

## HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use FERRIPROX safely and effectively. See full prescribing information for FERRIPROX.

FERRIPROX® (deferiprone) tablets, for oral use  
Initial U.S. Approval: 2011

### WARNING: AGRANULOCYTOSIS AND NEUTROPENIA See full prescribing information for complete boxed warning.

- FERRIPROX can cause agranulocytosis that can lead to serious infections and death. Neutropenia may precede the development of agranulocytosis. (5.1)
- Measure the absolute neutrophil count (ANC) before starting FERRIPROX and monitor weekly while on therapy. (5.1)
- Interrupt FERRIPROX if infection develops and monitor the ANC more frequently. (5.1)
- Advise patients taking FERRIPROX to report immediately any symptoms indicative of infection. (5.1)

### RECENT MAJOR CHANGES

Dosage and Administration, Recommended Dosage (2.1)	08/2019
Dosage and Administration, Recommended Dosage (2.1)	05/2020

### INDICATIONS AND USAGE

FERRIPROX® is an iron chelator indicated for the treatment of patients with transfusional iron overload due to thalassemia syndromes when current chelation therapy is inadequate. (1)

Approval is based on a reduction in serum ferritin levels. There are no controlled trials demonstrating a direct treatment benefit, such as improvement in disease-related symptoms, functioning, or increased survival (1).

#### Limitations of Use

Safety and effectiveness have not been established for the treatment of transfusional iron overload in patients with other chronic anemias. (1)

### DOSAGE AND ADMINISTRATION

- FERRIPROX is available in two different 1,000 mg tablet formulations, which have different dosing regimens to achieve the same total daily dosage. (2.1)
- To prevent medication errors, before prescribing and dispensing, ensure that the tablet formulation is appropriate for the dosing regimen. Each tablet has different identifying characteristics. (2.1, 3)
- FERRIPROX (three times a day):
  - Starting oral dosage: 75 mg/kg/day (actual body weight) in three divided doses (2.2)
  - Maximum oral dosage: 99 mg/kg/day (actual body weight) in three divided doses (2.2)

- FERRIPROX (twice a day):
  - Starting oral dosage: 75 mg/kg/day (actual body weight) in two divided doses (2.2)
  - Maximum oral dosage: 99 mg/kg/day (actual body weight) in two divided doses (2.2)

### DOSAGE FORMS AND STRENGTHS

- Tablets (three times a day): 1,000 mg with functional scoring (3)
- Tablets (twice a day): 1,000 mg with functional scoring (3)

### CONTRAINDICATIONS

Hypersensitivity to deferiprone or to any of the excipients in the formulation. (4)

### WARNINGS AND PRECAUTIONS

- Liver Enzyme Elevations: Monitor monthly and discontinue for persistent elevations. (5.2)
- Zinc Deficiency: Monitor during therapy and supplement for deficiency. (5.3)
- Embryo-Fetal Toxicity: Can cause fetal harm. (5.4)

### ADVERSE REACTIONS

The most common adverse reactions are (incidence  $\geq$  5%) nausea, vomiting and abdominal pain, alanine aminotransferase increased, arthralgia and neutropenia. (5.1, 6)

To report SUSPECTED ADVERSE REACTIONS, contact Chiesi USA, Inc. at 1-888-661-9260 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch)

### DRUG INTERACTIONS

- Drugs Associated with Neutropenia or Agranulocytosis: Avoid co-administration. If co-administration is unavoidable, closely monitor the absolute neutrophil count. (7.1)
- UGT1A6 Inhibitors: Avoid co-administration. (7.2)
- Polyvalent Cations: Allow at least a 4-hour interval between administration of FERRIPROX and drugs or supplements containing polyvalent cations (e.g., iron, aluminum, or zinc). (2.2, 7.2)

### USE IN SPECIFIC POPULATIONS

- Lactation: Advise not to breastfeed. (8.2)

See 17 for PATIENT COUNSELING INFORMATION and Medication Guide.

Revised: 05/2020

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## FULL PRESCRIBING INFORMATION

### WARNING: AGRANULOCYTOSIS AND NEUTROPENIA

- FERRIPROX can cause agranulocytosis that can lead to serious infections and death. Neutropenia may precede the development of agranulocytosis. [see Warnings and Precautions (5.1)]
- Measure the absolute neutrophil count (ANC) before starting FERRIPROX therapy and monitor weekly while on therapy. Interrupt FERRIPROX therapy if neutropenia develops. [see Warnings and Precautions (5.1)]
- Interrupt FERRIPROX if infection develops, and monitor the ANC more frequently. [see Warnings and Precautions (5.1)]
- Advise patients taking FERRIPROX to report immediately any symptoms indicative of infection. [see Warnings and Precautions (5.1)]

## 1 INDICATIONS AND USAGE

FERRIPROX is indicated for the treatment of patients with transfusional iron overload due to thalassemia syndromes when current chelation therapy is inadequate.

Approval is based on a reduction in serum ferritin levels. There are no controlled trials demonstrating a direct treatment benefit, such as improvement in disease-related symptoms, functioning, or increased survival [see Clinical Studies (14)].

### Limitations of Use

- Safety and effectiveness have not been established for the treatment of transfusional iron overload in patients with other chronic anemias.

