

# AZACITIDINE- azacitidine injection, powder, lyophilized, for solution

## Sandoz Inc

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### HIGHLIGHTS OF PRESCRIBING INFORMATION

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

**AZACITIDINE for injection for subcutaneous or intravenous use**  
**Initial U.S. Approval: 2004**

### -----RECENT MAJOR CHANGES-----

Indications and Usage, JMML (1.2) 5/2022  
Dosage and Administration (2.1, 2.4, 2.5, 2.10) 5/2022  
Warnings and Precautions (5.1, 5.2, 5.3, 5.4, 5.6) 5/2022

### -----INDICATIONS AND USAGE-----

Azacitidine for injection is a nucleoside metabolic inhibitor indicated for the treatment of:

- Adult patients with the following FAB myelodysplastic syndrome (MDS) subtypes: Refractory anemia (RA) or refractory anemia with ringed sideroblasts (RARS) (if accompanied by neutropenia or thrombocytopenia or requiring transfusions), refractory anemia with excess blasts (RAEB), refractory anemia with excess blasts in transformation (RAEB-T), and chronic myelomonocytic leukemia (CMML). (1.1)
- Pediatric patients aged 1 month and older with newly diagnosed Juvenile Myelomonocytic Leukemia (JMML). (1.2)

### -----DOSAGE AND ADMINISTRATION-----

- **Do not substitute azacitidine for injection for oral azacitidine. The indications and dosing regimen for azacitidine for injection differ from that of oral azacitidine (2.1, 5.1).**
- MDS: The recommended starting dosage for the first treatment cycle, for all patients regardless of baseline hematology values, is azacitidine 75 mg/m<sup>2</sup> daily for 7 days to be administered by subcutaneous injection or intravenous infusion. See full prescribing information for schedule for subsequent cycles. Premedicate for nausea and vomiting (2.2).
- JMML: See full prescribing information for recommended dosage and schedule.
- Continue treatment as long as the patient continues to benefit; up to 6 cycles for pediatric patients with JMML (2.3, 2.4).
- Monitor all patients for hematologic response and for renal toxicity; delay or reduce dosage as appropriate (2.3, 2.4, 2.6, 2.7).

### -----DOSAGE FORMS AND STRENGTHS-----

- Lyophilized powder in 100 mg single-dose vials (3).

### -----CONTRAINDICATIONS-----

- Advanced Malignant Hepatic Tumors (4.1).
- Hypersensitivity to Azacitidine or Mannitol (4.2).

### -----WARNINGS AND PRECAUTIONS-----

- **Risks of Substitution with Other Azacitidine Products:** Do not substitute azacitidine for oral azacitidine (2.1, 5.1).
- **Anemia, Neutropenia and Thrombocytopenia:** Monitor complete blood counts (CBC) frequently (5.2).
- **Hepatotoxicity:** Patients with severe preexisting hepatic impairment are at higher risk for toxicity (5.3).
- **Renal Toxicity:** Monitor patients with renal impairment for toxicity since azacitidine and its metabolites are primarily excreted by the kidneys (5.4).
- **Tumor Lysis Syndrome:** Azacitidine may cause fatal or serious tumor lysis syndrome, including in

patients with MDS. Assess baseline risk and monitor and treat as appropriate (5.5).

- **Embryo-Fetal Toxicity:** Azacitidine can cause fetal harm. Advise female patients and male patients with female partners of reproductive potential of the potential risk to a fetus and to use effective contraception (5.6).

#### ADVERSE REACTIONS

Most common adverse reactions (greater than 30%) in adult patients with MDS by subcutaneous route are: nausea, anemia, thrombocytopenia, vomiting, pyrexia, leukopenia, diarrhea, injection site erythema, constipation, neutropenia and ecchymosis. Most common adverse reactions by intravenous route also included petechiae, rigors, weakness and hypokalemia (6.1).

Most common adverse reactions (greater than 30%) by intravenous route in pediatric patients with JMML are pyrexia, rash, upper respiratory tract infection, and anemia (6.1).

**To report SUSPECTED ADVERSE REACTIONS, contact Sandoz Inc. at 1-800-525-8747 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

#### USE IN SPECIFIC POPULATIONS

- Lactation: Advise not to breastfeed (8.2).

See 17 for PATIENT COUNSELING INFORMATION.

Revised: 9/2022

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## FULL PRESCRIBING INFORMATION: CONTENTS\*

### 1 INDICATIONS AND USAGE

- 1.1 Myelodysplastic Syndromes (MDS)
- 1.2 Juvenile Myelomonocytic Leukemia (JMML)

### 2 DOSAGE AND ADMINISTRATION

- 2.1 Important Administration Information
- 2.2 First Treatment Cycle for Adults
- 2.3 Subsequent Treatment Cycles for Adults
- 2.4 Pediatric Patients with JMML
- 2.5 Dosage Adjustment Based on Hematology Laboratory Values
- 2.6 Dosage Adjustment Based on Serum Electrolytes and Renal Toxicity
- 2.7 Use in Geriatric Patients
- 2.8 Preparation of Azacitidine for Injection
- 2.9 Instructions for Subcutaneous Administration
- 2.10 Instructions for Intravenous Administration

### 3 DOSAGE FORMS AND STRENGTHS

### 4 CONTRAINDICATIONS

- 4.1 Advanced Malignant Hepatic Tumors
- 4.2 Hypersensitivity to Azacitidine or Mannitol

### 5 WARNINGS AND PRECAUTIONS

- 5.1 Risks of Substitution with Other Azacitidine Products
- 5.2 Anemia, Neutropenia and Thrombocytopenia
- 5.3 Hepatotoxicity in Patients with Severe Pre-existing Hepatic Impairment
- 5.4 Renal Toxicity
- 5.5 Tumor Lysis Syndrome
- 5.6 Embryo-Fetal Toxicity

### 6 ADVERSE REACTIONS

- 6.1 Clinical Trials Experience
- 6.2 Postmarketing Experience

## **8 USE IN SPECIFIC POPULATIONS**

- 8.1 Pregnancy
- 8.2 Lactation
- 8.3 Females and Males of Reproductive Potential
- 8.4 Pediatric Use
- 8.5 Geriatric Use

## **10 OVERDOSAGE**

## **11 DESCRIPTION**

## **12 CLINICAL PHARMACOLOGY**

- 12.1 Mechanism of Action
- 12.2 Pharmacodynamics
- 12.3 Pharmacokinetics

## **13 NONCLINICAL TOXICOLOGY**

- 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

## **14 CLINICAL STUDIES**

- 14.1 Myelodysplastic Syndromes (MDS)
- 14.2 Juvenile Myelomonocytic Leukemia (JMML)

## **15 REFERENCES**

## **16 HOW SUPPLIED/STORAGE AND HANDLING**

## **17 PATIENT COUNSELING INFORMATION**

\* Sections or subsections omitted from the full prescribing information are not listed.

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## **FULL PRESCRIBING INFORMATION**

### **1 INDICATIONS AND USAGE**

#### **1.1 Myelodysplastic Syndromes (MDS)**

Azacitidine for injection is indicated for treatment of adult patients with the following French-American-British (FAB) myelodysplastic syndrome subtypes: refractory anemia (RA) or refractory anemia with ringed sideroblasts (if accompanied by neutropenia or thrombocytopenia or requiring transfusions), refractory anemia with excess blasts (RAEB), refractory anemia with excess blasts in transformation (RAEB-T), and chronic myelomonocytic leukemia (CMMoL).

#### **1.2 Juvenile Myelomonocytic Leukemia (JMML)**

Azacitidine for injection is indicated for the treatment of pediatric patients aged one month and older with newly diagnosed JMML.

### **2 DOSAGE AND ADMINISTRATION**

#### **2.1 Important Administration Information**

**Do not substitute azacitidine for injection for oral azacitidine. The indications and dosing regimen for azacitidine for injection differ from that of oral**

## Azacitidine [see Warnings and Precautions (5.1)]

### 2.2 First Treatment Cycle for Adults

The recommended starting dose for the first treatment cycle, for all patients regardless of baseline hematology laboratory values, is 75 mg/m<sup>2</sup> subcutaneously or intravenously, daily for 7 days. Premedicate patients for nausea and vomiting.

Obtain complete blood counts, liver chemistries and serum creatinine prior to the first dose.

### 2.3 Subsequent Treatment Cycles for Adults

Repeat cycles every 4 weeks. The dose may be increased to 100 mg/m<sup>2</sup> if no beneficial effect is seen after 2 treatment cycles and if no toxicity other than nausea and vomiting has occurred. It is recommended that patients be treated for a minimum of 4 to 6 cycles. However, complete or partial response may require additional treatment cycles. Treatment may be continued as long as the patient continues to benefit.

