

**HIGHLIGHTS OF PRESCRIBING INFORMATION**

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

SIKLOS (hydroxyurea) tablets, for oral use  
Initial U.S. Approval: 1967

**WARNING: MYELOSUPPRESSION and MALIGNANCIES**  
*See full prescribing information for complete boxed warning.*

- **Myelosuppression:** SIKLOS may cause severe myelosuppression. Do not give if bone marrow function is markedly depressed. Monitor blood counts at baseline and throughout treatment. Interrupt treatment and reduce dose as necessary. (5.1)
- **Malignancies:** Hydroxyurea is carcinogenic. Advise sun protection and monitor patients for malignancies. (5.2)

-----**INDICATIONS AND USAGE**-----

SIKLOS is an antimetabolite, indicated to reduce the frequency of painful crises and to reduce the need for blood transfusions in pediatric patients, 2 years of age and older, with sickle cell anemia with recurrent moderate to severe painful crises.

-----**DOSAGE AND ADMINISTRATION**-----

- Initial dose: 20 mg/kg once daily. Monitor blood counts every two weeks. (2.1)
- The dose may be increased by 5 mg/kg/day every 8 weeks, or sooner if a severe painful crisis occurs, until a maximum tolerated dose or 35 mg/kg/day is reached if blood counts are in an acceptable range. (2.1)
- Discontinue SIKLOS until hematologic recovery if blood counts are considered toxic. Resume treatment after reducing the dose by 5 mg/kg/day from the dose associated with hematological toxicity. (2.1)
- Renal impairment: Reduce the dose of SIKLOS by 50% in patients with creatinine clearance less than 60 mL/min. (2.2, 8.5, 12.3)

-----**DOSAGE FORMS AND STRENGTHS**-----

Tablets: 100 mg and functionally triple-scored 1,000 mg tablet

-----**CONTRAINDICATIONS**-----

Patients who have demonstrated a previous hypersensitivity to hydroxyurea or any other component of its formulation.

-----**WARNINGS AND PRECAUTIONS**-----

- Embryo-Fetal toxicity: Can cause fetal harm. Advise of potential risk to a fetus and use of effective contraception. (5.3, 8.1, 8.3)
- Cutaneous vasculitic toxicities (incl. leg ulcers): Institute treatment and discontinue SIKLOS and/or reduce dose if this occurs. (5.4)
- Risks with concomitant use of antiretroviral drugs: Pancreatitis, hepatotoxicity, and neuropathy have occurred. Monitor for signs and symptoms patients with HIV infection using antiretroviral drugs; discontinue SIKLOS, and implement treatment. (5.5)
- Concomitant use with live virus vaccine: increased risk of severe infections.

-----**ADVERSE REACTIONS**-----

Most common adverse reactions to SIKLOS (incidence > 10%) include infections and neutropenia.

To report SUSPECTED ADVERSE REACTIONS, contact the marketer Medunik at 1 844-884-5520 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).

-----**USE IN SPECIFIC POPULATIONS**-----

- Lactation: Advise women to stop breastfeeding while taking SIKLOS.

See 17 for PATIENT COUNSELING INFORMATION and FDA-approved patient labeling.

Revised: [12/2017]

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## FULL PRESCRIBING INFORMATION

### WARNING: MYELOSUPPRESSION and MALIGNANCIES

**Myelosuppression:** SIKLOS may cause severe myelosuppression. Monitor blood counts at baseline and throughout treatment. Interrupt treatment and reduce dose as necessary [see *Warnings and Precautions (5.1)*].

**Malignancies:** Hydroxyurea is carcinogenic. Advise sun protection and monitor patients for malignancies [see *Warnings and Precautions (5.2)*].

## 1 INDICATIONS AND USAGE

SIKLOS<sup>®</sup> is indicated to reduce the frequency of painful crises and to reduce the need for blood transfusions in pediatric patients, 2 years of age and older, with sickle cell anemia with recurrent moderate to severe painful crises.

## 2 DOSAGE AND ADMINISTRATION

### 2.1 Recommended Dosing

The recommended SIKLOS dosing is described in Table 1.