## 2 DOSAGE AND ADMINISTRATION

### 2.1 Important Dosage and Administration Information

**FERRIPROX is available in two different 1,000 mg tablet formulations, which have different oral dosing regimens to achieve the same total daily dosage.**

- FERRIPROX (three times a day) is given three times a day [see Dosage and Administration (2.2)]
- FERRIPROX (twice a day) is given two times a day [see Dosage and Administration (2.3)]

To prevent medication errors, before prescribing and dispensing, ensure that the tablet formulation is appropriate for the dosing regimen. Each tablet has different identifying characteristics [see Dosage Forms and Strengths (3)].

### 2.2 Recommended Dosage for FERRIPROX (three times a day)

#### Starting Dosage for Three Times a Day Tablets

The recommended starting oral dosage of FERRIPROX (three times a day) is 75 mg/kg/day (actual body weight), in three divided doses per day. Table 1 describes the number of FERRIPROX tablets (three times a day) needed to achieve the 75 mg/kg/day total starting dosage). Round dose to the nearest 500 mg (half-tablet).

Body Weight (kg)	Morning	Midday	Evening
20	0.5	0.5	0.5
30	1	0.5	1
40	1	1	1
50	1.5	1	1.5
60	1.5	1.5	1.5
70	2	1.5	2
80	2	2	2
90	2.5	2	2.5

### Dosage Adjustments for Three Times Daily Tablets

Tailor dosage adjustments for FERRIPROX (three times a day) to the individual patient's response and therapeutic goals (maintenance or reduction of body iron burden). The maximum oral dosage is 99 mg/kg/day (actual body weight), orally, in three divided doses per day. Table 2 describes the number of FERRIPROX tablets (three times a day) needed to achieve the 99 mg/day total maximum daily dosage.

<b>Body Weight (kg)</b>	<b>Morning</b>	<b>Midday</b>	<b>Evening</b>
20	0.5	0.5	1
30	1	1	1
40	1.5	1	1.5
50	1.5	1.5	2
60	2	2	2
70	2.5	2	2.5
80	2.5	2.5	3
90	3	3	3

### **2.3 Recommended Dosage for FERRIPROX (twice a day)**

#### Starting Dosage for Twice Daily Tablets

The recommended starting oral dosage of FERRIPROX (twice a day) is 75 mg/kg/day (actual body weight) in two divided doses per day (taken approximately 12 hours apart), with food. Round the total daily dose to the nearest 500 mg (half-tablet). Table 3 describes the number of FERRIPROX tablets (twice a day) needed to achieve the 75 mg/kg/day total starting daily dosage.

<b>Body Weight (kg)</b>		
	<b>Morning</b>	<b>Evening</b>
20	0.5	1
30	1	1.5
40	1.5	1.5
50	2	2
60	2	2.5
70	2.5	3
80	3	3
90	3.5	3.5

#### Dosage Adjustments for Twice a Day Tablets

Tailor dosage adjustments of FERRIPROX (twice daily) to the individual patient's response and therapeutic goals (maintenance or reduction of body iron burden). The maximum total daily oral dosage is 99 mg/kg (actual body weight) divided into two doses taken

approximately 12 hours apart with food. Table 4 describes the number of FERRIPROX tablets (twice a day) needed to achieve the 99 mg/day total maximum daily dosage.

<b>Body Weight (kg)</b>	<b>Morning</b>	<b>Evening</b>
20	1	1
30	1.5	1.5
40	2	2
50	2.5	2.5
60	3	3
70	3.5	3.5
80	4	4
90	4.5	4.5

#### **2.4 Monitoring Ferritin Levels to Assess Efficacy**

Monitor serum ferritin concentration every two to three months to assess the effect of FERRIPROX on body iron stores. If the serum ferritin is consistently below 500 mcg/L, consider temporarily interrupting FERRIPROX therapy until serum ferritin rises above 500 mcg/L.

#### **2.5 Dosage Modification for Drug Interactions**

Allow at least a 4-hour interval between administration of FERRIPROX and other drugs or supplements containing polyvalent cations such as iron, aluminum, or zinc [see *Drug Interactions (7.2)*, *Clinical Pharmacology (12.3)*].

### **3 DOSAGE FORMS AND STRENGTHS**

- Tablets (three times a day): 1,000 mg film-coated, capsule-shaped, white to off-white tablets with functional scoring, and imprinted with “APO” score “1000” on one side and plain on the other.
- Tablets (twice a day): 1,000 mg, capsule-shaped, white to off-white tablets with functional scoring, engraved “FPX” bisect “DR” on one side, “APO” bisect “1000” on the other”.

### **4 CONTRAINDICATIONS**

FERRIPROX is contraindicated in patients with known hypersensitivity to deferiprone or to any of the excipients in the formulation. The following reactions have been reported in association with the administration of deferiprone: Henoch-Schönlein purpura; urticaria; and periorbital edema with skin rash [see *Adverse Reactions (6.2)*].

### **5 WARNINGS AND PRECAUTIONS**

#### **5.1 Agranulocytosis and Neutropenia**

Fatal agranulocytosis can occur with FERRIPROX use. FERRIPROX can also cause neutropenia, which may foreshadow agranulocytosis. Measure the absolute neutrophil count (ANC) before starting FERRIPROX therapy and monitor it weekly while on therapy.

Interrupt FERRIPROX therapy if neutropenia develops (ANC < 1.5 x 10<sup>9</sup>/L).

Interrupt FERRIPROX if infection develops and monitor the ANC frequently.