Monitor patients for hematologic response and renal toxicities [see Warnings and Precautions (5.4)], and delay or reduce dosage if necessary [see Dosage and Administration (2.6)].

### 2.4 Pediatric Patients with JMML

**Table 1. Dosage and Administration for Pediatric Patients (JMML)**

Pediatric Patients with JMML	Recommended Dose
Age 1 month to less than 1 year OR weighing less than 10 kg	2.5 mg/kg
Age 1 year and older AND weighing 10 kg or greater	75 mg/m <sup>2</sup>

The recommended dosage for pediatric patients with JMML is provided in **Table 1**. Azacitidine for injection is administered as an intravenous infusion daily for 7 days in a 28-day cycle. Patients should be treated for a minimum of 3 cycles and maximum of 6 cycles.

A delay in dose not exceeding 14 days can be considered for non-hematologic toxicities.

Monitor patients for hematologic response and renal toxicities [see Warnings and Precautions (5.4)], and delay or reduce dosage if necessary. Treatment may be continued up to six cycles as long as the patient continues to benefit.

### 2.5 Dosage Adjustment Based on Hematology Laboratory Values

- For adult patients with baseline (start of treatment) WBC greater than or equal to  $3 \times 10^9/L$ , ANC greater than or equal to  $1.5 \times 10^9/L$ , and platelets greater than or equal to  $75 \times 10^9/L$ , adjust the dose as follows, based on nadir counts for any given cycle:

Nadir Counts	% Dose in the Next
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		Course
ANC ( $\times 10^9/L$ )	Platelets ( $\times 10^9/L$ )	
Less than 0.5	Less than 25	50%
0.5-1.5	25-50	67%
Greater than 1.5	Greater than 50	100%

- For adult patients whose baseline counts are WBC less than  $3 \times 10^9/L$ , ANC less than  $1.5 \times 10^9/L$ , or platelets less than  $75 \times 10^9/L$ , base dose adjustments on nadir counts and bone marrow biopsy cellularity at the time of the nadir as noted below, unless there is clear improvement in differentiation (percentage of mature granulocytes is higher and ANC is higher than at onset of that course) at the time of the next cycle, in which case continue the current dose.

WBC or Platelet Nadir % decrease in counts from baseline	Bone Marrow Biopsy Cellularity at Time of Nadir (%)		
	30-60	15-30	Less than 15
	% Dose in the Next Course		
50-75	100	50	33
Greater than 75	75	50	33

If a nadir as defined in the table above has occurred, give the next course 28 days after the start of the preceding course, provided that both the WBC and the platelet counts are greater than 25% above the nadir and rising. If a greater than 25% increase above the nadir is not seen by day 28, reassess counts every 7 days. If a 25% increase is not seen by day 42, reduce the scheduled dose by 50%.

### *Pediatric Patients with JMML*

As hematological toxicity will be difficult to assess and to differentiate from the natural course of the underlying disorder, dose reductions are not recommended due to hematological toxicity within the first 3 cycles. However, if the patient has a neutrophil count of less than  $0.5 \times 10^9/L$  at end of Cycle 3 or on Day 1 of Cycles 5 or 6, discontinue the treatment.

## **2.6 Dosage Adjustment Based on Serum Electrolytes and Renal Toxicity**

If unexplained reductions in serum bicarbonate levels to less than 20 mEq/L occur, reduce the dosage by 50% for the next course. Similarly, if unexplained elevations of BUN or serum creatinine occur, delay the next cycle until values return to normal or baseline and reduce the dose by 50% for the next course [see *Warnings and Precautions (5.4)*].

## **2.7 Use in Geriatric Patients**

Azacitidine and its metabolites are known to be substantially excreted by the kidney, and the risk of toxic reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, select the dose carefully and monitor renal function [see *Warnings and Precautions (5.4)* and *Use in Specific Populations (8.5)*].

## 2.8 Preparation of Azacitidine for Injection

Azacitidine is a hazardous drug. Follow applicable special handling and disposal procedures. <sup>1</sup>

The azacitidine for injection vial is single-dose and does not contain any preservatives. Discard unused portions of each vial properly [see *How Supplied/Storage and Handling (16)*]. Do not save any unused portions for later administration.

## 2.9 Instructions for Subcutaneous Administration

Reconstitute azacitidine for injection aseptically with 4 mL sterile water for injection, USP to obtain a concentration of 25 mg/mL. Inject the diluent slowly into the vial. Vigorously shake or roll the vial until a uniform suspension is achieved. The suspension will be cloudy. Do not filter the suspension after reconstitution. Doing so could remove the active substance.

**Preparation for Immediate Subcutaneous Administration:** For doses requiring more than 1 vial, divide the dose equally between the syringes (e.g., dose 150 mg = 6 mL, 2 syringes with 3 mL in each syringe) and inject into two separate sites. Due to retention in the vial and needle, it may not be feasible to withdraw all of the suspension from the vial. The product may be held at room temperature for up to 1 hour, but must be administered within 1 hour after reconstitution.

**Preparation for Delayed Subcutaneous Administration:** The reconstituted product may be kept in the vial or drawn into a syringe. For doses requiring more than 1 vial, divide the dose equally between the syringes (e.g., dose 150 mg = 6 mL, 2 syringes with 3 mL in each syringe) and inject into two separate sites. Due to retention in the vial and needle, it may not be feasible to withdraw all of the suspension from the vial. The product must be refrigerated immediately. See **Table 2** for suspension stability storage timelines based on the temperature of the diluent for delayed subcutaneous administration.

After removal from refrigerated conditions, the suspension may be allowed to equilibrate to room temperature for up to 30 minutes prior to administration.

### **Subcutaneous Administration**

To provide a homogeneous suspension, the contents of the dosing syringe must be re-suspended immediately prior to administration. To re-suspend, vigorously roll the syringe between the palms until a uniform, cloudy suspension is achieved.

Azacitidine for injection suspension is administered subcutaneously. Rotate sites for each injection (thigh, abdomen, or upper arm). New injections should be given at least one inch from an old site and never into areas where the site is tender, bruised, red, or hard.

**Table 2 Suspension Stability:** Storage timelines based on the temperature of the diluent for suspension stability storage:

<b>Suspension Stability Storage timelines</b>	
Diluent	Storage Temperature/Duration
Room temperature (25°C / 77°F) Sterile Water for	Store at room temperature at 25°C

Injection, USP	(77°F) for up to 1 hour or refrigerated at 2°C to 8°C (36°F to 46°F) for up to 8 hours.
Cold (2°C to 8°C / 36°F to 46°F) Sterile Water for Injection, USP	Store refrigerated at 2°C to 8°C (36°F to 46°F) for up to 22 hours.

## 2.10 Instructions for Intravenous Administration

Parenteral drug product should be inspected visually for particulate matter and discoloration prior to administration, whenever solution and container permit. Do not use the product if there is evidence of particulate matter or discoloration.

### *Adult Patients with MDS*

Reconstitute the appropriate number of azacitidine for injection vials to achieve the desired dose. Reconstitute each vial with 10 mL sterile water for injection, USP. Vigorously shake or roll the vial until all solids are dissolved. The resulting solution will contain azacitidine 10 mg/mL. The solution should be clear.

Withdraw the required amount of azacitidine for injection solution to deliver the desired dose and inject into a 50-100 mL infusion bag of either 0.9% Sodium Chloride Injection, USP or Lactated Ringer's Injection, USP.

### *Pediatric Patients with JMML*

For pediatric patients with JMML, withdraw the required amount of azacitidine for injection solution to deliver the desired dose and inject into an infusion bag (volume up to 100 mL) of either 0.9% Sodium Chloride Injection, USP or Lactated Ringer's Injection, USP to achieve a final azacitidine for injection concentration between 0.9 mg/mL and 4 mg/mL.

### ***Intravenous Solution Incompatibility***

Azacitidine for injection is incompatible with 5% dextrose injection, USP solutions, Hespan, or solutions that contain bicarbonate. These solutions have the potential to increase the rate of degradation of azacitidine for injection and should therefore be avoided.

### ***Intravenous Administration***

Azacitidine for injection solution is administered intravenously. Administer the total dose over a period of 10 to 40 minutes. The administration must be completed within 1 hour of reconstitution of the azacitidine for injection vial.

***Solution Stability:*** Azacitidine for injection reconstituted and diluted for intravenous administration may be stored at 25°C (77°F), but administration must be completed within 1 hour of reconstitution.

## 3 DOSAGE FORMS AND STRENGTHS

Azacitidine for injection is supplied as lyophilized powder in 100 mg single-dose vials.