**Table 1: Dosing Recommendation Based on Blood Count**

Dosing Regimen	Dose	Dose Modification Criteria	Monitoring Parameters
<b>Initial Recommended Dosing</b>	20 mg/kg once daily based on patient's actual or ideal weight, whichever is less.		Monitor the patient's blood count every 2 weeks [see <i>Warnings and Precautions (5.1)</i> ].
<b>Dosing Adjustment Based on Blood Counts in an acceptable range</b>	Increase dose 5 mg/kg/day every 8 weeks or if a painful crisis occurs.  Give until mild myelosuppression (absolute neutrophil count 2,000/uL to 4,000/uL) is achieved, up to a maximum of 35 mg/kg/day.	Increase dosing only if blood counts are in an acceptable range.  Increase dosing if a painful crisis occurs.  Do not increase if myelosuppression occurs.	<b>Blood Counts Acceptable Range:</b> - neutrophils greater than or equal to 2,000 cells/mm <sup>3</sup> - platelets greater than or equal to 80,000/mm <sup>3</sup> - hemoglobin greater than 5.3 g/dL - reticulocytes greater than or equal to 80,000/mm <sup>3</sup> if the hemoglobin concentration less than 9 g/dL
<b>Dosing Adjustment Based on Blood Counts in a toxic range</b>	Discontinue treatment.	If blood counts are considered toxic, discontinue SIKLOS until hematologic recovery.	<b>Blood Counts Toxic Range:</b> - neutrophils less than 2,000 cells/mm <sup>3</sup> younger patients with lower baseline counts may safely tolerate absolute neutrophil counts down to 1,250/mm <sup>3</sup> . - platelets less than 80,000/mm <sup>3</sup> - hemoglobin less than

Dosing Regimen	Dose	Dose Modification Criteria	Monitoring Parameters
			4.5 g/dL - reticulocytes less than 80,000/mm <sup>3</sup> if the hemoglobin concentration less than 9 g/dL
<b>Dosing After Hematologic Recovery</b>	Reduce dose by 5 mg/kg/day.	Reduce the dose from the dose associated with hematologic toxicity.  May titrate up or down every 8 weeks in 5 mg/kg/day increments.  The patient should be at a stable dose with no hematologic toxicity for 24 weeks.  Discontinue the treatment permanently if a patient develops hematologic toxicity twice.	

Siklos is available in 100 mg and 1,000 mg tablets. The 1,000 mg tablets have 3 score lines and can be split into 4 parts (each 250 mg). Therefore, the two strengths can be used to deliver doses of 1,000 mg, 750 mg, 500 mg, 250 mg, 100 mg, and combinations thereof. Calculate the rounded doses to the nearest 50 mg or 100 mg strength based on clinical judgment.

**Do not split the SIKLOS 100 mg tablets into smaller parts.**

Patients must be able to follow directions regarding drug administration and their monitoring and care.

Fetal hemoglobin (HbF) levels may be used to evaluate the efficacy of SIKLOS in clinical use. Obtain HbF levels every three to four months. Monitor for an increase in HbF of at least two-fold over the baseline value.

## Administration:

The tablet should be taken once daily, with a glass of water. For patients who are not able to swallow the tablets, these can be dispersed **immediately before use** in a small quantity of water in a teaspoon.

SIKLOS is a cytotoxic drug. Follow applicable special handling and disposal procedures [see *References (15)*].

### 2.2 Dose Modifications for Renal Impairment

Reduce the dose of SIKLOS by 50% in patients with creatinine clearance of less than 60 mL/min or with end-stage renal disease (ESRD) [see *Use in Specific Populations (8.5)* and *Clinical Pharmacology (12.3)*]. Obtain the creatinine clearance using a 24-hour urine collection.

Creatinine Clearance (mL/min)	Recommended SIKLOS Initial Dose (mg/kg daily)
Greater than or equal to 60	20
Less than 60 or ESRD*	10

\* On dialysis days, administer SIKLOS to patients with ESRD following hemodialysis

Monitor the hematologic parameters closely in these patients.

## 3 DOSAGE FORMS AND STRENGTHS

Film-coated tablets:

- 100 mg tablets: off-white round, film-coated tablet embossed 100 on one side.
- 1,000 mg tablets: off-white, capsule-shaped, film-coated, functionally triple-scored tablet with scoring on both sides which can be divided into four equal parts embossed with “T” on one side.

## 4 CONTRAINDICATIONS

SIKLOS is contraindicated in:

- Patients who have demonstrated a previous hypersensitivity to hydroxyurea or any other component of its formulation [see *Adverse Reactions (6)*].

## 5 WARNINGS AND PRECAUTIONS

### 5.1 Myelosuppression

Hydroxyurea causes severe myelosuppression. Do not initiate treatment with hydroxyurea in patients if bone marrow function is markedly depressed. Bone marrow suppression may occur, and leukopenia is generally its first and most common manifestation. Thrombocytopenia and anemia occur less often, and are seldom seen without a preceding leukopenia.

Some patients, treated at the recommended initial dose of 20 mg/kg/day, have experienced severe or life-threatening myelosuppression. Due to the change in body weight requiring modification of daily dose, pediatric patients have an increased risk of myelosuppression at the time of dose adjustment.

Evaluate hematologic status prior to and during treatment with SIKLOS. Provide supportive care and modify dose or discontinue SIKLOS as needed. Recovery from myelosuppression is usually observed within 15 days when therapy is interrupted. Resume therapy after interruption at a lower dose [see *Dosage and Administration (2.1)*].

### 5.2 Malignancies

Hydroxyurea is a human carcinogen. In patients receiving long-term hydroxyurea for myeloproliferative disorders (a condition for which Siklos is not approved), secondary leukemia has been reported. Skin cancer has also been reported in patients receiving long-term hydroxyurea. Advise protection from sun exposure and monitor for the development of secondary malignancies.