Advise patients taking FERRIPROX to immediately interrupt therapy and report to their physician if they experience any symptoms indicative of infection.

In pooled clinical trials, the incidence of agranulocytosis was 1.7% of patients. The mechanism of FERRIPROX-associated agranulocytosis is unknown. Agranulocytosis and neutropenia usually resolve upon discontinuation of FERRIPROX, but there have been reports of agranulocytosis leading to death.

Implement a plan to monitor for and to manage agranulocytosis and neutropenia prior to initiating FERRIPROX treatment.

For agranulocytosis (ANC < 0.5 x 10<sup>9</sup>/L):

Consider hospitalization and other management as clinically appropriate.

Do not resume FERRIPROX in patients who have developed agranulocytosis unless potential benefits outweigh potential risks. Do not rechallenge patients who have developed neutropenia with FERRIPROX unless potential benefits outweigh potential risks.

For neutropenia (ANC < 1.5 x 10<sup>9</sup>/L and > 0.5 x 10<sup>9</sup>/L):

Instruct the patient to immediately discontinue FERRIPROX and all other medications with a potential to cause neutropenia.

Obtain a complete blood cell (CBC) count, including a white blood cell (WBC) count corrected for the presence of nucleated red blood cells, an absolute neutrophil count (ANC), and a platelet count daily until recovery (ANC ≥ 1.5 x 10<sup>9</sup>/L).

## **5.2 Liver Enzyme Elevations**

In clinical studies, 7.5% of 642 patients treated with FERRIPROX developed increased ALT values. Four (0.62%) FERRIPROX-treated subjects discontinued the drug due to increased serum ALT levels and 1 (0.16%) due to an increase in both ALT and AST.

Monitor serum ALT values monthly during therapy with FERRIPROX and consider interruption of therapy if there is a persistent increase in the serum transaminase levels.

## **5.3 Zinc Deficiency**

Decreased plasma zinc concentrations have been observed on FERRIPROX therapy. Monitor plasma zinc, and supplement in the event of a deficiency.

## **5.4 Embryo-Fetal Toxicity**

Based on findings from animal reproduction studies and evidence of genotoxicity, FERRIPROX can cause fetal harm when administered to a pregnant woman. The available data on the use of FERRIPROX in pregnant women are insufficient to inform risk. In animal studies, administration of deferiprone during the period of organogenesis resulted in embryo-fetal death and malformations at doses lower than equivalent human clinical doses. Advise pregnant women and females of reproductive potential of the potential risk to the fetus [see *Use in Specific Populations* (8.1)].

Advise females of reproductive potential to use an effective method of contraception during treatment with FERRIPROX and for at least six months after the last dose. Advise males with female partners of reproductive potential to use effective contraception during treatment with FERRIPROX and for at least three months after the last dose [see *Use in Specific Populations* (8.1, 8.3)].

# **6 ADVERSE REACTIONS**

The following clinically significant adverse reactions are described below and elsewhere in the labeling:

- Agranulocytosis and Neutropenia [see *Warnings and Precautions* (5.1)]
- Liver Enzyme Elevations [see *Warnings and Precautions* (5.2)]
- Zinc Deficiency [see *Warnings and Precautions* (5.3)]

## **6.1 Clinical Trial Experience**

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

FERRIPROX tablets (twice a day) were evaluated in trials in healthy subjects. Currently, there are no clinical data in patients with FERRIPROX tablets (twice a day). FERRIPROX tablets (twice a day) contain deferiprone, the same active ingredient as FERRIPROX (deferiprone) tablets (three times a day) and oral solution. The following adverse reaction information represents the pooled data collected from 642 patients who participated in single arm or active-controlled clinical trials taking FERRIPROX (deferiprone) tablets (three times a day) and oral solution.

The most serious adverse reaction reported in clinical trials with FERRIPROX was agranulocytosis [see *Warnings and Precautions* (5.1)].

The most common adverse reactions reported during clinical trials were nausea, vomiting, abdominal pain, alanine aminotransferase increased, arthralgia and neutropenia.

The table below lists the adverse drug reactions that occurred in at least 1% of patients treated with FERRIPROX in clinical trials.

**Table 5: Adverse drug reactions occurring in  $\geq$  1% of FERRIPROX-treated patients**

<b>Body System</b>	<b>(N=642)</b>
<b>Adverse Reaction</b>	<b>% Subjects</b>
<b>BLOOD AND LYMPHATIC SYSTEM DISORDERS</b>	
Neutropenia	6
Agranulocytosis	2
<b>GASTROINTESTINAL DISORDERS</b>	
Nausea	13
Abdominal pain/discomfort	10
Vomiting	10
Diarrhea	3
Dyspepsia	2
<b>INVESTIGATIONS</b>	
Alanine Aminotransferase increased	7
Weight increased	2
Aspartate Aminotransferase increased	1
<b>METABOLISM AND NUTRITION DISORDERS</b>	
Increased appetite	4
Decreased appetite	1
<b>MUSCULOSKELETAL AND CONNECTIVE TISSUE DISORDERS</b>	
Arthralgia	10
Back pain	2
Pain in extremity	2
Arthropathy	1
<b>NERVOUS SYSTEM DISORDERS</b>	
Headache	2

Gastrointestinal symptoms such as nausea, vomiting, and abdominal pain were the most frequent adverse reactions reported by patients participating in clinical trials and led to the discontinuation of FERRIPROX therapy in 1.6% of patients.