## 4 CONTRAINDICATIONS

#### **4.1 Advanced Malignant Hepatic Tumors**

Azacitidine is contraindicated in patients with advanced malignant hepatic tumors [see *Warnings and Precautions (5.3)*].

#### **4.2 Hypersensitivity to Azacitidine or Mannitol**

Azacitidine is contraindicated in patients with a known hypersensitivity to azacitidine or mannitol.

### **5 WARNINGS AND PRECAUTIONS**

#### **5.1 Risks of Substitution with Other Azacitidine Products**

Due to substantial differences in the pharmacokinetic parameters [see *Clinical Pharmacology (12.3)*], the recommended dose and schedule for azacitidine are different from those of oral azacitidine products. Treatment of patients using azacitidine at the recommended dosage of oral azacitidine may result in a fatal adverse reaction. Treatment of patients using oral azacitidine at the doses recommended for azacitidine may not be effective.

Do not substitute azacitidine for oral azacitidine [see *Dosage and Administration (2.1)*].

#### **5.2 Anemia, Neutropenia and Thrombocytopenia**

Azacitidine causes anemia, neutropenia and thrombocytopenia in adult patients with MDS and in pediatric patients with JMML. Monitor complete blood counts frequently for response and/or toxicity, at a minimum, prior to each dosing cycle.

In adult patients with MDS, after administration of the recommended dosage for the first cycle, adjust dosage for subsequent cycles based on nadir counts and hematologic response [see *Dosage and Administration (2.5)*].

In pediatric patients with JMML, dose reductions due to hematological toxicity are not recommended within the first 3 cycles as hematological toxicity will be difficult to assess and to differentiate from the natural course of the underlying disorder [see *Dosage and Administration (2.5)*].

#### **5.3 Hepatotoxicity in Patients with Severe Pre-existing Hepatic Impairment**

Because azacitidine is potentially hepatotoxic in patients with severe pre-existing hepatic impairment, caution is needed in patients with liver disease. Patients with extensive tumor burden due to metastatic disease have been reported to experience progressive hepatic coma and death during azacitidine treatment, especially in such patients with baseline albumin less than 30 g/L. Azacitidine is contraindicated in patients with advanced malignant hepatic tumors [see *Contraindications (4.1)*]. Monitor liver chemistries prior to initiation of therapy and with each cycle.

Safety and effectiveness of azacitidine in patients with MDS or in pediatric patients with JMML and hepatic impairment have not been studied as these patients were excluded from the clinical trials.

#### **5.4 Renal Toxicity**



Renal toxicity ranging from elevated serum creatinine to renal failure and death have been reported in patients treated with intravenous azacitidine in combination with other chemotherapeutic agents for non-MDS conditions. In addition, renal tubular acidosis, defined as a fall in serum bicarbonate to less than 20 mEq/L in association with an alkaline urine and hypokalemia (serum potassium less than 3 mEq/L) developed in 5 patients with CML treated with azacitidine and etoposide. Monitor serum creatinine and electrolytes prior to initiation of therapy and with each cycle. If unexplained reductions in serum bicarbonate less than 20 mEq/L or elevations of BUN or serum creatinine occur, reduce or hold the dose [see *Dosage and Administration (2.6)*].

Patients with renal impairment may be at increased risk for renal toxicity. Also, azacitidine and its metabolites are primarily excreted by the kidney. Therefore, monitor these patients closely for toxicity [see *Dosage and Administration (2.6, 2.7)*]. Patients with MDS or pediatric patients with JMML and renal impairment were excluded from the clinical studies.

### **5.5 Tumor Lysis Syndrome**

Azacitidine may cause fatal or serious tumor lysis syndrome, including in patients with MDS. Tumor lysis syndrome may occur despite concomitant use of allopurinol. Assess baseline risk and monitor and treat as appropriate.

### **5.6 Embryo-Fetal Toxicity**

Based on the mechanism of action and findings in animals, azacitidine can cause fetal harm when administered to a pregnant woman. Azacitidine administered to pregnant rats via a single intraperitoneal (IP) dose approximating 8% of the recommended human daily dose caused fetal death and anomalies.

Advise pregnant women of the potential risk to a fetus. Advise females of reproductive potential to use effective contraception during treatment with azacitidine and for 6 months after the last dose. Advise males with female partners of reproductive potential to use effective contraception during treatment with azacitidine and for 3 months after the last dose [see *Use in Specific Populations (8.1, 8.3)*].

## **6 ADVERSE REACTIONS**

The following adverse reactions are described in other labeling sections:

- o Anemia, Neutropenia and Thrombocytopenia [see *Warnings and Precautions (5.2)*]
- o Hepatotoxicity in Patients with Severe Pre-existing Hepatic Impairment [see *Warnings and Precautions (5.3)*]
- o Renal Toxicity [see *Warnings and Precautions (5.4)*]
- o Tumor Lysis Syndrome [see *Warnings and Precautions (5.5)*]

### **6.1 Clinical Trials 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.

#### MDS

The data described below reflect exposure to azacitidine in 443 patients with MDS from 4 clinical studies. Study 1 was a supportive-care controlled trial (subcutaneous administration), Studies 2 and 3 were single arm studies (one with subcutaneous administration and one with intravenous administration), and Study 4 was an international randomized trial (subcutaneous administration) [see *Clinical Studies (14.1)*].

In Studies 1, 2 and 3, a total of 268 patients were exposed to azacitidine, including 116 exposed for 6 cycles (approximately 6 months) or more and 60 exposed for greater than 12 cycles (approximately one year). Azacitidine was studied primarily in supportive-care controlled and uncontrolled trials (n=150 and n=118, respectively). The population in the subcutaneous studies (n=220) was 23 to 92 years old (mean 66.4 years), 68% male, and 94% white, and had MDS or AML. The population in the intravenous study (n=48) was 35 to 81 years old (mean 63.1 years), 65% male, and 100% white. Most patients received average daily doses between 50 and 100 mg/m<sup>2</sup>.

In Study 4, a total of 175 patients with higher-risk MDS (primarily RAEB and RAEB-T subtypes) were exposed to azacitidine. Of these patients, 119 were exposed for 6 or more cycles, and 63 for at least 12 cycles. The mean age of this population was 68.1 years (ranging from 42 to 83 years), 74% were male, and 99% were white. Most patients received daily azacitidine doses of 75 mg/m<sup>2</sup>.

Most Commonly Occurring Adverse Reactions (Subcutaneous or Intravenous Route) in Adult Patients with MDS: nausea, anemia, thrombocytopenia, vomiting, pyrexia, leukopenia, diarrhea, injection site erythema, constipation, neutropenia, ecchymosis. The most common adverse reactions by intravenous route also included petechiae, rigors, weakness and hypokalemia.

Adverse Reactions Most Frequently (greater than 2%) Resulting in Clinical Intervention (Subcutaneous or Intravenous Route) in Adult Patients with MDS:

Discontinuation: leukopenia, thrombocytopenia, neutropenia.

Dose Held: leukopenia, neutropenia, thrombocytopenia, pyrexia, pneumonia, febrile neutropenia.

Dose Reduced: leukopenia, neutropenia, thrombocytopenia.

**Table 3** presents adverse reactions occurring in at least 5% of patients treated with azacitidine (subcutaneous) in Studies 1 and 2. It is important to note that duration of exposure was longer for the azacitidine-treated group than for the observation group: patients received azacitidine for a mean of 11.4 months while mean time in the observation arm was 6.1 months.

**Table 3. Most Frequently Observed Adverse Reactions (≥ 5% in All Subcutaneous Azacitidine-Treated Patients; Studies 1 and 2)**

System Organ Class Preferred Term*	Number (%) of Patients	
	All Azacitidine for Injection† (N=220)	Observation‡ (N=92)
<b>Blood and lymphatic system disorders</b>		
Anemia	153 (70)	59 (64)
Anemia aggravated	12 (6)	5 (5)