### **5.3 Embryo-Fetal Toxicity**

Based on the mechanism of action and findings in animals, SIKLOS can cause fetal harm when administered to a pregnant woman. Hydroxyurea was embryotoxic and teratogenic in rats and rabbits at doses 0.8 times and 0.3 times, respectively, the maximum recommended human daily dose on a mg/m<sup>2</sup> basis. Advise pregnant women of the potential risk to a fetus [*see Use in Specific Populations (8.1)*].

Advise females of reproductive potential to use effective contraception during and after treatment with SIKLOS for at least 6 months after therapy. Advise males of reproductive potential to use effective contraception during and after treatment with SIKLOS for at least 6 months after therapy [*see Use in Specific Populations (8.1, 8.3)*].

### **5.4 Vasculitic Toxicities (including Leg Ulcers)**

Cutaneous vasculitic toxicities, including vasculitic ulcerations and gangrene, have occurred in patients with myeloproliferative disorders during therapy with hydroxyurea. These vasculitic toxicities were reported most often in patients with a history of, or currently receiving, interferon therapy. Due to potentially severe clinical outcomes for the cutaneous vasculitic ulcers reported in patients with myeloproliferative disease (a condition for which SIKLOS is not approved), treatment with SIKLOS should be discontinued and/or its dose reduced if cutaneous vasculitic ulcerations develop. Rarely, ulcers are caused by leukocytoclastic vasculitis.

Avoid use of SIKLOS in patients with wounds on the legs (leg ulcers).

### **5.5 Risks with Concomitant Use of Antiretroviral Drugs**

Pancreatitis, hepatotoxicity, and peripheral neuropathy have occurred when hydroxyurea was administered concomitantly with antiretroviral drugs, including didanosine and stavudine [*see Drug Interactions (7.1)*].

### **5.6 Risks with Concomitant Use of Live Virus Vaccine**

Avoid use of live virus vaccine in patients taking SIKLOS. Concomitant use of hydroxyurea with a live virus vaccine may potentiate the replication of the vaccine virus and/or may increase the adverse reactions of the vaccine virus and result in severe infections [*see Drug Interactions (7.2)*]. Patient's antibody response to vaccines may be decreased. Consider consultation with a specialist.

### **5.7 Macrocytosis**

SIKLOS may cause macrocytosis, which is self-limiting, and is often seen early in the course of treatment. The morphologic change resembles pernicious anemia, but is not related to vitamin B12 or folic acid deficiency. This may mask the diagnosis of pernicious anemia. Prophylactic administration of folic acid is recommended.

### **5.8 Test Interference**

Interference with Uric Acid, Urea, or Lactic Acid Assays is possible, rendering falsely elevated results of these in patients treated with hydroxyurea [*see Drug Interactions (7.3)*].

## **6 ADVERSE REACTIONS**

- Myelosuppression [*see Warnings and Precautions (5.1)*]
- Malignancies [*see Warnings and Precautions (5.2)*]
- Embryo-fetal toxicity [*see Boxed Warning and Warnings and Precautions (5.3)*]

- Vasculitic toxicities (including Leg Ulcers) [see Warnings and Precautions (5.4)]
- Risks with concomitant use of antiretroviral drugs [see Warnings and Precautions (5.5)]
- Risk with concomitant use of live virus vaccine [see Warnings and Precautions (5.6)]
- Macrocytosis [see Warnings and Precautions (5.7)]

### 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.

The safety of SIKLOS has been assessed in 405 pediatric patients with sickle cell disease from 2-18 years of age in the European Sickle Cell Disease prospective Cohort study ESCORT-HU.

The most frequently reported adverse reactions in ESCORT-HU were infections and myelosuppression, with mild to moderate neutropenia as the most common manifestation.

Other adverse reactions include skin and subcutaneous disorders (skin depigmentation/melanonychia, skin rash, alopecia), gastrointestinal disorders, vitamin D deficiency and headache.

At least one serious adverse reaction was reported in 32.6 % of the 405 pediatric patients with sickle cell disease in ESCORT-HU. The most frequent serious adverse reactions were infections (17.8 %), and blood and lymphatic system disorders (9.1 %). This included serious neutropenia (3.2%), thrombocytopenia (3.0%) and anemia (3.0%). Other reported serious adverse reactions were gastrointestinal disorders (3.2 %), fever (2.5 %) and nervous system disorders (4.0 %), including headache (2.7%).

