

# Cystinuria

## How THIOLA<sup>®</sup> (tiopronin) Can Help

### Indications

THIOLA<sup>®</sup> (tiopronin) tablets are a prescription medicine used to help prevent the formation of cystine (kidney) stones in patients who were not successfully treated with dietary changes and increased fluid intake, or in patients who have had side effects with the drug d-penicillamine.

### Important Safety Information

THIOLA is not for everyone. You should not take THIOLA if you:

- Are pregnant or plan to become pregnant
- Are breastfeeding or plan to breastfeed
- Have a history of blood disorders including aplastic anemia (your bone marrow does not make enough new cells), agranulocytosis (decrease in certain white blood cells), or thrombocytopenia (decrease in the number of platelets)

Please see additional Important Safety Information on the following pages and accompanying full Prescribing Information on back page.

THIOLA<sup>®</sup> is a registered trademark of Mission Pharmacal Company

**Thiola<sup>®</sup>**  
(tiopronin) tablets  
Rx Only

## How is Cystinuria Treated?

There are several ways to manage cystinuria and help keep cystine kidney stones from forming.<sup>1</sup> Treatment must be continued throughout a patient's lifetime, in order to help keep these stones from forming.

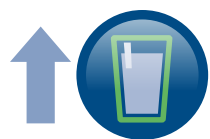
### Prevention is key!

The goal of treatment is to prevent more stones from forming by reducing the level of cystine in the urine.<sup>2</sup>

### Therapeutic lifestyle changes

The first step is making dietary changes and increasing the amount of fluids taken each day.<sup>2-4</sup>

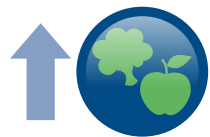
These long-term changes can help prevent stones from forming, and include:



Drink lots of fluids—at least 3 liters (10 glassfuls, 10 oz each) and you may want to aim for up to 1 gallon (about 4 liters) per day.<sup>2,3</sup>



Lower the amount of salt and animal food products in the diet.<sup>3,4</sup>



Eat more fruits and vegetables.<sup>3,4</sup>



Take products to make the urine less acidic (making urine less acidic is called urinary alkalinization) to maintain urinary pH at a high normal range of 6.5 - 7.0. Taking potassium citrate (which doctors may prescribe as pills) and/or eating fruits with high levels of potassium (such as citrus fruits) may help make the urine less acidic.<sup>3,5</sup>

## Treatment with medication

When therapeutic lifestyle changes alone may not be enough to keep stones from forming, it is recommended that cystine-binding thiol medication be added.<sup>4</sup>

Every person with cystinuria should continue to make therapeutic lifestyle changes in their diet, even if medication or surgery is also needed.



### The goals of treating cystinuria are<sup>3,6</sup>:

- ☒ Prevent new cystine kidney stones from growing
- ☒ Avoid surgery
- ☒ Keep the kidneys working normally
- ☒ Lower levels of cystine in the urine to under 250 mg/L

Keeping your cystine level below line of solubility (generally <250 mg/L) is important to managing cystinuria. When levels are below the line of solubility, cystine is able to dissolve easily and pass through the urine, preventing stone formation.<sup>2,7</sup>

Please see additional Important Safety Information on the following pages and accompanying full Prescribing Information on back page.

**References:** 1. Knoll T, et al. *Pediatr Nephrol.* 2005;20:19-24. 2. THIOLA<sup>®</sup> [prescribing information]. San Antonio, TX: Mission Pharmacal Company. 3. Biyani CS, et al. *EAU-EBU Update Series.* 2006;4:175-183. 4. Pearle MS, et al. *J Urol.* 2014;192:316-324. 5. Moe OW. *Lancet.* 2006;367:333-344. 6. Chiu PKF, et al. *Hong Kong Med J.* 2008;14:399-401. 7. Eggermann T, et al. *Orphanet J Rare Dis.* 2012;7:19.doi:10.1186/1750-1172-7-19.