Chromaturia (reddish/brown discoloration of the urine) is a result of the excretion of iron in the urine.

## 6.2 Postmarketing Experience

The following additional adverse reactions have been reported in patients receiving FERRIPROX. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or to establish a causal relationship to drug exposure.

*Blood and lymphatic system disorders:* thrombocytosis, pancytopenia.

*Cardiac disorders:* atrial fibrillation, cardiac failure.

*Congenital, familial and genetic disorders:* hypospadias.

*Eye disorders:* diplopia, papilledema, retinal toxicity.

*Gastrointestinal disorders:* enterocolitis, rectal hemorrhage, gastric ulcer, pancreatitis, parotid gland enlargement.

*General disorders and administration site conditions:* chills, pyrexia, edema peripheral, multi-organ failure.

*Hepatobiliary disorders:* jaundice, hepatomegaly.

*Immune system disorders:* anaphylactic shock, hypersensitivity.

*Infections and infestations:* cryptococcal cutaneous infection, enteroviral encephalitis, pharyngitis, pneumonia, sepsis, furuncle, infectious hepatitis, rash pustular, subcutaneous abscess.

*Investigations:* blood bilirubin increased, blood creatinine phosphokinase increased.

*Metabolism and nutrition disorders:* metabolic acidosis, dehydration.

*Musculoskeletal and connective tissue disorders:* myositis, chondropathy, trismus.

*Nervous system disorders:* cerebellar syndrome, cerebral hemorrhage, convulsion, gait disturbance, intracranial pressure increased, psychomotor skills impaired, pyramidal tract syndrome, somnolence.

*Psychiatric disorders:* bruxism, depression, obsessive-compulsive disorder.

*Renal disorders:* glycosuria, hemoglobinuria.

*Respiratory, thoracic and mediastinal disorders:* acute respiratory distress syndrome, epistaxis, hemoptysis, pulmonary embolism.

*Skin, subcutaneous tissue disorders:* hyperhidrosis, periorbital edema, photosensitivity reaction, pruritis, urticaria, rash, Henoch-Schönlein purpura.

*Vascular disorders:* hypotension, hypertension.

## **7 DRUG INTERACTIONS**

### **7.1 Drugs Associated with Neutropenia or Agranulocytosis**

Avoid co-administration of FERRIPROX with other drugs known to be associated with neutropenia or agranulocytosis. If co-administration is unavoidable, closely monitor the absolute neutrophil count [see *Warnings and Precautions (5.1)*].

### **7.2 Effect of Other Drugs on FERRIPROX**

#### UDP-Glucuronosyltransferases (UGT)

Avoid use of UGT1A6 inhibitors (e.g., diclofenac, probenecid, or silymarin (milk thistle)) with FERRIPROX [see *Dosage and Administration (2.2)*, *Adverse Reactions (6.1)*, *Clinical Pharmacology (12.3)*].

#### Polyvalent Cations

Deferiprone has the potential to bind polyvalent cations (e.g., iron, aluminum, and zinc); allow at least a 4-hour interval between FERRIPROX and other medications (e.g., antacids), or supplements containing these polyvalent cations [see *Dosage and Administration (2.2)*].

## **8 USE IN SPECIFIC POPULATIONS**

### **8.1 Pregnancy**

#### Risk Summary

In animal reproduction studies, oral administration of deferiprone to pregnant rats and rabbits during organogenesis at doses 33% and 49%, respectively, of the maximum recommended human dose (MRHD) resulted in structural abnormalities, embryo-fetal mortality and alterations to growth (*see Data*). The limited available data deferiprone use in pregnant women are insufficient to inform a drug-associated risk of major birth defects and miscarriage. Based on evidence and developmental toxicity in animal studies, FERRIPROX can cause fetal harm when administered to a pregnant woman. Advise pregnant women and females of reproductive potential of the potential risk to a fetus.

The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. All pregnancies have a background risk of birth defect, loss, or other adverse outcomes. In the U.S. general population, the estimated background risk of major birth defects and of miscarriage is 2-4% and 15-20%, respectively.

#### Data

##### *Human Data*

Post-marketing data available from 39 pregnancies of deferiprone-treated patients and 10 pregnancies of partners of deferiprone-treated patients are as follows:

Of the 39 pregnancies in deferiprone-treated patients, 23 resulted in healthy newborns, 6 ended in spontaneous abortion, 9 had unknown outcomes, and 1 infant was born with anal atresia, nephroptosis, ventricular septal defect, hemivertebra and urethral fistula.

Of the 10 pregnancies in partners of deferiprone-treated patients, 5 resulted in healthy newborns, 1 resulted in a healthy newborn with slight hypospadias, 1 was electively terminated, 1 resulted in the intrauterine death of twins, and 2 had unknown outcomes.

##### *Animal Data*

During organogenesis, pregnant rats and rabbits received deferiprone at oral doses of 0, 30, 80 or 200 mg/kg/day, and 0, 10, 50, or 150 mg/kg/day, respectively. The daily dose was administered as two equal divided doses approximately 7 hours apart. Doses of 200 mg/kg/day in rats and 150 mg/kg/day in rabbits, approximately 33% and 49% of the MRHD, respectively, resulted in increased



post-implantation loss and reduced fetal weights in the presence of maternal toxicity (reduced maternal body weight and body weight gain in both rats and rabbits; abnormal large placenta at low incidence in rats). The 200 mg/kg/day dose in rats resulted in external, visceral and skeletal fetal malformations such as cranial malformations, cleft palate, limb malrotation, anal atresia, internal hydrocephaly, anophthalmia and fused bones. The dose of 150 mg/kg/day in rabbits resulted in external fetal malformations (partially opened eyes) and minor blood vessel and skeletal variations.