Febrile neutropenia	36 (16)	4 (4)
Leukopenia	106 (48)	27 (29)
Neutropenia	71 (32)	10 (11)
Thrombocytopenia	144 (66)	42 (46)
<b>Gastrointestinal disorders</b>		
Abdominal tenderness	26 (12)	1 (1)
Constipation	74 (34)	6 (7)
Diarrhea	80 (36)	13 (14)
Gingival bleeding	21 (10)	4 (4)
Loose stools	12 (6)	0
Mouth hemorrhage	11 (5)	1 (1)
Nausea	155 (71)	16 (17)
Stomatitis	17 (8)	0
Vomiting	119 (54)	5 (5)
<b>General disorders and administration site conditions</b>		
Chest pain	36 (16)	5 (5)
Injection site bruising	31 (14)	0
Injection site erythema	77 (35)	0
Injection site granuloma	11 (5)	0
Injection site pain	50 (23)	0
Injection site pigmentation changes	11 (5)	0
Injection site pruritus	15 (7)	0
Injection site reaction	30 (14)	0
Injection site swelling	11 (5)	0
Lethargy	17 (8)	2 (2)
Malaise	24 (11)	1 (1)
Pyrexia	114 (52)	28 (30)
<b>Infections and infestations</b>		
Nasopharyngitis	32 (15)	3 (3)
Pneumonia	24 (11)	5 (5)
Upper respiratory tract infection	28 (13)	4 (4)
<b>Injury, poisoning, and procedural complications</b>		
Post procedural hemorrhage	13 (6)	1 (1)
<b>Metabolism and nutrition disorders</b>		
Anorexia	45 (21)	6 (7)
<b>Musculoskeletal and connective tissue disorders</b>		
Arthralgia	49 (22)	3 (3)
Chest wall pain	11 (5)	0
Myalgia	35 (16)	2 (2)
<b>Nervous system disorders</b>		
Dizziness	41 (19)	5 (5)
Headache	48 (22)	10 (11)
<b>Psychiatric disorders</b>		

Anxiety	29 (13)	3 (3)
Insomnia	24 (11)	4 (4)
<b>Respiratory, thoracic and mediastinal disorders</b>		
Dyspnea	64 (29)	11 (12)
<b>Skin and subcutaneous tissue disorders</b>		
Dry skin	11 (5)	1 (1)
Ecchymosis	67 (31)	14 (15)
Erythema	37 (17)	4 (4)
Rash	31 (14)	9 (10)
Skin nodule	11 (5)	1 (1)
Urticaria	13 (6)	1 (1)
<b>Vascular disorders</b>		
Hematoma	19 (9)	0
Hypotension	15 (7)	2 (2)
Petechiae	52 (24)	8 (9)

\* Multiple terms of the same preferred terms for a patient are only counted once within each treatment group.

† Includes adverse reactions from all patients exposed to azacitidine, including patients after crossing over from observations.

‡ Includes adverse reactions from observation period only; excludes any adverse events after crossover to azacitidine.

**Table 4** presents adverse reactions occurring in at least 5% of patients treated with azacitidine in Study 4. Similar to Studies 1 and 2 described above, duration of exposure to treatment with azacitidine was longer (mean 12.2 months) compared with best supportive care (mean 7.5 months).

**Table 4. Most Frequently Observed Adverse Reactions ( $\geq 5\%$  in the Azacitidine-Treated Patients and the Percentage with NCI CTC Grade 3/4 Reactions; Study 4)**

System Organ Class Preferred Term*	Number (%) of Patients			
	Any Grade		Grade 3/4	
	Azacitidine (N=175)	Best Supportive Care Only (N=102)	Azacitidine (N=175)	Best Supportive Care Only (N=102)
<b>Blood and lymphatic system disorders</b>				
Anemia	90 (51)	45 (44)	24 (14)	9 (9)
Febrile neutropenia	24 (14)	10 (10)	22 (13)	7 (7)
Leukopenia	32 (18)	2 (2)	26 (15)	1 (1)
Neutropenia	115 (66)	29 (28)	107 (61)	22 (22)
Thrombocytopenia	122 (70)	35 (34)	102 (58)	29 (28)
<b>Gastrointestinal disorders</b>				
Abdominal pain	22 (13)	7 (7)	7 (4)	0
Constipation	88 (50)	8 (8)	2 (1)	0
Dyspepsia	10 (6)	2 (2)	0	0
Nausea	84 (48)	12 (12)	3 (2)	0

Vomiting	47 (27)	7 (7)	0	0
<b>General disorders and administration site conditions</b>				
Fatigue	42 (24)	12 (12)	6 (3)	2 (2)
Injection site bruising	9 (5)	0	0	0
Injection site erythema	75 (43)	0	0	0
Injection site hematoma	11 (6)	0	0	0
Injection site induration	9 (5)	0	0	0
Injection site pain	33 (19)	0	0	0
Injection site rash	10 (6)	0	0	0
Injection site reaction	51 (29)	0	1 (1)	0
Pyrexia	53 (30)	18 (18)	8 (5)	1 (1)
<b>Infections and infestations</b>				
Rhinitis	10 (6)	1 (1)	0	0
Upper respiratory tract infection	16 (9)	4 (4)	3 (2)	0
Urinary tract infection	15 (9)	3 (3)	3 (2)	0
<b>Investigations</b>				
Weight decreased	14 (8)	0	1 (1)	0
<b>Metabolism and nutrition disorders</b>				
Hypokalemia	11 (6)	3 (3)	3 (2)	3 (3)
<b>Nervous system disorders</b>				
Lethargy	13 (7)	2 (2)	0	1 (1)
<b>Psychiatric disorders</b>				
Anxiety	9 (5)	1 (1)	0	0
Insomnia	15 (9)	3 (3)	0	0
<b>Renal and urinary disorders</b>				
Hematuria	11 (6)	2 (2)	4 (2)	1 (1)
<b>Respiratory, thoracic and mediastinal disorders</b>				
Dyspnea	26 (15)	5 (5)	6 (3)	2 (2)
Dyspnea exertional	9 (5)	1 (1)	0	0
Pharyngolaryngeal pain	11 (6)	3 (3)	0	0
<b>Skin and subcutaneous tissue disorders</b>				
Erythema	13 (7)	3 (3)	0	0
Petechiae	20 (11)	4 (4)	2 (1)	0
Pruritus	21 (12)	2 (2)	0	0
Rash	18 (10)	1 (1)	0	0
<b>Vascular disorders</b>				
Hypertension	15 (9)	4 (4)	2 (1)	2 (2)

\* Multiple reports of the same preferred term from a patient were only counted once within each treatment.

In Studies 1, 2 and 4 with subcutaneous administration of azacitidine, adverse reactions of neutropenia, thrombocytopenia, anemia, nausea, vomiting, diarrhea, constipation, and injection site erythema/reaction tended to increase in incidence with higher doses of azacitidine. Adverse reactions that tended to be more pronounced during the first 1 to 2 cycles of subcutaneous treatment compared with later cycles included

thrombocytopenia, neutropenia, anemia, nausea, vomiting, injection site erythema/pain/bruising/reaction, constipation, petechiae, dizziness, anxiety, hypokalemia, and insomnia. There did not appear to be any adverse reactions that increased in frequency over the course of treatment.

Overall, adverse reactions were qualitatively similar between the intravenous and subcutaneous studies. Adverse reactions that appeared to be specifically associated with the intravenous route of administration included infusion site reactions (e.g. erythema or pain) and catheter site reactions (e.g. infection, erythema, or hemorrhage).

In clinical studies of either subcutaneous or intravenous azacitidine, the following serious adverse reactions occurring at a rate of less than 5% (and not described in **Tables 2** or **3**) were reported:

**Blood and lymphatic system disorders:** agranulocytosis, bone marrow failure, pancytopenia splenomegaly.

**Cardiac disorders:** atrial fibrillation, cardiac failure, cardiac failure congestive, cardio-respiratory arrest, congestive cardiomyopathy.

**Eye disorders:** eye hemorrhage

**Gastrointestinal disorders:** diverticulitis, gastrointestinal hemorrhage, melena, perirectal abscess.

**General disorders and administration site conditions:** catheter site hemorrhage, general physical health deterioration, systemic inflammatory response syndrome.

**Hepatobiliary disorders:** cholecystitis.

**Immune system disorders:** anaphylactic shock, hypersensitivity.

**Infections and infestations:** abscess limb, bacterial infection, cellulitis, blastomycosis, injection site infection, Klebsiella sepsis, neutropenic sepsis, pharyngitis streptococcal, pneumonia Klebsiella, sepsis, septic shock, Staphylococcal bacteremia, Staphylococcal infection, toxoplasmosis.

**Metabolism and nutrition disorders:** dehydration.

**Musculoskeletal and connective tissue disorders:** bone pain aggravated, muscle weakness, neck pain.

**Neoplasms benign, malignant and unspecified:** leukemia cutis.

**Nervous system disorders:** cerebral hemorrhage, convulsions, intracranial hemorrhage.

**Renal and urinary disorders:** loin pain, renal failure.

**Respiratory, thoracic and mediastinal disorders:** hemoptysis, lung infiltration, pneumonitis, respiratory distress.

**Skin and subcutaneous tissue disorders:** pyoderma gangrenosum, rash pruritic, skin induration.

**Surgical and medical procedures:** cholecystectomy.

**Vascular disorders:** orthostatic hypotension.

Juvenile Myelomonocytic Leukemia (JMML)

The safety of azacitidine was evaluated in pediatric patients with JMML (N=18; 0.2-6.9 years old) in Study AZA-JMML-001 [see *Clinical Studies (14.2)*]. Patients received azacitidine as intravenous infusion daily for 7 days in a 28-day cycle [see *Dosage and Administration (2.4)*].