**Table 2: Most frequent (greater than or equal to 2.0%) adverse reactions reported in pediatric patients enrolled in ESCORT-HU**

Global Safety Set (N=405)	Total		Intensity					
			Mild		Moderate		Severe	
	n	%	n	%	n	%	n	%
At least one adverse reaction	261	64.4						
<b>Infections</b>	161	39.8	120	29.6	88	21.7	18	4.4
Other Infections	92	22.7	66	16.3	32	7.9	3	0.7
Bacterial	65	16.0	24	5.9	37	9.1	10	2.5
Viral	40	9.9	23	5.7	14	3.5	3	0.7
Parvovirus B19	15	3.7	7	1.7	5	1.2	2	0.5
<b>Blood and lymphatic system disorders</b>	85	21.0	51	12.6	59	14.6	14	3.5
Neutropenia	51	12.6	26	6.4	31	7.7	4	1.0
Thrombocytopenia	30	7.4	16	4.0	15	3.7	2	0.5
Anemia	17	4.2	4	1.0	8	2.0	7	1.7
<b>Gastrointestinal disorders</b>	53	13.1	29	7.2	30	7.4	4	1.0
Other Gastrointestinal Disorders	30	7.4	13	3.2	15	3.7	2	0.5
Constipation	10	2.5	5	1.2	5	1.2	0	0
Nausea	10	2.5	4	1.0	4	1.0	2	0.5
<b>Metabolic and nutrition disorders</b>	44	10.9	24	5.9	21	5.2	1	0.2
Deficiency of vitamin D	25	6.2	19	4.7	7	1.7	1	0.2

Other Metabolic and nutrition disorders	8	2.0	3	0.7	4	1.0	1	0.2
Weight gain	8	2.0	1	0.2	7	1.7	0	0
<b>Nervous system disorders</b>	45	11.1	19	4.7	19	4.7	8	2.0
Headache	30	7.4	15	3.7	7	1.7	4	1.0
Other Nervous system disorders	11	2.7	2	0.5	4	1.0	4	1.0
<b>General disorders</b>	41	10.1	22	5.4	17	4.2	4	1.0
Fever	31	7.7	20	4.9	12	3.0	2	0.5
<b>Skin and subcutaneous tissue disorders</b>	38	9.4	29	7.2	14	3.5	1	0.2
Skin reactions	15	3.7	8	2.0	7	1.7	1	0.2
Other Skin and subcutaneous tissue disorders	13	3.2	8	2.0	5	1.2	0	0
<b>Other Not SCD-related reactions</b>	23	5.7	16	4.0	3	0.7	1	0.2
Other Not SCD-related reactions	23	5.7	16	4.0	3	0.7	1	0.2
<b>Respiratory thoracic and mediastinal disorders</b>	11	2.7	6	1.5	3	0.7	2	0.5
<b>Renal and urinary disorders</b>	8	2.0	2	0.5	4	1.0	0	0

n: number of patients with an adverse reaction

## 6.2 Postmarketing Experience

The following adverse reactions have been identified during post-approval use of SIKLOS. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

- *Infections and infestations*: Parvovirus B19 infection
- *Blood and lymphatic system disorders*: bone marrow depression including neutropenia ( $<2.0 \times 10^9/l$ ), reticulocytopenia ( $<80 \times 10^9/l$ ), macrocytosis, thrombocytopenia ( $<80 \times 10^9/l$ ), anemia (hemoglobin  $<4.5g/dl$ )
- *Nervous system disorders*: headache, dizziness
- *Gastrointestinal disorders*: nausea, gastrointestinal disturbances, vomiting, gastrointestinal ulcer, severe hypomagnesemia
- *Hepatobiliary disorders*: elevation of hepatic enzymes
- *Skin and subcutaneous tissue disorders*: skin reactions (oral, ungula and cutaneous pigmentation), oral mucositis, rash, melanonychia, alopecia, leg ulcers, cutaneous dryness
- *Reproductive system and breast disorders*: oligospermia, azoospermia, amenorrhea
- *General disorders*: fever
- *Investigations*: weight gain

## 7 DRUG INTERACTIONS

### 7.1 Increased Toxicity with Concomitant Use of Antiretroviral Drugs

#### *Pancreatitis*

Pancreatitis (including fatal cases) have occurred in patients with HIV infection during therapy with hydroxyurea and didanosine, with or without stavudine. Hydroxyurea is not indicated for the treatment of HIV infection; however, if patients with HIV infection are treated with hydroxyurea, and in particular, in combination with didanosine and/or stavudine, monitor closely for signs and symptoms of pancreatitis. Permanently discontinue therapy with hydroxyurea in patients who develop signs and symptoms of pancreatitis.

#### *Hepatotoxicity*

Hepatotoxicity and hepatic failure resulting in death have been reported during postmarketing surveillance in patients with HIV infection treated with hydroxyurea and other antiretroviral drugs. Fatal hepatic events

were reported most often in patients treated with the combination of hydroxyurea, didanosine, and stavudine. Avoid this combination.

#### *Peripheral Neuropathy*

Peripheral neuropathy, which was severe in some cases, has been reported in patients with HIV infection receiving hydroxyurea in combination with antiretroviral drugs, including didanosine, with or without stavudine.