In rats, malformations including micrognathia and persistent ductus arteriosus could be observed in the absence of maternal toxicity at doses equal to or greater than 30 and 80 mg/kg/day, approximately 5% and 13% of the MHRD, respectively.

## **8.2 Lactation**

### Risk Summary

There is no information regarding the presence of deferiprone in human milk, the effects on the breastfed child, or the effects on milk production.

Because of the potential for serious adverse reactions in the breastfed child, including the potential for tumorigenicity shown for deferiprone in animal studies, advise patients that breastfeeding is not recommended during FERRIPROX, and for at least 2 weeks after the last dose.

## **8.3 Females and Males of Reproductive Potential**

### Pregnancy Testing

Pregnancy testing is recommended for females of reproductive potential prior to initiating FERRIPROX.

### Contraception

#### *Females*

FERRIPROX can cause embryo-fetal harm when administered to a pregnant woman [*see Use in Specific Populations (8.1)*]. Advise female patients of reproductive potential to use effective contraception during treatment with FERRIPROX and for at least 6 months after the last dose.

#### *Males*

Based on genotoxicity findings, advise males with female partners of reproductive potential to use effective contraception during treatment with FERRIPROX and for at least 3 months after the last dose [*see Nonclinical Toxicology (13.1)*].

## **8.4 Pediatric Use**

Safety and effectiveness in pediatric patients have not been established.

## **8.5 Geriatric Use**

Clinical studies of deferiprone did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. Other reported clinical experience has not identified differences in responses between the elderly and younger patients.

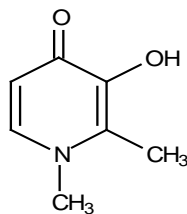
## **10 OVERDOSAGE**

No cases of acute overdose have been reported. There is no specific antidote to FERRIPROX overdose.

Neurological disorders such as cerebellar symptoms, diplopia, lateral nystagmus, psychomotor slowdown, hand movements and axial hypotonia have been observed in children treated with 2.5 to 3 times the recommended dose for more than one year. The neurological disorders progressively regressed after deferiprone discontinuation.

## 11 DESCRIPTION

FERRIPROX (deferiprone) tablets contain 1,000 mg deferiprone (3-hydroxy-1,2-dimethylpyridin-4-one), a synthetic, orally active, iron-chelating agent. The molecular formula for deferiprone is  $C_7H_9NO_2$  and its molecular weight is 139.15 g/mol. Deferiprone has the following structural formula:



Deferiprone is a white to pinkish-white powder. It is sparingly soluble in deionized water (14.3 mg/mL) and has a melting point range of 272 °C - 278 °C.

### FERRIPROX tablets (three times a day)

White to off-white, capsule-shaped tablets, and imprinted with “APO” score “1000” on one side and plain on the other. The tablets can be broken in half along the score line. Each tablet contains 1,000 mg deferiprone and the following inactive ingredients: Tablet core - methylcellulose, crospovidone, and magnesium stearate; Coating - hypromellose, hydroxypropyl cellulose, macrogol, titanium dioxide.

### FERRIPROX tablets (twice a day)

White to off-white, capsule-shaped tablets, and imprinted with “FPX” score “DR” on one side and “APO” score “1000” on the other. The tablets can be broken in half along the score line. Each tablet contains 1,000 mg deferiprone and the following inactive ingredients: Tablet core - hypromellose acetate succinate, magnesium oxide, colloidal silicon dioxide and magnesium stearate; Coating - triethyl citrate, talc, titanium dioxide, and methacrylic acid and ethyl acrylate copolymer.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Deferiprone is a chelating agent with an affinity for ferric ion (iron III). Deferiprone binds with ferric ions to form neutral 3:1 (deferiprone:iron) complexes that are stable at physiological pH.

### 12.2 Pharmacodynamics

No clinical studies were performed to assess the relationship between the dose of deferiprone and the amount of iron eliminated from the body.

#### Cardiac Electrophysiology

At the maximum approved recommended dose, deferiprone does not prolong the QT interval to any clinically relevant extent.

### 12.3 Pharmacokinetics

#### FERRIPROX tablets (three times a day)

The mean  $C_{max}$  and AUC of deferiprone was 20 mcg/mL and 50 mcg·h/mL, respectively, in healthy subjects. The dose proportionality of deferiprone over the approved recommended dosage range is unknown.

#### Absorption

Deferiprone appeared in the blood within 5 to 10 minutes after oral administration. Peak serum concentration of deferiprone was reached approximately 1 to 2 hours after a single dose.

#### Effect of Food

No clinically significant differences in the pharmacokinetics of deferiprone were observed following administration with food.

#### Elimination

The elimination half-life of deferiprone is approximately 2 hours.

### *Metabolism*

Deferiprone is metabolized primarily by UGT1A6. The major metabolite of deferiprone is the 3-*O*-glucuronide, which lacks iron binding capability.

