rabbits, and decreased foetal survival in rabbits was observed when given in doses that caused maternal toxicity.

#### Mutagenicity

No mutagenicity was seen with midodrine, according to either the Ames test, using 5 strains of *Salmonella typhimurium* (up to 1000 mg/dish), or the micronucleus test in mice (up to 50 mg/kg with 5 males and 5 females/dose).

#### Carcinogenicity

There is no information regarding carcinogenicity studies in animals.

#### Reproductive studies

Midodrine administered to male CFLP mice in doses of up to 81 mg/kg/day for 5 days prior to pairing with untreated females did not cause any change in foetal implantation rate, litter size or post implantation loss when compared to controls.

Midodrine given to female Sprague Dawley rats during the sixth to fifteenth day of pregnancy caused reduction in foetal weight, dam weight and food consumption only at the highest dose studied. Similar results were seen in a rabbit study.

## 6 PHARMACEUTICAL PARTICULARS

### 6.1 List of excipients

Midodrine hydrochloride 2.5 and 5 mg tablets MEDICIANZ contain:

- magnesium stearate
- microcrystalline cellulose
- purified talc
- colloidal anhydrous silica
- maize starch

Midodrine hydrochloride 5 mg tablets MEDICIANZ also contain:

- Sunset yellow lake

### 6.2 Incompatibilities

Not applicable.

### 6.3 Shelf life

24 months

### 6.4 Special precautions for storage

Store below 25°C.

### 6.5 Nature and contents of container

PVC/PVDC/Al blister packs of 10s, 14s, 20s, 28s, 30s, 56s, 60s, 84s, 90s, 100s, 112s tablets.

Not all strengths and packs may be marketed.

### 6.6 Special precautions for disposal

Any unused medicine or waste material should be disposed of in accordance with local requirements.

## 7 MEDICINE SCHEDULE

Prescription medicine

## 8 SPONSOR

Medicianz Healthcare Limited

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## 9 DATE OF FIRST APPROVAL

20 Jan 2022

## 10 DATE OF REVISION OF THE TEXT

Not Applicable

## SUMMARY TABLE OF CHANGES

New datasheet.