Sixteen patients completed 3 cycles of therapy and 5 of the 16 patients completed 6 cycles. The median treatment duration was 12.3 weeks (range: 4.0 to 30.6 weeks) and the median total number of treatment cycles completed was 3 cycles (range: 1 to 6 cycles).

Serious adverse reactions occurred in 67% of patients who received azacitidine for JMML.

Permanent discontinuation of azacitidine due to an adverse reaction occurred in a single patient who had abdominal pain and acute respiratory distress syndrome.

The most common (greater than or equal to 30%) adverse reactions were pyrexia, rash, upper respiratory tract infection, and anemia.

**Table 5** summarizes the adverse reactions in pediatric JMML.

**Table 5. Most Frequently Observed Adverse Reactions (≥10%) in Pediatric Patients with JMML Receiving Azacitidine in Study AZA-JMML-001**

<b>Adverse Reaction</b>	<b>All Grades N=18 %</b>	<b>Grade 3 or 4 N=18 %</b>
<b>General disorders and administration site conditions</b>		
Pyrexia	61	0
Edema*	11	0
<b>Skin and subcutaneous tissue disorders</b>		
Rash†	44	0
Pruritus‡	22	0
Dermatitis allergic	11	0
Petechiae	11	0
<b>Infections and infestations</b>		
Upper respiratory tract infection§	44	6
Febrile infection	11	6
Fungal infection¶	11	6
Pneumonia#	11	0
<b>Blood and lymphatic system disorders</b>		
Anemia	39	33
Thrombocytopenia	28	22
Neutropenia	17	11
Febrile Neutropenia	11	6
Lymphadenopathy	11	6
<b>Gastrointestinal disorders</b>		
Vomiting	28	0

Abdominal pain <sup>p</sup>	22	11
Constipation	22	0
Diarrhea	22	6
Hemorrhage <sup>β</sup>	11	0
Nausea	11	0
Ascites	11	6
<b>Respiratory, thoracic and mediastinal disorders</b>		
Cough	22	0
Epistaxis	17	6
<b>Metabolism and nutrition disorders</b>		
Hyperuricemia	17	0
Fluid retention	11	0
<b>Musculoskeletal and connective tissue disorders</b>		
Musculoskeletal pain <sup>à</sup>	11	0

\* Grouped term includes: face edema, generalized edema, edema peripheral.

† Grouped term includes: rash, rash macular, dermatitis bullous, rash maculo-papular, rash papular, rash pruritic.

‡ Grouped term includes: pruritis, pruritis generalized.

§ Grouped term includes: influenza, nasopharyngitis, Parainfluenzae virus infection, respiratory tract infection, rhinitis, upper respiratory tract infection, and viral upper respiratory tract infection

¶ Grouped term includes: anal candidiasis, Candida infection, oral candidiasis.

# Grouped term includes: lung infection, pneumonia respiratory syncytial viral.

p Grouped term includes: abdominal pain, abdominal pain upper.

β Grouped term includes: mouth hemorrhage, rectal hemorrhage.

à Grouped term includes: back pain, musculoskeletal pain, non-cardiac chest pain, pain in extremity.

## 6.2 Postmarketing Experience

The following adverse reactions have been identified during postmarketing use of azacitidine. 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.

- Interstitial lung disease
- Tumor lysis syndrome
- Injection site necrosis
- Sweet's syndrome (acute febrile neutrophilic dermatosis)
- Necrotizing fasciitis (including fatal cases)
- Differentiation syndrome
- Pericardial effusion
- Pericarditis

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

#### **Risk Summary**

Based on its mechanism of action and findings in animals, azacitidine can cause fetal harm when administered to a pregnant woman [see *Clinical Pharmacology (12.1)*]. There



are no data on the use of azacitidine in pregnant women. Azacitidine was teratogenic and caused embryo-fetal lethality in animals at doses lower than the recommended human daily dose (see ). Advise pregnant women of the potential risk to the fetus.

The background rate of major birth defects and miscarriage is unknown for the indicated population. 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% to 4% and 15% to 20%, respectively.

## **Data**

### *Animal Data*

Early embryotoxicity studies in mice revealed a 44% frequency of intrauterine embryonal death (increased resorption) after a single IP (intraperitoneal) injection of 6 mg/m<sup>2</sup> (approximately 8% of the recommended human daily dose on a mg/m<sup>2</sup> basis) azacitidine on gestation day 10. Developmental abnormalities in the brain have been detected in mice given azacitidine on or before gestation day 15 at doses of ~3-12 mg/m<sup>2</sup> (approximately 4%-16% the recommended human daily dose on a mg/m<sup>2</sup> basis).

In rats, azacitidine was clearly embryotoxic when given IP on gestation days 4-8 (postimplantation) at a dose of 6 mg/m<sup>2</sup> (approximately 8% of the recommended human daily dose on a mg/m<sup>2</sup> basis), although treatment in the preimplantation period (on gestation days 1-3) had no adverse effect on the embryos. Azacitidine caused multiple fetal abnormalities in rats after a single IP dose of 3 to 12 mg/m<sup>2</sup> (approximately 8% the recommended human daily dose on a mg/m<sup>2</sup> basis) given on gestation day 9, 10, 11 or 12. In this study azacitidine caused fetal death when administered at 3-12 mg/m<sup>2</sup> on gestation days 9 and 10; average live animals per litter was reduced to 9% of control at the highest dose on gestation day 9. Fetal anomalies included: CNS anomalies (exencephaly/encephalocele), limb anomalies (micromelia, club foot, syndactyly, oligodactyly), and others (micrognathia, gastroschisis, edema, and rib abnormalities).

## **8.2 Lactation**

### **Risk Summary**

There is no information regarding the presence of azacitidine in human milk, the effects of azacitidine on the breastfed infant, or the effects of azacitidine on milk production. Because many drugs are excreted in human milk and because of the potential for tumorigenicity shown for azacitidine in animal studies [see *Nonclinical Toxicology (13.1)*] and the potential for serious adverse reactions in nursing infants from azacitidine, advise patients not to breastfeed during treatment with azacitidine and for 1 week after the last dose.

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

Based on its mechanism of action and findings in animals, azacitidine can cause fetal harm when administered to a pregnant woman [see *Use in Specific Populations (8.1)*].

### **Pregnancy Testing**

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

## **Contraception**

### *Females*

Advise pregnant women of the potential risk to a fetus. Advise females of reproductive potential to use effective contraception during treatment with azacitidine and for 6 months after the last dose.

### *Males*

Advise males with female partners of reproductive potential to use effective contraception during treatment with azacitidine and for 3 months after the last dose.

## **Infertility**

Based on animal data, azacitidine could have an effect on male or female fertility [see *Nonclinical Toxicology (13.1)*].

## **8.4 Pediatric Use**

Safety and effectiveness of azacitidine in pediatric patients with MDS have not been established.

The safety and effectiveness of azacitidine have been established in pediatric patients with newly diagnosed JMML aged 1 month and older and the information on this use is discussed throughout the labeling. The safety and effectiveness of azacitidine have not been established in pediatric patients younger than 1 month old [see *Clinical Studies (14.2)*].

## **8.5 Geriatric Use**

Of the total number of patients in Studies 1, 2 and 3, 62% were 65 years and older and 21% were 75 years and older. No overall differences in effectiveness were observed between these patients and younger patients. In addition, there were no relevant differences in the frequency of adverse reactions observed in patients 65 years and older compared to younger patients.

Of the 179 patients randomized to azacitidine in Study 4, 68% were 65 years and older and 21% were 75 years and older. Survival data for patients 65 years and older were consistent with overall survival results. The majority of adverse reactions occurred at similar frequencies in patients less than 65 years of age and patients 65 years of age and older.

Elderly patients are more likely to have decreased renal function. Monitor renal function in these patients [see *Dosage and Administration (2.7)* and *Warnings and Precautions (5.4)*].

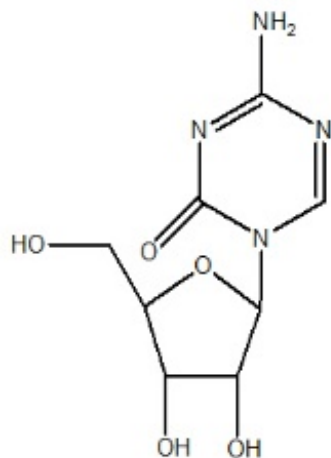
## **10 OVERDOSAGE**

One case of overdose with azacitidine was reported during clinical trials. A patient experienced diarrhea, nausea, and vomiting after receiving a single intravenous dose of approximately 290 mg/m<sup>2</sup>, almost 4 times the recommended starting dose. The events resolved without sequelae, and the correct dose was resumed the following day. In the event of overdosage, the patient should be monitored with appropriate blood counts and should receive supportive treatment, as necessary. There is no known specific

antidote for azacitidine overdosage.