## What is THIOLA® (tiopronin)?<sup>2</sup>

THIOLA (THIGH-OH-LA), or tiopronin (TEE-OH-PRO-NIN), is a thiol-binding prescription medicine that can help prevent the formation of cystine kidney stones.

### Who should take THIOLA?

THIOLA may be prescribed for:

- People who were not successfully treated with dietary changes, increased fluid intake, or products that make the urine less acidic (urinary alkalinization)

OR

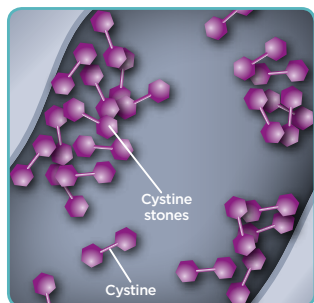
- People who have had side effects with the drug d-penicillamine

### How does THIOLA work?

THIOLA attaches to cystine in the urine. With THIOLA attached, cystine can dissolve more easily and can then be removed from the body in the urine.<sup>2</sup> This lowers the amount of cystine in the urine which reduces the risk of cystine stone formation.<sup>2</sup>

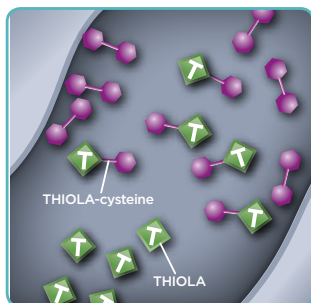
#### In the small tubes of the kidney

##### In cystinuria



Cystine does not dissolve well in the urine. High levels of cystine lead to cystine stone formation.

##### With THIOLA



THIOLA attaches to cystine to become a new compound called THIOLA-cystine, which dissolves more easily.

## THIOLA can help get your cystine level below the line<sup>2</sup>

THIOLA was studied in a trial that included 66 people with cystinuria across the United States. In 14 participants who were not previously treated with d-penicillamine, THIOLA helped to<sup>8</sup>:

- Stop new kidney stones from forming in 71% of participants (stone remission)
- Slow the rate that new kidney stones were formed in 94% of participants (stone reduction)

### What should you expect from THIOLA therapy?<sup>8</sup>

Studies show THIOLA causes fewer and less severe side effects than d-penicillamine. Side effects are more likely to occur in people who have already taken d-penicillamine and have had side effects.

The following side effects have been reported in patients taking THIOLA: nausea, vomiting, diarrhea/soft stools, loss of appetite, abdominal pain, mouth ulcers, rash, bruising, itching, hives, skin wrinkling, fever, joint pain, weakness, anemia, fatigue, protein in the urine, edema (swelling caused by fluid), impotence, cough, and chest pain.

Tell your doctor if you have any side effects. You may also report side effects to the Food and Drug Administration directly at 1-800-FDA-1088.

### Who should not take THIOLA?<sup>2</sup>

THIOLA is not for everyone. You should not take THIOLA if you:

- ⊘ Are pregnant or plan to become pregnant
- ⊘ Are breastfeeding or plan to breastfeed
- ⊘ Have a history of blood disorders including aplastic anemia (bone marrow does not make enough new blood cells), agranulocytosis (decrease in certain white blood cells), or thrombocytopenia (fewer platelets)
- ⊘ Are under the age of 9

## Important Safety Information (cont.)

The safety and effectiveness of THIOLA have not been established in children under 9 years of age, and there are no well-controlled studies in pregnant women. High doses of THIOLA in pregnant laboratory animals have been shown to harm the fetus, so you should talk about these risks with your doctor to determine whether THIOLA is right for you. No long-term animal studies have been performed to see whether THIOLA can cause cancer, so you should discuss these risks with your doctor.

Please see additional Important Safety Information on the following pages and accompanying full Prescribing Information on back page.

## Finding the THIOLA® (tiopronin) dosage that's right for you<sup>2</sup>

THIOLA should be taken in combination with therapeutic lifestyle changes, which include changes in diet, increasing the amount of fluids, and taking products to make the urine less acidic (urinary alkalinization). (See page 2 for more details about therapeutic lifestyle changes.)