### **7.2 Concomitant Use of Live Virus Vaccine**

Concomitant use of SIKLOS with a live virus vaccine may potentiate the replication of the vaccine virus and/or may increase the adverse reactions of the vaccine virus, because normal defense mechanisms may be suppressed by SIKLOS therapy. Vaccination with a live vaccine in a patient taking SIKLOS may result in severe infections. Generally, the patient's antibody response to vaccines may be decreased. Treatment with SIKLOS and concomitant immunization with live virus vaccines should only be performed if benefits clearly outweigh potential risks. Consider consultation with a specialist.

### **7.3 Test Interference**

#### *Interference with Uric Acid, Urea, or Lactic Acid Assays*

Studies have shown that there is an analytical interference of SIKLOS with the enzymes (urease, uricase, and lactate dehydrogenase) used in the determination of urea, uric acid, and lactic acid, rendering falsely elevated results of these in patients treated with SIKLOS.

## **8 USE IN SPECIFIC POPULATIONS**

### **8.1 Pregnancy**

#### Risk Summary

SIKLOS can cause fetal harm based on findings from animal studies and the drug's mechanism of action [see *Clinical Pharmacology (12.1)*]. There are no studies with the use of SIKLOS in pregnant women, and limited available data on SIKLOS use during pregnancy are insufficient to inform drug-associated risks. Drugs which affect DNA synthesis, such as hydroxyurea, may be potential mutagenic agents. In animal reproduction studies, administration of hydroxyurea to pregnant rats and rabbits during organogenesis produced embryotoxic and teratogenic effects at doses 0.8 times and 0.3 times, respectively, the maximum recommended human daily dose on a mg/m<sup>2</sup> basis. In rats and rabbits, fetal malformations were observed with partially ossified cranial bones, absence of eye sockets, hydrocephaly, bipartite sternbrae, and missing lumbar vertebrae. Embryotoxicity was characterized by decreased fetal viability, reduced live litter sizes, and developmental delays (*see Data*). Advise pregnant women of the potential risk to a fetus (*see Clinical Considerations*).

Background risk of major birth defects and miscarriage for the indicated population are 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 miscarriage in clinically recognized pregnancies is 2%–4% and 15%–20%, respectively.

#### Clinical Considerations

##### *Fetal/Neonatal adverse reactions*

Although the data on a limited number of exposed pregnancies indicate no adverse effects on pregnancy or on the health of the fetus/newborn, patients on SIKLOS should be made aware of the potential risks to the fetus.

Based on the limited amount of available information, in case of an exposure to SIKLOS of pregnant female patients or pregnant partners of male patients, treated by SIKLOS, a careful follow-up with adequate clinical, biological and ultrasonographic examinations should be considered.

## Data

### *Human Data*

According to a retrospective analysis of a cohort of 123 adult patients treated with hydroxyurea, twenty-three pregnancies have been reported from 15 women treated with hydroxyurea and partners of 3 men not using barrier contraception treated with hydroxyurea. Most (61%) had no adverse developmental outcomes. In the other cases with known evolution, pregnancy had been interrupted either voluntarily or upon medical advice.

In retrospective cohorts of 352 children and adolescents with sickle cell disease older than 2 years treated with hydroxyurea for a period of up to 12 years, 3 pregnancies under hydroxyurea were reported with no adverse developmental outcomes.

From post-marketing data of SIKLOS, 3 pregnancies have been reported while the father was treated with SIKLOS and 16 pregnancies have been reported in 15 females treated with SIKLOS. Among the 13 cases with known evolution, 5 pregnancies had no adverse developmental outcomes, 4 led to premature birth, and 4 were early terminated.

### *Animal Data*

Hydroxyurea has been demonstrated to be a potent teratogen in a wide variety of animal models, including mice, hamsters, cats, miniature swine, dogs, and monkeys at doses within 1-fold of the human dose given on a mg/m<sup>2</sup> basis. Hydroxyurea is embryotoxic and causes fetal malformations (partially ossified cranial bones, absence of eye sockets, hydrocephaly, bipartite sternbrae, missing lumbar vertebrae) at 180 mg/kg/day (about 0.8 times the maximum recommended human daily dose on a mg/m<sup>2</sup> basis) in rats and at 30 mg/kg/day (about 0.3 times the maximum recommended human daily dose on a mg/m<sup>2</sup> basis) in rabbits. Embryotoxicity was characterized by decreased fetal viability, reduced live litter sizes, and developmental delays. Hydroxyurea crosses the placenta. Single doses of  $\geq 375$  mg/kg (about 1.7 times the maximum recommended human daily dose on a mg/m<sup>2</sup> basis) to rats caused growth retardation and impaired learning ability.

## **8.2 Lactation**

### **Risk Summary**

It is not known whether SIKLOS is excreted in human milk, the effects of SIKLOS on the breastfed child, or the effects of SIKLOS on milk production. Because of the potential for serious adverse reactions in a breastfed child from SIKLOS, including carcinogenicity, advise patients not to breastfeed during treatment with SIKLOS.

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

### **Pregnancy Testing**

SIKLOS can cause fetal harm when administered to a pregnant woman [*see Use in Specific Populations (8.1)*].

Verify the pregnancy status of females of reproductive potential prior to initiating SIKLOS therapy.