## 11 DESCRIPTION

Azacitidine for injection contains azacitidine, which is a nucleoside metabolic inhibitor. Azacitidine is 4-amino-1- $\beta$ -D-ribofuranosyl-s-triazin-2(1H)-one. The structural formula is as follows:



The empirical formula is C<sub>8</sub>H<sub>12</sub>N<sub>4</sub>O<sub>5</sub>. The molecular weight is 244. Azacitidine for injection is a white to off-white solid. Azacitidine for injection was found to be insoluble in acetone, ethanol, and methyl ethyl ketone; slightly soluble in ethanol/water (50/50), propylene glycol, and polyethylene glycol; sparingly soluble in water, water saturated octanol, 5% dextrose in water, N-methyl-2-pyrrolidone, normal saline and 5% Tween 80 in water; and soluble in dimethylsulfoxide (DMSO).

The finished product is supplied in a sterile form for reconstitution as a suspension for subcutaneous injection or reconstitution as a solution with further dilution for intravenous infusion. Vials of azacitidine for injection contain 100 mg of azacitidine and 100 mg mannitol as a sterile lyophilized powder.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Azacitidine is a pyrimidine nucleoside analog of cytidine. Azacitidine is believed to exert its antineoplastic effects by causing hypomethylation of DNA and direct cytotoxicity on abnormal hematopoietic cells in the bone marrow. The concentration of azacitidine required for maximum inhibition of DNA methylation *in vitro* does not cause major suppression of DNA synthesis. Hypomethylation may restore normal function to genes that are critical for differentiation and proliferation. The cytotoxic effects of azacitidine cause the death of rapidly dividing cells, including cancer cells that are no longer responsive to normal growth control mechanisms. Non-proliferating cells are relatively insensitive to azacitidine.

### 12.2 Pharmacodynamics

In pediatric patients with JMML post azacitidine treatment (75 mg/m<sup>2</sup> or 2.5 mg/kg), reductions in genome-wide DNA methylation (global DNA methylation scores) were attained in bone marrow granulocytes during the first treatment cycle, confirming the DNA-hypomethylating activity of azacitidine.

### **12.3 Pharmacokinetics**

The pharmacokinetics of azacitidine were studied in 6 adult patients with MDS following a single 75 mg/m<sup>2</sup> subcutaneous dose and a single 75 mg/m<sup>2</sup> intravenous dose.

#### ***Absorption***

Azacitidine is rapidly absorbed after subcutaneous administration; the peak plasma azacitidine concentration of 750 ± 403 ng/ml occurred in 0.5 hour after subcutaneous administration.

#### ***Distribution***

The bioavailability of subcutaneous azacitidine relative to intravenous azacitidine is approximately 89%, based on area under the curve. Mean volume of distribution following intravenous dosing is 76 ± 26 L. Mean apparent subcutaneous clearance is 167 ± 49 L/hour and mean half-life after subcutaneous administration is 41 ± 8 minutes. The AUC and C<sub>max</sub> of subcutaneous administration of azacitidine in 21 patients with cancer were approximately dose proportional within the 25 to 100 mg/m<sup>2</sup> dose range. Multiple dosing at the recommended dose-regimen does not result in drug accumulation with intravenous or subcutaneous administration.

#### ***Elimination***

##### *Metabolism*

An *in vitro* study of azacitidine incubation in human liver fractions indicated that azacitidine is not metabolized by the cytochrome P450 (CYP) enzymes. Azacitidine undergoes spontaneous hydrolysis and deamination mediated by cytidine deaminase.

##### *Excretion*

Published studies indicate that urinary excretion is the primary route of elimination of azacitidine and its metabolites. Following intravenous administration of radioactive azacitidine to 5 cancer patients, the cumulative urinary excretion was 85% of the radioactive dose. Fecal excretion accounted for less than 1% of administered radioactivity over 3 days. Mean excretion of radioactivity in urine following subcutaneous administration of <sup>14</sup>C-azacitidine was 50%. The mean elimination half-lives of total radioactivity (azacitidine and its metabolites) were similar after intravenous and subcutaneous administrations, about 4 hours.

#### ***Specific Populations***

The effects of hepatic impairment, gender, or race/ethnicity on the pharmacokinetics of intravenous and subcutaneous azacitidine have not been studied.

##### *Pediatric Patients*

Following intravenous administration of a 75 mg/m<sup>2</sup> or 2.5 mg/kg dose in pediatric patients with JMML, population pharmacokinetic analysis determined that azacitidine rapidly reached a geometric mean C<sub>max</sub> of 4510 ng/mL (CV%: 65.6%), and a geometric

mean  $AUC_{0-24}$  of 1550 ng•h/mL (CV%: 56.6%). The geometric mean  $t_{1/2}$  was 0.3 hours (CV%: 59.9%), and the geometric mean clearance was 21.8 L/h (CV%: 102.2%).

Population PK analysis of 6 adults and 34 pediatric patients did not identify any clinically meaningful differences in the pharmacokinetics of intravenous azacitidine according to sex (62.5% male), and tumor type (MDS, JMML, AML). Increased clearance was associated with increased baseline body weight (4.6 to 102 kg). BSA or body weight-based dosing resulted in consistent plasma azacitidine exposure in pediatric patients with JMML across the body weight range (4.6 to 18.5 kg) and age range (0.2 to 6.9 years).

#### *Patients with Renal Impairment*

In adult patients with cancer, the pharmacokinetics of azacitidine in 6 patients with normal renal function (CL<sub>cr</sub> greater than 80 mL/min) and 6 patients with severe renal impairment (CL<sub>cr</sub> less than 30 mL/min) were compared following daily subcutaneous dosing (Days 1 through 5) at 75 mg/m<sup>2</sup>/day. Severe renal impairment increased azacitidine exposure by approximately 70% after single and 41% after multiple subcutaneous administrations. This increase in exposure was not correlated with an increase in adverse events. The exposure was similar to exposure in patients with normal renal function receiving 100 mg/m<sup>2</sup>.

#### **Drug-Drug Interactions**

No formal clinical drug interaction studies with azacitidine have been conducted.

#### *In vitro Studies*

*Cytochrome P450 (CYP) Enzymes:* An *in vitro* study at azacitidine concentrations up to 100 μM (IV C<sub>max</sub> = 10.6 μM) in human liver microsomes indicated that azacitidine does not cause any inhibition of CYP isoforms CYP1A2, CYP2B6, CYP2C8, CYP2C9, CYP2C19, CYP2D6, CYP3A4, or CYP2E1 at clinically achievable concentrations.

*In vitro* studies with human cultured hepatocytes indicate that azacitidine at concentrations of 1.0 μM to 100 μM does not induce CYP 1A2, 2C19, or 3A4/5.

*Transporter Systems:* An *in vitro* study with LLC-PK1 cells expressing P-glycoprotein (P-gp) indicated that azacitidine is not a substrate or inhibitor of P-gp.

Azacitidine does not inhibit, breast cancer resistance protein (BCRP), organic anion transporters (OAT) OAT1 and OAT3, organic anion transporting polypeptides (OATP) OATP1B1 and OATP1B3, or organic cation transporter (OCT) OCT2 at clinically relevant concentrations.

## **13 NONCLINICAL TOXICOLOGY**

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

The potential carcinogenicity of azacitidine was evaluated in mice and rats. Azacitidine induced tumors of the hematopoietic system in female mice at 2.2 mg/kg (6.6 mg/m<sup>2</sup>, approximately 8% the recommended human daily dose on a mg/m<sup>2</sup> basis) administered IP three times per week for 52 weeks. An increased incidence of tumors in the lymphoreticular system, lung, mammary gland, and skin was seen in mice treated with azacitidine IP at 2.0 mg/kg (6.0 mg/m<sup>2</sup>, approximately 8% the recommended human

daily dose on a mg/m<sup>2</sup> basis) once a week for 50 weeks. A tumorigenicity study in rats dosed twice weekly at 15 or 60 mg/m<sup>2</sup> (approximately 20%-80% the recommended human daily dose on a mg/m<sup>2</sup> basis) revealed an increased incidence of testicular tumors compared with controls.