### What is the starting dosage of THIOLA?

The right dose of THIOLA for each person will be determined by his/her doctor.

Adults may be started at a dosage of 800 mg of THIOLA per day. For children 9 years or older, the doctor will calculate how much THIOLA they need based on their weight.

People who have had reactions to d-penicillamine in the past may start with a lower dosage of THIOLA.

Doctors may use a 24-hour urine collection and the test results to determine the dosage of THIOLA needed to reduce cystine levels to below 250 mg in a liter of urine (250 mg/L).

### How should THIOLA be taken?

- THIOLA should be taken in divided doses 3 times per day.
- THIOLA should be taken at least 1 hour before or 2 hours after meals.
  - Do not take THIOLA with meals.
  - Food may affect how it is absorbed in your body, potentially lessening the effect of THIOLA.



## Important Safety Information (cont.)

While you are taking THIOLA, your doctor will monitor you closely for signs and symptoms of possible complications. Your doctor will routinely do certain blood and urine tests, and yearly scans of your abdomen to look at the size and appearance of kidney stones. THIOLA should only be used under the close supervision of your doctor.

Please see additional Important Safety Information on the following pages and accompanying full Prescribing Information on back page.

## Why is it very important to keep taking THIOLA?<sup>2</sup>

THIOLA works quickly and leaves the body quickly. The effects of THIOLA last as long as it is in the body. Once you stop taking THIOLA, you no longer benefit from its effects. If you have any questions about this information, be sure to contact your doctor.

Because cystinuria is a lifelong condition, it's important to continue to take THIOLA as part of your ongoing treatment plan as directed by your doctor.

While taking THIOLA be sure to continue to adhere to any recommended therapeutic lifestyle changes.

It is important to not miss doses of THIOLA, to prevent new stones from growing.

### Your THIOLA dose may need to be adjusted

It is important for people taking THIOLA to keep seeing their doctor regularly to:

- make sure you are taking the right amount of THIOLA
- assess your treatment plan to determine if your cystine level is below the solubility line
- monitor for possible side effects

### How often should you be monitored?

People taking THIOLA should have their urinary cystine (amount of cystine in the urine) measured 1 month after starting THIOLA, and every 3 months thereafter. The THIOLA dosage should be changed based on these results.

Frequent monitoring of cystine levels is important to manage cystinuria. 24-hour urine collections may be repeated every 3 months.<sup>3</sup>

## Important Safety Information (cont.)

THIOLA can cause serious side effects or potential complications, and some of these could be fatal. Therefore, it is important to call your doctor right away if you have any side effects.

Side effects associated with THIOLA include a drug-related fever that typically occurs during the first month of treatment. If this occurs, talk with your doctor, who may discontinue treatment until the fever goes away.

## Important Safety Information (cont.)

You may notice a reduced sense of taste while taking THIOLA, which will eventually go away. Some patients also report wrinkling or thin, fragile skin during long-term treatment.

Other side effects of THIOLA may include an itchy rash that is found on many parts of your body. This typically occurs during the first few months of treatment, and antihistamines can help reduce the itching. The rash will usually disappear once you stop taking THIOLA. Less often, patients who take THIOLA for more than 6 months may develop a rash that is usually located on the upper body and is very itchy. It typically goes away slowly after discontinuing treatment and returns after re-starting treatment.

Some patients may develop a drug hypersensitivity reaction to THIOLA that includes fever, joint pain, and swollen lymph nodes. If this occurs, your doctor may discontinue THIOLA.

THIOLA can cause serious and potentially fatal blood disorders, including aplastic anemia (your bone marrow does not make enough new cells), agranulocytosis (decrease in certain white blood cells), or thrombocytopenia (decrease in the number of platelets). Call your doctor immediately if you have any signs or symptoms such as fever, sore throat, chills, bleeding, or if you are bruising more easily.