### *Excretion*

Following oral administration, 75% to 90% of the administered dose was recovered in urine (primarily as metabolite) in the first 24 hours.

### FERRIPROX tablets (twice a day)

In healthy subjects, the mean  $\pm$  SD  $C_{\max}$  of deferiprone in serum was  $6 \pm 2$  mcg/mL, and the mean  $\pm$  SD AUC was  $28 \pm 7$  mcg·h/mL following oral administration of a 1,000 mg dose of FERRIPROX tablets (twice a day) with food.

### Absorption

Peak serum concentrations of deferiprone occur approximately 2 hours after a single dose of FERRIPROX tablets (twice a day) in fasted healthy subjects.

### Effect of Food

Following the administration of FERRIPROX tablets (twice a day) to healthy volunteers, the  $C_{\max}$  and the AUC of deferiprone remain unchanged after a high-fat meal (approximately 1,000 calories, 53% fat, 33% carbohydrates, and 14% protein) compared to fasted conditions.

### Effect of Alcohol

At 40% (v/v) alcohol concentration *in vitro* dissolution studies, there was 88% release of deferiprone from a 1,000 mg FERRIPROX tablet (twice a day) within two hours compared to 4% release of deferiprone within 2 hours in the absence of alcohol.

### Distribution

The apparent mean  $\pm$  SD volume of distribution (V/F) of deferiprone was  $97 \pm 28$  L following oral administration of a 1,000 mg dose of FERRIPROX tablets (twice a day) with food.

### Elimination

The mean  $\pm$  SD elimination half-life of deferiprone is  $1.8 \pm 0.3$  hours following the administration of FERRIPROX tablets (twice a day).

### *Metabolism*

Deferiprone is metabolized primarily by UGT1A6. The major metabolite of deferiprone is the 3-*O*-glucuronide, which lacks iron-binding capability.

### *Excretion*

Following oral administration, 75% to 90% of the administered dose was recovered in urine (primarily as metabolite) in the first 24 hours.

### Specific Populations

No clinically significant differences in the pharmacokinetics of deferiprone were observed based on sex, race/ethnicity, body weight, mild to severe (eGFR 15 to 89 mL/min/1.73 m<sup>2</sup>) renal impairment, or mild (Child Pugh Class A) to moderate (Child Pugh Class B) hepatic impairment. The effect of age, including geriatric or pediatric populations, end stage renal disease or severe (Child Pugh Class C) hepatic impairment on the pharmacokinetics of deferiprone is unknown.

### Drug Interaction Studies

#### *In Vitro Studies*

*UGT1A6 Inhibitors:* Phenylbutazone (UGT1A6 inhibitor) decreased glucuronidation of deferiprone by up to 78%.

*Polyvalent Cations:* Deferiprone has the potential to bind polyvalent cations (e.g., iron, aluminum, and zinc).

## 13 NONCLINICAL TOXICOLOGY

### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenicity studies have not been conducted with deferiprone. However, in view of the genotoxicity results, and the findings of mammary gland hyperplasia and mammary gland tumors in rats treated with deferiprone in the 52-week toxicology study, tumor formation in carcinogenicity studies must be regarded as likely.

Deferiprone was positive in a mouse lymphoma cell assay *in vitro*. Deferiprone was clastogenic in an *in vitro* chromosomal aberration test in mice and in a chromosomal aberration test in Chinese Hamster Ovary cells. Deferiprone given orally or intraperitoneally was clastogenic in a bone marrow micronucleus assay in non-iron-loaded mice. A micronucleus test was also positive when mice predosed with iron dextran were treated with deferiprone. Deferiprone was not mutagenic in the Ames bacterial reverse mutation test.

A fertility and early embryonic development study of deferiprone was conducted in rats. Sperm counts, motility and morphology were unaffected by treatment with deferiprone. There were no effects observed on male or female fertility or reproductive function at the highest dose which was 25% of the MRHD.

## 14 CLINICAL STUDIES

FERRIPROX tablets (twice a day) were evaluated in trials in healthy subjects. Currently, there are no clinical data in patients treated with FERRIPROX tablets (twice a day). FERRIPROX tablets (twice a day) contains deferiprone, the same active ingredient as FERRIPROX (deferiprone) tablets and oral solution. The following information is based on studies with FERRIPROX (deferiprone) tablets (three times a day) and oral solution.

### Transfusional Iron Overload

In a prospective, planned, pooled analysis of patients from several studies, the efficacy of deferiprone was assessed in transfusion-dependent iron overload patients in whom previous iron chelation therapy had failed or was considered inadequate due to poor tolerance. The main criterion for chelation failure was serum ferritin > 2,500 mcg/L before treatment with deferiprone. Deferiprone therapy (35-99 mg/kg/day) was considered successful in individual patients who experienced a  $\geq 20\%$  decline in serum ferritin within one year of starting therapy.

Data from a total of 236 patients were analyzed. Of the 224 patients with thalassemia who received deferiprone monotherapy and were eligible for serum ferritin analysis, 105 (47%) were male and 119 (53%) were female. The mean age of these patients was 18.2 years.

For the patients in the analysis, the endpoint of at least a 20% reduction in serum ferritin was met in 50% (of 236 subjects), with a 95% confidence interval of 43% to 57%.