### **Contraception**

#### *Females*

Advise females of reproductive potential to use effective contraception during and after treatment with SIKLOS for at least 6 months after therapy. Advise females to immediately report pregnancy.

### *Males*

SIKLOS may damage spermatozoa and testicular tissue, resulting in possible genetic abnormalities. Males with female sexual partners of reproductive potential should use effective contraception during and after treatment with SIKLOS for at least 6 months after therapy [see *Nonclinical Toxicology (13.1)*].

### **Infertility**

#### *Males*

Based on findings in animals and humans, male fertility may be compromised by treatment with SIKLOS. Azoospermia or oligospermia, sometimes reversible, has been observed in men. Before the start of therapy, inform male patients about the possibility of sperm conservation [see *Adverse Reactions (6) and Nonclinical Toxicology (13.1)*].

### **8.4 Pediatric Use**

The safety and effectiveness of SIKLOS have been established in pediatric patients aged 2-18 years with sickle cell anemia with recurrent moderate to severe painful crises. Use of SIKLOS in these age groups is supported by evidence from a non-interventional cohort study, the European Sickle Cell Disease prospective Cohort study, ESCORT-HU, in which 405 pediatric patients ages 2 to <18 were enrolled. Among the 405 pediatric patients treated with SIKLOS, 274 were children (2-11) and 108 were adolescents (12-16) [see *Clinical Studies (14)*].

Continuous follow-up of the growth of treated children is recommended.

Pediatric patients aged 2-16 years had a higher risk of neutropenia than patients more than 16 years old.

The safety and effectiveness of SIKLOS have not been established in pediatric patients less than 2 years of age.

### **8.5 Renal Impairment**

The exposure to SIKLOS is higher in patients with creatinine clearance of less than 60 mL/min. Reduce dosage and closely monitor the hematologic parameters when SIKLOS is to be administered to these patients [see *Dosage and Administration (2.2) and Clinical Pharmacology (12.3)*].

### **8.6 Hepatic impairment**

Close monitoring of hematologic parameters is advised in patients with hepatic impairment receiving SIKLOS.

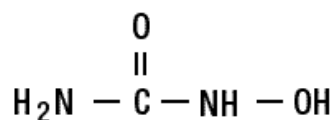
## **10 OVERDOSAGE**

Acute mucocutaneous toxicity has been reported in patients receiving hydroxyurea at doses several times above the therapeutic dose. Soreness, violet erythema, oedema on palms and soles followed by scaling of hand and feet, severe generalized hyperpigmentation of the skin and stomatitis have been observed. In patients with sickle cell anemia, neutropenia was reported in isolated cases of hydroxyurea overdose (1.43 times and 8.57 times of the maximum recommended dose of 35 mg/kg b.w./day). Monitor blood counts weekly until recovery. Treatment of overdose consists of gastric lavage, followed by symptomatic treatment and control of bone marrow function.

## **11 DESCRIPTION**

SIKLOS (hydroxyurea) is an antimetabolite that is available for oral use as 100 mg film-coated tablet and functionally triple-scored 1,000 mg film-coated tablet containing 100 and 1,000 mg of hydroxyurea, respectively. Inactive ingredients include silicified microcrystalline cellulose, sodium stearyl fumarate, and film-coating agent amino methacrylate copolymer.

Hydroxyurea is a white crystalline powder. It has a molecular weight of 76.05. Its structural formula is:



## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

The precise mechanism by which hydroxyurea produces its cytotoxic and cytoreductive effects is not known. However, various studies support the hypothesis that hydroxyurea causes an immediate inhibition of DNA synthesis by acting as a ribonucleotide reductase inhibitor, without interfering with the synthesis of ribonucleic acid or of protein.

The mechanisms by which SIKLOS produces its beneficial effects in patients with sickle cell Anemia (SCA) are uncertain. Known pharmacologic effects of SIKLOS that may contribute to its beneficial effects include increasing hemoglobin F levels in red blood cells (RBCs), decreasing neutrophils, increasing the water content of RBCs, increasing deformability of sickled cells, and altering the adhesion of RBCs to endothelium.

### 12.2 Pharmacodynamics

The correlation between hydroxyurea concentrations, reduction of crisis rate, and increase in HbF, is not known.

### 12.3 Pharmacokinetics

#### Absorption

Following oral administration, hydroxyurea reaches peak plasma concentrations in 1 to 4 hours. Mean peak plasma concentrations and AUCs increase more than proportionally with increase of dose.

#### *Effect of Food*

There are no data on the effect of food on the absorption of hydroxyurea.

#### Distribution

Hydroxyurea distributes throughout the body with a volume of distribution approximating total body water. Hydroxyurea concentrates in leukocytes and erythrocytes.

#### Elimination

#### *Metabolism*

Up to 60% of an oral dose undergoes conversion through saturable hepatic metabolism and a minor pathway of degradation by urease found in intestinal bacteria.