Although THIOLA may be less toxic than d-penicillamine, it could potentially cause all of the serious side effects reported for d-penicillamine. No deaths have been reported as a result of THIOLA treatment; however, fatal outcomes have been reported with certain complications of d-penicillamine therapy, including reduced white blood cells, red blood cells, or platelets; Goodpasture's syndrome (an autoimmune disorder that affects the lungs and kidneys); and myasthenia gravis (an autoimmune disorder that causes muscles to weaken). Do not take THIOLA if you have a history of these conditions.

Additional side effects that have been reported during treatment with d-penicillamine and that might occur during THIOLA treatment include: decreased sense of smell, nausea, vomiting, diarrhea or soft stools, loss of appetite, abdominal pain, bloating, gas, sore throat, sores in the mouth, hives, warts, swelling of the throat, difficulty breathing, shortness of breath, fatigue or weakness, muscle or joint pain, swelling in your legs or fluid build-up in the lungs, lung or kidney problems, and blood or high amounts of protein in urine. These side effects are more likely to develop during THIOLA therapy in patients who had previous reactions to d-penicillamine. Talk to your doctor about any unusual side effects.

Seek immediate medical attention and discontinue THIOLA if you notice symptoms such as fever, sore throat, chills, bleeding, easy bruising, coughing up blood, muscle weakness, blistering or raw areas on the skin or mucous membranes, joint pain, swelling of the lymph nodes, or swelling in your legs, as these may be signs of a serious reaction to the drug.

Jaundice (yellow appearance of the skin and whites of the eyes) and abnormal liver function tests have been reported during THIOLA treatment for conditions unrelated to cystine stones.

Call your doctor for medical advice about side effects. You may report negative side effects to Retrophin® Medical Information at 1-877-659-5518, or to the FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).

Welcome to the



A comprehensive program for people  
who have been prescribed THIOLA®

Visit [ThiolaHUB.com](http://ThiolaHUB.com) or call  
844-4-THIOLA (844-484-4652) to find  
out more.

Please visit [THIOLA.com](http://THIOLA.com) for more  
information about THIOLA.

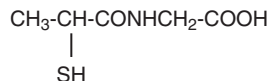


# THIOLA®

## (Tiopronin) Tablets

## FULL PRESCRIBING INFORMATION

**DESCRIPTION:** THIOLA® (Tiopronin) is a reducing and complexing thiol compound. Tiopronin is N-(2-Mercaptopropionyl) glycine and has the following structure:



Tiopronin has the empirical formula  $\text{C}_5\text{H}_9\text{NO}_3\text{S}$  and a molecular weight of 163.20. In this drug product tiopronin exists as a dl racemic mixture.

Tiopronin is a white crystalline powder which is freely soluble in water.

THIOLA® tablets are white, sugar coated tablets, each containing 100 mg. of Tiopronin and are taken orally.

Inactive ingredients: Calcium carbonate, carnauba wax, ethyl cellulose, Eudragit E 100, hydroxypropyl cellulose, lactose, magnesium stearate, povidone, sugar, talc, titanium dioxide.

**CLINICAL PHARMACOLOGY:** THIOLA® is an active reducing agent which undergoes thiol-disulfide exchange with cystine to form a mixed disulfide of Thiola-cystine.



Thiola Cystine  $\rightleftharpoons$  Thiola-cystine

From this reaction a water-soluble mixed disulfide is formed and the amount of sparingly soluble cystine is reduced. When THIOLA® is given orally, up to 48% of dose appears in urine during the first 4 hours and up to 78% by 72 hours. Thus, in patients with cystinuria, sufficient amount of THIOLA® or its active metabolites could appear in urine to react with cystine, lowering cystine excretion.

The decrement in urinary cystine produced by THIOLA® is generally proportional to the dose. A reduction in urinary cystine of 250-350 mg/day at a THIOLA® dosage of 1 g/day, and a decline of approximately 500 mg/day at a dosage of 2 g/day, might be expected. THIOLA® causes a sustained reduction in cystine excretion without apparent loss of effectiveness. THIOLA® has a rapid onset and offset of action, showing a fall in cystine excretion on the first day of administration and a rise on the first day of drug withdrawal.