The mutagenic and clastogenic potential of azacitidine was tested in *in vitro* bacterial systems *Salmonella typhimurium* strains TA100 and several strains of *trpE8*, *Escherichia coli* strains WP14 Pro, WP3103P, WP3104P, and CC103; in *in vitro* forward gene mutation assay in mouse lymphoma cells and human lymphoblast cells; and in an *in vitro* micronucleus assay in mouse L5178Y lymphoma cells and Syrian hamster embryo cells. Azacitidine was mutagenic in bacterial and mammalian cell systems. The clastogenic effect of azacitidine was shown by the induction of micronuclei in L5178Y mouse cells and Syrian hamster embryo cells.

Administration of azacitidine to male mice at 9.9 mg/m<sup>2</sup> (approximately 9% the recommended human daily dose on a mg/m<sup>2</sup> basis) daily for 3 days prior to mating with untreated female mice resulted in decreased fertility and loss of offspring during subsequent embryonic and postnatal development. Treatment of male rats 3 times per week for 11 or 16 weeks at doses of 15-30 mg/m<sup>2</sup> (approximately 20%-40%, the recommended human daily dose on a mg/m<sup>2</sup> basis) resulted in decreased weight of the testes and epididymides, and decreased sperm counts accompanied by decreased pregnancy rates and increased loss of embryos in mated females. In a related study, male rats treated for 16 weeks at 24 mg/m<sup>2</sup> resulted in an increase in abnormal embryos in mated females when examined on day 2 of gestation.

## 14 CLINICAL STUDIES

### 14.1 Myelodysplastic Syndromes (MDS)

Study 1 was a randomized, open-label, controlled trial carried out in 53 U.S. sites compared the safety and efficacy of subcutaneous azacitidine plus supportive care with supportive care alone ("observation") in adult patients with any of the five FAB subtypes of myelodysplastic syndromes (MDS): refractory anemia (RA), RA with ringed sideroblasts (RARS), RA with excess blasts (RAEB), RAEB in transformation (RAEB-T), and chronic myelomonocytic leukemia (CMML). RA and RARS patients were included if they met one or more of the following criteria: required packed RBC transfusions; had platelet counts less than or equal to  $50.0 \times 10^9/L$ ; required platelet transfusions; or were neutropenic (ANC less than  $1.0 \times 10^9/L$ ) with infections requiring treatment with antibiotics. Patients with acute myelogenous leukemia (AML) were not intended to be included. Supportive care allowed in this study included blood transfusion products, antibiotics, antiemetics, analgesics and antipyretics. The use of hematopoietic growth factors was prohibited. Baseline patient and disease characteristics are summarized in **Table 6**; the 2 groups were similar.

Azacitidine was administered at a subcutaneous dose of 75 mg/m<sup>2</sup> daily for 7 days every 4 weeks. The dose was increased to 100 mg/m<sup>2</sup> if no beneficial effect was seen after 2 treatment cycles. The dose was decreased and/or delayed based on hematologic response or evidence of renal toxicity. Patients in the observation arm were allowed by protocol to cross over to azacitidine if they had increases in bone marrow blasts, decreases in hemoglobin, increases in red cell transfusion requirements, or decreases in platelets, or if they required a platelet transfusion or developed a clinical infection

requiring treatment with antibiotics. For purposes of assessing efficacy, the primary endpoint was response rate (as defined in **Table 7**).

Of the 191 patients included in the study, independent review (adjudicated diagnosis) found that 19 had the diagnosis of AML at baseline. These patients were excluded from the primary analysis of response rate, although they were included in an intent-to-treat (ITT) analysis of all patients randomized. Approximately 55% of the patients randomized to observation crossed over to receive azacitidine treatment.

**Table 6. Baseline Demographics and Disease Characteristics**

	<b>Azacitidine (N=99)</b>	<b>Observation (N=92)</b>
<b>Gender (n%)</b>		
Male	72 (72.7)	60 (65.2)
Female	27 (27.3)	32 (34.8)
<b>Race (n%)</b>		
White	93 (93.9)	85 (92.4)
Black	1 (1.0)	1 (1.1)
Hispanic	3 (3.0)	5 (5.4)
Asian/Oriental	2 (2.0)	1 (1.1)
<b>Age (years)</b>		
N	99	91
Mean ± SD	67.3 ± 10.39	68.0 ± 10.23
Range	31 - 92	35 - 88
<b>Adjudicated MDS diagnosis at study entry (n%)</b>		
RA	21 (21.2)	18 (19.6)
RARS	6 (6.1)	5 (5.4)
RAEB	38 (38.4)	39 (42.4)
RAEB-T	16 (16.2)	14 (15.2)
CMMoL	8 (8.1)	7 (7.6)
AML	10 (10.1)	9 (9.8)
<b>Transfusion product used in 3 months before study entry (n%)</b>		
Any transfusion product	70 (70.7)	59 (64.1)
Blood cells, packed human	66 (66.7)	55 (59.8)
Platelets, human blood	15 (15.2)	12 (13.0)
Hetastarch	0 (0.0)	1 (1.1)
Plasma protein fraction	1 (1.0)	0 (0.0)
Other	2 (2.0)	2 (2.2)

**Table 7. Response Criteria**

		<b>RA</b>	<b>RARS</b>	<b>RAEB</b>	<b>RAEB-T</b>	<b>CMMoL</b>
<b>Complete Response (CR),</b> duration ≥4 weeks	<b>Marrow</b>	<5% blasts				
	<b>Peripheral Blood</b>	Normal CBC if abnormal at baseline				
		Absence of blasts in the peripheral circulation				

<b>Partial Response (PR),</b> duration ≥4 weeks	<b>Marrow</b>	No marrow requirements	≥50% decrease in blasts Improvement of marrow dyspoiesis
	<b>Peripheral Blood</b>	≥50% restoration in the deficit from normal levels of baseline white cells, hemoglobin and platelets if abnormal at baseline No blasts in the peripheral circulation For CMMoL, if WBC is elevated at baseline, a ≥75% reduction in the excess count over the upper limit of normal	

The overall response rate (CR + PR) of 15.7% in azacitidine-treated patients without AML (16.2% for all azacitidine randomized patients including AML) was statistically significantly higher than the response rate of 0% in the observation group (p<0.0001) (**Table 8**). The majority of patients who achieved either CR or PR had either 2 or 3 cell line abnormalities at baseline (79%; 11/14) and had elevated bone marrow blasts or were transfusion dependent at baseline. Patients responding to azacitidine had a decrease in bone marrow blasts percentage, or an increase in platelets, hemoglobin or WBC. Greater than 90% of the responders initially demonstrated these changes by the 5<sup>th</sup> treatment cycle. All patients who had been transfusion dependent became transfusion independent during PR or CR. The mean and median duration of clinical response of PR or better was estimated as 512 and 330 days, respectively; 75% of the responding patients were still in PR or better at completion of treatment. Response occurred in all MDS subtypes as well as in patients with adjudicated baseline diagnosis of AML.

**Table 8. Response Rates**

	<b>Azacitidine (N=89)</b>	<b>Observation Before Crossover (N=83)</b>	
<b>Response</b>	<b>n (%)</b>	<b>n (%)</b>	<b>P value</b>
Overall (CR+PR)	14 (15.7)	0 (0.0)	(<0.0001)
Complete (CR)	5 (5.6)	0 (0.0)	(0.06)
Partial (PR)	9 (10.1)	0 (0.0)	--

Patients in the observation group who crossed over to receive azacitidine treatment (47 patients) had a response rate of 12.8%.

Study 2, a multi-center, open-label, single-arm study of 72 patients with RAEB, RAEB-T, CMMoL, or AML was also carried out. Treatment with subcutaneous azacitidine resulted in a response rate (CR + PR) of 13.9%, using criteria similar to those described above. The mean and median duration of clinical response of PR or better was estimated as 810 and 430 days, respectively; 80% of the responding patients were still in PR or better at the time of completion of study involvement. In Study 3, another open-label, single-arm study of 48 patients with RAEB, RAEB-T, or AML, treatment with intravenous azacitidine resulted in a response rate of 18.8%, again using criteria similar to those described above. The mean and median duration of clinical response of PR or better was estimated as 389 and 281 days, respectively; 67% of the responding patients were still in PR or



better at the time of completion of treatment. Response occurred in all MDS subtypes as well as in patients with adjudicated baseline diagnosis of AML in both of these studies. Azacitidine dosage regimens in these 2 studies were similar to the regimen used in the controlled study.

Benefit was seen in patients who did not meet the criteria for PR or better, but were considered "improved." About 24% of azacitidine-treated patients were considered improved, and about 2/3 of those lost transfusion dependence. In the observation group, only 5/83 patients met criteria for improvement; none lost transfusion dependence. In all 3 studies, about 19% of patients met criteria for improvement with a median duration of 195 days.