#### *Excretion*

The percentage of the dose excreted in urine was approximately 40% in pediatric patients with sickle cell anemia.

### Specific Populations

#### *Patients with Renal Impairment*

The effect of renal impairment on the pharmacokinetics of hydroxyurea was assessed in adult patients with sickle cell anemia and renal impairment. Patients with normal renal function (creatinine clearance [CrCl] >80 mL/min), mild (CrCl 50-80 mL/min), moderate (CrCl =30-<50 mL/min), or severe (<30 mL/min) renal impairment received a single oral dose of 15 mg/kg hydroxyurea. Creatinine clearance values were obtained using 24-hour urine collections. Patients with ESRD received two doses of 15 mg/kg separated by 7 days; the first was given following a 4-hour hemodialysis session, the second prior to hemodialysis. The exposure to hydroxyurea (mean AUC) in patients with CrCl <60 mL/min and those with ESRD was 64% higher than in patients with normal renal function (CrCl >60 mL/min). Reduce the dose of SIKLOS when it is administered to patients with creatinine clearance of <60 mL/min or with ESRD following hemodialysis [see *Dosage and Administration (2.2) and Use in Specific Populations (8.5)*].

#### *Patients with Hepatic impairment*

There are no data that support specific guidance for dose adjustment in patients with hepatic impairment.

#### *Pediatric Patients*

The pharmacokinetics of hydroxyurea is similar between children (4 to 17 years) and adults.

## **13 NONCLINICAL TOXICOLOGY**

### **13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

Conventional long-term studies to evaluate the carcinogenic potential of hydroxyurea have not been performed. However, hydroxyurea is presumed to be a transspecies carcinogen. Intraperitoneal administration of 125 to 250 mg/kg hydroxyurea (about 0.6-1.2 times the maximum recommended human oral daily dose on a mg/m<sup>2</sup> basis) thrice weekly for 6 months to female rats increased the incidence of mammary tumors in rats surviving to 18 months compared to control. Hydroxyurea is mutagenic *in vitro* to bacteria, fungi, protozoa, and mammalian cells. Hydroxyurea is clastogenic *in vitro* (hamster cells, human lymphoblasts) and *in vivo* (SCE assay in rodents, mouse micronucleus assay). Hydroxyurea causes the transformation of rodent embryo cells to a tumorigenic phenotype [see *Warnings and Precautions (5.2, 5.3)*].

Hydroxyurea administered to male rats at 60 mg/kg /day (about 0.3 times the maximum recommended human daily dose on a mg/m<sup>2</sup> basis) produced testicular atrophy, decreased spermatogenesis and significantly reduced their ability to impregnate females [see *Use in Specific Populations (8.3)*].

## **14 CLINICAL STUDIES**

The efficacy of SIKLOS was assessed in the European Sickle Cell Disease Cohort study (ESCORT HU) [NCT02516579]. This is an open-label single-arm study of 405 pediatric patients with sickle cell disease from 2-18 years of age, of which 141 had not been previously treated with hydroxyurea prior to enrollment. Evaluable patients had at least 12 months follow-up (median [range] 23 months [12,80]). Median (range) hemoglobin F percentages were 5.6% (1.3, 15.0) at baseline and 12.8% (2.1, 37.2) at least

6 months (the value closest to 6 months collected between 5 and 14 months) after initiation of SIKLOS treatment, with median (range) change of 5.9% (-2.2, 34.7) in 47 patients. Median (range) hemoglobin levels were 8.2 g/dL (3.7, 14.2) at baseline, 8.8 g/dL (0.7, 13.1) at 6 months (the value closest to 6 months collected between 5 and 7 months), and 8.9 g/dL (5.5, 13.2) at 12 months (the value closest to 12 months collected between 10 and 14 months) after initiation of SIKLOS treatment. The median (range) change was 0.5 g/dL (-4.6, 6.1) in 63 patients at 6 months (the post-baseline value closest to 6 months collected between 5 and 7 months) and 0.7 g/dL (-6.4, 6.0) in 83 patients at 12 months (the post-baseline value closest to 12 months collected between 10 and 14 months) after initiation of SIKLOS treatment.

Among pediatric patients not previously treated with hydroxyurea prior to enrollment and analyzable for efficacy (N=141), the percentage of patients with at least one vaso-occlusive episode, one episode of acute chest syndrome, one hospitalization due to SCD or one blood transfusion decreased after 12 months of SIKLOS treatment (Table 3).