**INDICATIONS AND USAGE:** THIOLA® is indicated for the prevention of cystine (kidney) stone formation in patients with severe homozygous cystinuria with urinary cystine greater than 500 mg/day, who are resistant to treatment with conservative measures of high fluid intake, alkali and diet modification, or who have adverse reactions to d-penicillamine.

Cystine stones typically occur in approximately 10,000 persons in the United States who are homozygous for cystinuria. These persons excrete abnormal amounts of cystine in urine of over 250 mg/g creatinine, as well as excessive amounts of other dibasic amino acids (lysine, arginine and ornithine). In addition, they show varying intestinal transport defects for these same amino acids. The stone formation is the result of poor aqueous solubility of cystine.

Since there are no known inhibitors of the crystallization of cystine, the stone formation is determined primarily by the urinary supersaturation of cystine. Thus, cystine stones could theoretically form whenever urinary cystine concentration exceeds the solubility limit. Cystine solubility in urine is pH-dependent, and ranges from 170-300 mg/liter at pH 5, 190-400 mg/liter at pH 7 and 220-500 mg/liter at pH 7.5.

The goal of therapy is to reduce urinary cystine concentration below its solubility limit. It may be accomplished by dietary means aimed at reducing cystine synthesis and by a high fluid intake in order to increase urine volume and thereby lower cystine concentration.

Unfortunately, the above conservative measures alone may be ineffective in controlling cystine stone formation in some homozygous patients with severe cystinuria (urinary cystine exceeding 500 mg/day). In such patients, d-penicillamine has been used as an additional therapy. Like THIOLA®,

d-penicillamine undergoes thiol-disulfide exchange with cystine, thereby lowering the amount of sparingly soluble cystine in urine.

However, d-penicillamine treatment is frequently accompanied by adverse reactions, such as dermatologic complications, hypersensitivity reactions, hematologic abnormalities and renal disturbances. THIOLA® may have a particular therapeutic role in such patients.

**CONTRAINDICATIONS:** The use of THIOLA® during pregnancy is contraindicated, except in those with severe cystinuria where the anticipated benefit of inhibited stone formation clearly outweighs possible hazards of treatment (see PRECAUTIONS).

THIOLA® should not be begun again in patients with a prior history of developing agranulocytosis, aplastic anemia or thrombocytopenia on this medication.

Mothers maintained on THIOLA® treatment should not nurse their infants.

**WARNINGS:** Despite apparent lower toxicity of THIOLA®, THIOLA® may potentially cause all the serious adverse reactions reported for d-penicillamine. Thus, although no death has been reported to result directly from THIOLA® treatment, a fatal outcome from THIOLA® is possible, as has been reported with d-penicillamine therapy from such complications as aplastic anemia, agranulocytosis, thrombocytopenia, Goodpasture's syndrome or myasthenia gravis.

Leukopenia of the granulocytic series may develop without eosinophilia. Thrombocytopenia may be immunologic in origin or occur on an idiosyncratic basis. The reduction in peripheral blood white count to less than 3500/cubic mm or in platelet count to below 100,000 cubic mm mandates cessation of therapy. Patients should be instructed to report promptly the occurrence of any symptom or sign of these hematological abnormalities, such as fever, sore throat, chills, bleeding or easy bruisability.

Proteinuria, sometimes sufficiently severe to cause nephrotic syndrome, may develop from membranous glomerulopathy. A close observation of affected patients is mandatory.

The following complications, though rare, have been reported during d-penicillamine therapy and could occur during THIOLA® treatment. When there are abnormal urinary findings associated with hemoptysis and pulmonary infiltrates suggestive of Goodpasture's syndrome, THIOLA® treatment should be stopped. Appearance of myasthenic syndrome or myasthenia gravis requires cessation of treatment. When pemphigus-type reactions develop, THIOLA® therapy should be stopped. Steroid treatment may be necessary.

**PRECAUTIONS:** Patients should be advised of the potential development of complications and to report promptly the occurrence of any symptom or sign of them.