A small number of patients with thalassemia and iron overload were assessed by measuring the change in the number of milliseconds (ms) in the cardiac MRI T2\* value before and after treatment with deferiprone for one year. There was an increase in cardiac MRI T2\* from a mean at baseline of  $11.8 \pm 4.9$  ms to a mean of  $15.1 \pm 7.0$  ms after approximately one year of treatment. The clinical significance of this observation is not known.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### FERRIPROX tablets (three times a day)

FERRIPROX® (deferiprone) tablets (three times a day) are white to off-white capsule-shaped tablets, film-coated, and have a functional score imprinted with “APO” score “1000” on one side and are plain on the other. They are provided in HDPE bottles.

1,000 mg film-coated tablets, 50 tablets NDC 10122-103-05

Store at 20°C to 25°C (68°F to 77°F); excursions permitted to 15°C to 30°C (59°F to 86°F) [see USP Controlled Room Temperature]. Keep the bottle tightly closed to protect from moisture.

### FERRIPROX tablets (twice a day)

FERRIPROX® (deferiprone) tablets (twice a day) are white to off-white capsule-shaped, beveled edge, biconvex coated tablets, and have a functional score engraved “FPX” bisect “DR” on one side, “APO” bisect “1000” on the other. They are supplied in child-resistant blister packs or HDPE bottles.

1,000 mg tablets, carton of 5 x 10-count blister packs NDC 10122-104-01

1,000 mg tablets, bottle of 50 tablets NDC 10122-104-05

1,000 mg tablets, bottle of 500 tablets NDC 10122-104-50

Store at 20°C to 25°C (68°F to 77°F); excursions permitted to 15°C to 30°C (59°F to 86°F) [see USP Controlled Room Temperature].

## 17 PATIENT COUNSELING INFORMATION

Advise the patient to read the FDA-approved patient labeling (Medication Guide)

- Instruct patients and their caregivers to store FERRIPROX at 68°F to 77°F (20°C to 25°C); excursions permitted to 59°F to 86°F (15°C to 30°C) [see USP Controlled Room Temperature].

- FERRIPROX tablets (three times a day):

Store in the originally supplied bottle, closed tightly to protect from moisture.

Advise patients to take the first dose of FERRIPROX in the morning, the second dose at midday, and the third dose in the evening. Clinical experience suggests that taking FERRIPROX with meals may reduce nausea.

- FERRIPROX tablets (twice a day):

Advise patients to take the first dose of FERRIPROX tablets (twice a day) in the morning and the second in the evening.

Advise patients to take FERRIPROX tablets (twice a day) with food to reduce the risk of nausea and vomiting.

Advise patients to avoid alcohol while taking FERRIPROX tablets (twice a day). Consumption of alcohol while taking FERRIPROX tablets (twice a day) may result in more rapid release of deferiprone.

- If a dose of this medicine has been missed, take it as soon as possible. However, if it is almost time for the next dose, skip the missed dose and go back to the regular dosing schedule. Do not catch-up or double doses.
- Inform patients of the risks of developing agranulocytosis and instruct them to immediately interrupt therapy and report to their physician if they experience any symptoms of infection such as fever, sore throat or flu-like symptoms.
- Advise patients to contact their physician in the event of overdose.
- Inform patients that their urine might show a reddish/brown discoloration due to the excretion of iron. This is a very common sign of the desired effect, and it is not harmful.

### Embryo-Fetal toxicity

Advise pregnant women and females of reproductive potential of the potential risk to a fetus. Advise females to inform their healthcare provider of a known or suspected pregnancy [see *Warnings and Precautions (5.4) and Use in Specific Populations (8.1)*]. Advise female patients of reproductive potential to use effective contraception during treatment with FERRIPROX and for at least six months after the last dose [see *Use in Specific Populations (8.1, 8.3)*]. Advise males with female partners of reproductive potential to use effective contraception during treatment with FERRIPROX and for at least three months after the last dose [see *Use in Specific Populations (8.3) and Nonclinical Toxicology (13.1)*].

### Lactation

Advise females not to breastfeed during treatment with FERRIPROX and for at least 2 weeks after the last dose [see *Use in Specific Populations (8.2)*].

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CTFD-001-0320-00-W

**Medication Guide**  
**FERRIPROX® (Feh' ri prox)**  
**(deferiprone) tablets**

**What is the most important information I should know about FERRIPROX?**

FERRIPROX can cause serious side effects, including a very low white blood cell count. One type of white blood cell that is important for fighting infections is called a neutrophil. If your neutrophil count is low (neutropenia), you may be at risk of developing a serious infection that can lead to death. Neutropenia is common with FERRIPROX and can become severe in some people. Severe neutropenia is known as agranulocytosis. If you develop agranulocytosis, you will be at risk of developing serious infections that can lead to death.

Your healthcare provider should do a blood test before you start FERRIPROX and weekly during treatment to check your neutrophil count. If you develop neutropenia, your healthcare provider should check your blood counts every day until your white blood cell count improves. Your healthcare provider may temporarily stop treatment with FERRIPROX if you develop neutropenia or infection.

Stop taking FERRIPROX and get medical help right away if you develop any of these symptoms of infection:

- fever
- sore throat or mouth sores
- flu-like symptoms
- chills and severe shaking.

See “**What are the possible side effects of FERRIPROX?**” for more information about side effects.

**What is FERRIPROX?**

FERRIPROX is a prescription medicine used to treat people with thalassemia syndromes who have iron overload from blood transfusions, when current iron removal (chelation) therapy does not work well enough.