**Table 2: Comparison of SCD Events in the First Year of Treatment with SIKLOS with SCD Events in the 12 Months Prior to Enrollment – ESCORT HU Trial (N=141)**

SCD events	Patients under 18 years old previously not treated with hydroxyurea with at least 12 months follow-up data available for clinical efficacy (N=141)		
	In the 12 months prior to enrolment	After 12 months of Siklos <sup>®</sup> treatment	Change
<b>Number of patients with at least one vaso-occlusive episode (in 120 evaluable patients)</b>			
No	37 (30.8%)	69 (57.5%)	
Yes	83 (69.2%)	51 (42.5%)	
<b>Number of vasoocclusive episodes over 12 months (in 113 evaluable patients)</b>			
Median (range)	2.0 (0.0, 10.0)	0.0 (0.0, 7.0)	-1.0 (-10.0, 5.0)
<b>Number of patients with at least one episode of acute chest syndrome (in 123 evaluable patients)</b>			
No	94 (76.4%)	116 (94.3%)	
Yes	29 (23.6%)	7 (5.7%)	
<b>Number of episodes of acute chest syndrome over 12 months (in 123 evaluable patients)</b>			
Median (range)	0.0 (0.0, 2.0)	0.0 (0.0, 1.0)	0.0 (-2.0, 1.0)
<b>Number of patients with at least one hospitalization related to SCD (in 110 evaluable patients)</b>			
No	27 (24.5%)	64 (58.2%)	
Yes	83 (75.5%)	46 (41.8%)	
<b>Number of hospitalizations related to SCD over 12 months (in 106 evaluable patients)</b>			
Median (range)	2.0 (0.0, 6.0)	0.0 (0.0, 7.0)	-1.0 (-6.0, 6.0)
<b>Number of days of hospitalizations related to SCD over 12 months (in 100 evaluable patients)</b>			
Median (range)	8.0 (0.0, 58.0)	0.0 (0.0, 100.0)	-3.0 (-58.0, 86.0)
<b>Number of patients with at least one blood transfusion (in 122 evaluable patients)</b>			
No	66 (54.1%)	94 (77.0%)	
Yes	56 (45.9%)	28 (23.0%)	

## 15 REFERENCES

OSHA Hazardous Drugs. OSHA.<http://www.osha.gov/SLTC/hazardousdrugs/index.html>.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### 16.1 How Supplied

SIKLOS (hydroxyurea) film-coated tablet is supplied in high density polyethylene (HDPE) bottle with polypropylene child-resistant cap with a desiccant unit containing 30 (SIKLOS 1,000 mg) or 60 (SIKLOS

100 mg) film coated tablets. Each bottle containing SIKLOS 100 mg tablets or SIKLOS 1,000 mg tablets is supplied in a carton.

SIKLOS is supplied in the following strengths:

- 100 mg off-white round, film-coated tablet, embossed with 100 on one side.
- 1,000 mg off-white, capsule-shaped, film-coated, functionally triple-scored tablet with scoring on both sides which can be divided into four equal parts embossed with “T” on one side.

	Bottles of 30	Bottles of 60
100 mg	N/A	NDC 71132-323-06
1,000 mg	NDC 71132-758-03	N/A

### 16.2 Storage

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

Broken 1,000 mg tablets must be stored in the bottle and must be used within three months.

### 16.3 Handling and Disposal

SIKLOS is a cytotoxic drug. Follow applicable special handling and disposal procedures [see *References (15)*].

To decrease the risk of contact, advise caregivers to wear disposable gloves when handling SIKLOS or bottles containing SIKLOS. Wash hands with soap and water before and after contact with the bottle or tablets when handling SIKLOS. Avoid exposure to crushed tablets. If contact with crushed tablets occurs on the skin, wash affected area immediately and thoroughly with soap and water. If contact with crushed tablets occurs on the eye(s), the affected area should be flushed thoroughly with water or isotonic eyewash designated for that purpose for at least 15 minutes.

Powder spilled from the broken tablet should be wiped up with a damp disposable towel which must be thrown away in a closed container such as a plastic bag to avoid ingestion of powder by other people. The spill areas should then be cleaned using a detergent solution followed by clean water.

## 17 PATIENT COUNSELING INFORMATION

Advise the patient or caregiver to read the FDA-approved patient labeling (Instructions for Use and Medication Guide).

- There is a risk of myelosuppression. Emphasize the importance of monitoring blood counts every two weeks throughout the duration of therapy to patients taking SIKLOS [see *Warnings and Precautions (5.1)*]. Advise patients to report signs and symptoms of infection or bleeding immediately.
- Advise patients that there is a risk of cutaneous vasculitic toxicities and secondary malignancies including leukemia. Advise use of sun protection [see *Warnings and Precautions (5.1)*].
- Advise females of reproductive potential of the potential risk to a fetus should they become pregnant while taking SIKLOS. Advise patients to inform their healthcare provider of a known or suspected pregnancy. Advise females and males of reproductive potential to use contraception during and after treatment with SIKLOS [see *Warnings and Precautions (5.3) and Use in Specific Populations (8.1,8.3)*].

- Advise females to discontinue breastfeeding during treatment with SIKLOS [*see Use in Specific Populations (8.2)*].
- Advise male patients of potential risk to fertility.
- Advise patients with HIV infection to contact their physician for signs and symptoms of pancreatitis, hepatic events, and peripheral neuropathy [*see Warnings and Precautions (5.5)*].
- Because SIKLOS 1,000 mg tablets are scored, advise patients on how to take SIKLOS properly.

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