To help monitor potential complications, the following tests are recommended: peripheral blood counts, direct platelet count, hemoglobin, serum albumin, liver function tests, 24-hour urinary protein and routine urinalysis at 3-6 month intervals during treatment. In order to assess effect on stone disease, urinary cystine analysis should be monitored frequently during the first 6 months when the optimum dose schedule is being determined, and at 6-month intervals thereafter. Abdominal roentgenogram (KUB) is advised on a yearly basis to monitor the size and appearance/disappearance of stone(s).

**CARCINOGENESIS, MUTAGENESIS, IMPAIRMENT OF FERTILITY:** Long-term carcinogenicity studies in animals have not been performed. High doses of THIOLA® in experimental animals have been shown to interfere with maintenance of pregnancy and viability of the fetus.

**USE IN PREGNANCY:** Pregnancy category C. D-penicillamine has been shown to cause skeletal defects and cleft palates in the fetus when given to pregnant rats at 10 times the dose recommended for human use. A similar teratogenicity might be expected for THIOLA® although no such findings could be related to the drug in studies in mice and rats at doses up to 10 times the highest recommended human dose.



There are no adequate and well-controlled studies in pregnant women. THIOLA® should be used during pregnancy only if the potential benefit justifies potential risk to the fetus.

**NURSING MOTHERS:** Because THIOLA® may be excreted in milk and because of the potential serious adverse reactions of nursing infants from THIOLA®, mothers taking THIOLA® should not nurse their infants.

**PEDIATRIC USE:** Safety and effectiveness below the age of 9 have not been established.

**ADVERSE REACTIONS:** Some patients may develop drug fever, usually during the first month of therapy. THIOLA® treatment should be discontinued until the fever subsides. It may be reinstated at a small dose, with a gradual increase in dosage until the desired level is achieved.

A generalized rash (erythematous, maculopapular or morbilliform) accompanied by pruritis may develop during the first few months of treatment. It may be controlled by antihistamine therapy, typically recedes when THIOLA® treatment is discontinued, and seldom recurs when THIOLA® treatment is restarted at a lower dosage. Less commonly, rash may appear late in the course of treatment (of more than 6 months). Located usually in the trunk, the late rash is associated with intense pruritis, recedes slowly after discontinuing treatment, and usually recurs upon resumption of treatment.

A drug reaction simulating lupus erythematosus, manifested by fever, arthralgia and lymphadenopathy may develop. It may be associated with a positive antinuclear antibody test, but not necessarily with nephropathy. It may require discontinuance of THIOLA® treatment.

A reduction in taste perception may develop. It is believed to be the result of chelation of trace metals by THIOLA®. Hypogeusia is often self-limiting.

Unlike during d-penicillamine therapy, vitamin B<sub>6</sub> deficiency is uncommonly associated with THIOLA® treatment.

Some patients may complain of wrinkling and friability of skin. This complication usually occurs after long-term treatment, and is believed to result from the effect of THIOLA® on collagen.

A multiclinic trial involving 66 cystinuric patients in the United States indicated that THIOLA® is associated with fewer or less severe adverse reactions than d-penicillamine. Among those who had to stop taking d-penicillamine due to toxicity, 64.7% could take THIOLA®. In those without prior history of d-penicillamine treatment, only 5.9% developed reactions of sufficient severity to require THIOLA® withdrawal. A review of available literature supports the findings from this trial.

Despite this apparent reduced toxicity to THIOLA® relative to d-penicillamine, THIOLA® treatment may potentially be associated with all the adverse reactions reported with d-penicillamine. They include:

Gastrointestinal side-effects (nausea, emesis, diarrhea or soft stools, anorexia, abdominal pain, bloating or flatus) in about 1 in 6 patients;

Impairment in taste and smell in about 1 in 25 patients;

Dermatologic complications (pharyngitis, oral ulcers, rash, ecchymosis, prurites, urticaria, warts, skin wrinkling, pemphigus, elastosis perforans serpiginosa) in about 1 in 6 patients;