It is not known if FERRIPROX is safe and effective:

- to treat iron overload due to blood transfusions in people with any other type of anemia that is long lasting (chronic)
- in children

**Do not take FERRIPROX if you are allergic to deferiprone or any of the ingredients in FERRIPROX.**

See the end of this Medication Guide for a complete list of ingredients in FERRIPROX.

**Before you take FERRIPROX, tell your healthcare provider about all of your medical conditions, including if you:**

- have liver problems
- are pregnant or plan to become pregnant. FERRIPROX can harm your unborn baby. You should avoid becoming pregnant during treatment with FERRIPROX. Tell your healthcare provider right away if you become pregnant during treatment with FERRIPROX.

**Females who are able to become pregnant:**

- Your healthcare provider should do a pregnancy test before you start treatment with FERRIPROX.
- You should use effective birth control during treatment with FERRIPROX and for at least 6 months after the last dose.

**Males with female partners who are able to become pregnant:**

- You should use effective birth control during treatment with FERRIPROX and for at least 3 months after the last dose.
- are breastfeeding or plan to breastfeed. It is not known if FERRIPROX passes into your breast milk. Do not breastfeed during treatment with FERRIPROX and for at least 2 weeks after the last dose.

**Tell your healthcare provider about all the medicines you take**, including prescription and over-the-counter medicines, vitamins and herbal supplements.

### How should I take FERRIPROX?

- Take FERRIPROX exactly as your healthcare provider tells you.
- Your healthcare provider will check your body iron level during treatment with FERRIPROX and may change your dose if needed. Your healthcare provider may also change your dose of FERRIPROX if you have certain side effects. Do not change your dose of FERRIPROX unless your healthcare provider tells you to.
- There are 2 types of FERRIPROX tablets that are taken on different schedules. Be sure you are taking the correct tablet and ask your healthcare provider if unsure.
  - **FERRIPROX tablets (3 times a day):**  
Take these FERRIPROX tablets 3 times each day. Take your first dose in the morning, the second dose at mid-day, and the third dose in the evening. Taking FERRIPROX tablets with meals may help reduce nausea.
  - **FERRIPROX tablets (2 times a day):**  
Take these FERRIPROX tablets 2 times each day. Take your first dose in the morning and the second dose in the evening. Taking FERRIPROX tablets with meals may help reduce nausea.
- **If you must take a medicine to treat indigestion (antacid), or supplements that contain iron, aluminum, or zinc during treatment with FERRIPROX, allow at least 4 hours between taking FERRIPROX and these products.**
- If you take too much FERRIPROX, call your healthcare provider.
- If you miss a dose, take it as soon as you remember. If it is almost time for your next dose, skip the missed dose and then continue with your regular schedule. Do not try to catch-up or take 2 doses at the same time to make up for a missed dose.

### What should be avoided during treatment with FERRIPROX?

- **FERRIPROX tablets (2 times a day):**
  - Avoid drinking alcohol during treatment with FERRIPROX tablets (2 times a day). This may cause a faster release of the medicine.

### What are the possible side effects of FERRIPROX?

#### FERRIPROX can cause serious side effects, including:

- **See “What is the most important information I should know about FERRIPROX?”**
- **Increased liver enzyme levels in your blood.** Your healthcare provider should do monthly blood tests to check your liver function during treatment with FERRIPROX.
- **Decreased levels of zinc in your blood.** Your healthcare provider will do blood tests to check your zinc levels during treatment with FERRIPROX and may prescribe a zinc supplement for you if your zinc levels are low.

The most common side effects of FERRIPROX include:

- nausea
- vomiting
- stomach-area (abdominal) pain
- joint pain

FERRIPROX may cause a change in urine color to reddish-brown. This is not harmful and is expected during treatment with FERRIPROX.

These are not all of the possible side effects of FERRIPROX.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

### How should I store FERRIPROX?

- Store FERRIPROX at room temperature, 68°F to 77°F (20°C to 25°C).
- Store FERRIPROX tablets (3 times a day) in the original bottle and tightly closed to protect from moisture.

**Keep FERRIPROX and all medicines out of the reach of children.**

### General information about the safe and effective use of FERRIPROX.

Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide. Do not use FERRIPROX for a condition for which it was not prescribed. Do not give FERRIPROX to other people, even if they have the same symptoms that you have. It may harm them. You can ask your pharmacist or healthcare provider for information about FERRIPROX that is written for health professionals.

### What are the ingredients in FERRIPROX?

**Active ingredient:** deferiprone

**Inactive ingredients:**

- **FERRIPROX tablets (3 times a day):** Tablet core: methylcellulose, crospovidone, and magnesium stearate. Coating: hypromellose, hydroxypropyl cellulose, macrogol, and titanium dioxide.

- **FERRIPROX tablets (2 times a day):** Tablet core: hypromellose acetate succinate, magnesium oxide, colloidal silicon dioxide and magnesium stearate. Coating: triethyl citrate, talc, titanium dioxide, and methacrylic acid and ethyl acrylate copolymer.

Distributed by: Chiesi USA, Inc., Cary, NC 27518.

Manufactured by: Apotex Inc., Toronto, Ontario, Canada, M9L 1T9.

For more information, call 1-888-661-9260.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

Issued: 05/2020

CTFD-002-0320-00-W