Hypersensitivity reactions (laryngeal edema, dyspnea, respiratory distress, fever, chills, arthralgia, weakness, fatigue, myalgia, adenopathy) in about 1 in 25 patients;

Hematologic abnormalities (increased bleeding, anemia, leukopenia, thrombocytopenia, eosinophilia) in about 1 in 25 patients;

Renal complications (proteinuria, nephrotic syndrome, hematuria) in about 1 in 20 patients;

Pulmonary manifestations (bronchiolitis, hemoptysis, pulmonary infiltrates, dyspnea) in about 1 in 50 patients;

Neurologic complications (myasthenic syndrome) in about 1 in 50 patients.

These reactions are more likely to develop during THIOLA® therapy among patients who had previously shown toxicity to d-penicillamine.

In patients who had previously manifested adverse reactions to d-penicillamine, adverse reactions to THIOLA® are more likely to occur than in patients who took THIOLA® for the first time. A close supervision with a careful monitoring of potential side effects is mandatory during THIOLA® treatment. Patients should be told to report promptly any symptoms suggesting toxicity. The treatment with THIOLA® should be stopped if severe toxicity develops.

Jaundice and abnormal liver function tests have been reported during THIOLA® therapy for non-cystinuric conditions. A direct cause and effect relationship, based upon these foreign reports, has not been established. Although such complications were not encountered in the small multi-center trials in the United States, patients should be carefully monitored and if any abnormalities are noted, the drug should be discontinued and the patient treated by appropriate measures.

**DOSAGE AND ADMINISTRATION:** It is recommended that a conservative treatment program should be attempted first. At least 3 liters of fluid (10-10 oz. glassfuls) should be provided, including two glasses with each meal and at bedtime. The patients should be expected to awake at night to urinate; they should drink two more glasses of fluids before returning to bed. Additional fluids should be consumed if there is excessive sweating or intestinal fluid loss. A minimum urine output of 2 liters/day on a consistent basis should be sought. A modest amount of alkali should be provided in order to maintain urinary pH at a high normal range (6.5-7.0). Potassium alkali are advantageous over sodium alkali, because they do not cause hypercalciuria and are less likely to cause the complication of calcium stones.

Excessive alkali therapy is not advisable. When urinary pH increases above 7.0 with alkali therapy, the complication of calcium phosphate nephrolithiasis may ensue because of the enhanced urinary supersaturation of hydroxyapatite in an alkaline environment.

In patients who continue to form cystine stones on the above conservative program, THIOLA® may be added to the treatment program. THIOLA® may also be substituted for d-penicillamine in patients who have developed toxicity to the latter drug. In both situations, the conservative treatment program should be continued.

The dose of THIOLA® should not be arbitrary but should be based on that amount required to reduce urinary cystine concentration to below its solubility limit (generally <250 mg/liter). The extent of the decline in cystine excretion is generally dependent on the THIOLA® dosage.

THIOLA® may be begun at a dosage of 800 mg/day in adult patients with cystine stones. In a multiclinic trial, average dose of THIOLA® was about 1000 mg/day. However, some patients require a smaller dose. In children, initial dosage may be based on 15 mg/kg/day. Urinary cystine should be measured at 1 month after THIOLA® treatment, and every 3 months thereafter. THIOLA® dosage should be readjusted depending on the urinary cystine value. Whenever possible, THIOLA® should be given in divided doses 3 times/day at least one hour before or 2 hours after meals.

In patients who had shown severe toxicity to d-penicillamine, THIOLA® might be begun at a lower dosage.

**HOW SUPPLIED:** THIOLA® (NDC 0178-0900-01), is available for oral administration as 100 mg. round, white, sugar coated tablets in bottles of 100 tablets each. Each tablet is imprinted in red with "M" on one side and blank on the other side. Store at 25°C (77°F); excursions permitted to 15-30°C (59-86°F) [see USP Controlled Room Temperature].

  
MISSION PHARMACAL COMPANY  
SAN ANTONIO, TX 78230 1355  
Toll Free (800) 531-3333

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