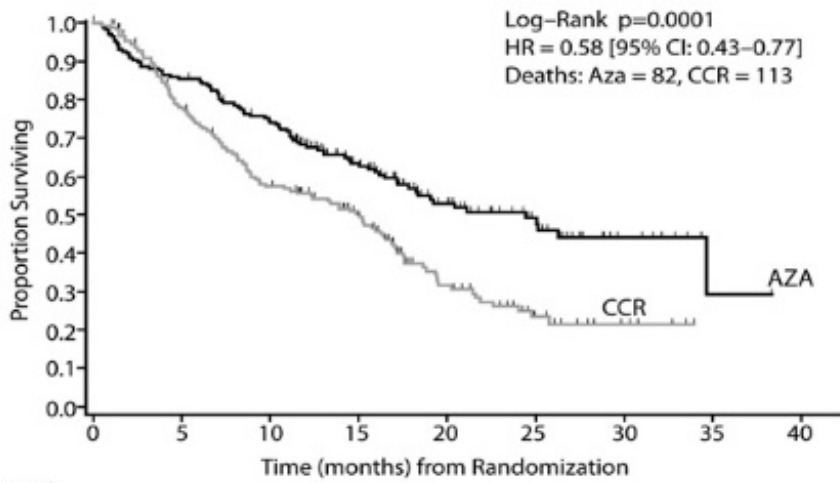
Study 4 was an international, multicenter, open-label, randomized trial in patients with MDS with RAEB, RAEB-T or modified CMMoL according to FAB classification and Intermediate-2 and High risk according to IPSS classification. Of the 358 patients enrolled in the study, 179 were randomized to receive azacitidine plus best supportive care (BSC) and 179 were randomized to receive conventional care regimens (CCR) plus BSC (105 to BSC alone, 49 to low dose cytarabine and 25 to chemotherapy with cytarabine and anthracycline). The primary efficacy endpoint was overall survival.

The azacitidine and CCR groups were comparable for baseline parameters. The median age of patients was 69 years (range was 38-88 years), 98% were Caucasian, and 70% were male. At baseline, 95% of the patients were higher risk by FAB classification: RAEB (58%), RAEB-T (34%), and CMMoL (3%). By IPSS classification, 87% were higher risk: Int-2 (41%), High (47%). At baseline, 32% of patients met WHO criteria for AML.

Azacitidine was administered subcutaneously at a dose of 75 mg/m<sup>2</sup> daily for 7 consecutive days every 28 days (which constituted one cycle of therapy). Patients continued treatment until disease progression, relapse after response, or unacceptable toxicity. Azacitidine patients were treated for a median of 9 cycles (range 1 to 39), BSC only patients for a median of 7 cycles (range 1 to 26), low dose cytarabine patients for a median of 4.5 cycles (range 1 to 15), and chemotherapy with cytarabine and anthracycline patients for a median of 1 cycle (range 1 to 3, i.e. induction plus 1 or 2 consolidation cycles).

In the Intent-to-Treat analysis, patients treated with azacitidine demonstrated a statistically significant difference in overall survival as compared to patients treated with CCR (median survival of 24.5 months vs. 15.0 months; stratified log-rank p=0.0001). The hazard ratio describing this treatment effect was 0.58 (95% CI: 0.43, 0.77).

**Kaplan-Meier Curve of Time to Death from Any Cause:** (Intent-to-Treat Population)



# at risk	0	5	10	15	20	25	30	35	40
AZA	179	152	130	85	52	30	10	1	0
CCR	179	132	95	69	32	14	5	0	0

Key: AZA = azacitidine; CCR = conventional care regimens; CI = confidence interval; HR = Hazard Ratio

Azacitidine treatment led to a reduced need for red blood cell transfusions (see **Table 8**). In patients treated with azacitidine who were RBC transfusion dependent at baseline and became transfusion independent, the median duration of RBC transfusion independence was 13.0 months.

**Table 9. Effect of Azacitidine on RBC Transfusions in Patients with MDS**

Efficacy Parameter	Azacitidine plus BSC (n= 179)	Conventional Care Regimens (n= 179)
Number and percent of patients who were transfusion dependent at baseline who became transfusion independent on treatment*	50/111 (45.0%)  (95% CI: 35.6%, 54.8%)	13/114 (11.4%)  (95% CI: 6.2%, 18.7%)
Number and percent of patients who were transfusion-independent at baseline who became transfusion-dependent on treatment	10/68 (14.7%)  (95% CI: 7.3%, 25.4%)	28/65 (43.1%)  (95% CI: 30.9%, 56.0%)

\* A patient was considered RBC transfusion independent during the treatment period if the patient had no RBC transfusions during any 56 consecutive days or more during the treatment period. Otherwise, the patient was considered transfusion dependent.

## 14.2 Juvenile Myelomonocytic Leukemia (JMML)

AZA-JMML-001 (NCT02447666) was an international, multicenter, open-label study to

evaluate the pharmacokinetics, pharmacodynamics, safety, and activity of azacitidine prior to hematopoietic stem cell transplantation (HSCT) in a total of 18 pediatric patients (median age of 2.1 years, range 0.2-6.9 years; 61% male; 89% white) with juvenile myelomonocytic leukemia (JMML).

Patients with newly diagnosed JMML were included if they met the following criteria: diagnosis confirmed in peripheral blood and bone marrow, and had one of the following: somatic mutation in PTPN11, KRAS, or NRAS and HbF % greater than 5 x normal value for age, or clinical diagnosis of neurofibromatosis Type 1 (NF-1). Additionally, patients included had no CNS involvement, isolated extramedullary disease, or germline molecular aberrations in CBL, PTPN11, NRAS, or KRAS.

Eighteen patients with JMML (13 *PTPN11*, 3 *NRAS*, 1 *KRAS* somatic mutations and 1 clinical diagnosis of neurofibromatosis type 1 [*NF 1*]) were enrolled. Patients were treated with intravenous azacitidine [see *Dosage and Administration (2.4)*], daily on Days 1 to 7 of a 28-day cycle for a minimum of 3 cycles and a maximum of 6 cycles, provided the patients did not have disease progression or were ready for HSCT between Cycles 4 and 6. The efficacy of azacitidine was established based on clinical complete remission (cCR) or clinical partial remission (cPR) according to the International JMML response criteria at 3 months (Cycle 3 Day 28). Responses must have been sustained for at least 4 weeks either in the 4-week period preceding or succeeding Cycle 3 Day 28 (i.e., sustained over the period Cycle 2 Day 28 to Cycle 3 Day 28, or Cycle 3 Day 28 to Cycle 4 Day 28).

There were a total of 9 patients (50%, 95% CI 26-74) with a confirmed clinical response. Of these 9 patients, there were 3 cCR and 6 cPR. The median time to response was 1.2 months (range 1-1.9 months). The proportion of patients with JMML undergoing HSCT was 94% and the median time to HSCT was 4.6 months (range 2.8-19 months).

## **15 REFERENCES**

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

## **16 HOW SUPPLIED/STORAGE AND HANDLING**

### ***How Supplied***

Azacitidine for injection is supplied as a lyophilized powder in 100 mg single-dose vials packaged in cartons of 1 vial (NDC 0781-9253-94).

### ***Storage***

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

### ***Handling and Disposal***

Azacitidine for injection is a hazardous drug. Follow applicable special handling and disposal procedures. <sup>1</sup>

## **17 PATIENT COUNSELING INFORMATION**

## **Hepatotoxicity in Patients with Severe Pre-Existing Hepatic Impairment**

Instruct patients to inform their physician about any underlying liver disease [see *Warnings and Precautions (5.3)*].

## **Renal Toxicity**

Instruct patients to inform their physician about any underlying renal disease [see *Warnings and Precautions (5.4)*].

## **Embryo-Fetal Toxicity**

Advise pregnant women of the potential risk to a fetus [see *Warnings and Precautions (5.6) and Use in Specific Populations (8.1)*].

Advise females of reproductive potential to use effective contraception during treatment with azacitidine and for 6 months after the last dose. Advise males with female partners of reproductive potential to use effective contraception during treatment with azacitidine and for 3 months after the last dose. Advise patients to report known or suspected pregnancy to their physicians immediately [see *Warnings and Precautions (5.6) and Use in Specific Populations (8.3)*].

## **Lactation**

Advise patients to avoid breastfeeding while receiving azacitidine and for 1 week after the last dose [see *Use in Specific Populations (8.2)*].

## **Infertility**

Advise males and females that azacitidine may impair fertility [see *Use in Specific Populations (8.3) and Nonclinical Toxicology (13.1)*].

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AZANPI.017 Revised 09/2022

## **PRINCIPAL DISPLAY PANEL - 100 mg Vial Label**

NDC 0781-9253-94

Azacitidine  
for Injection

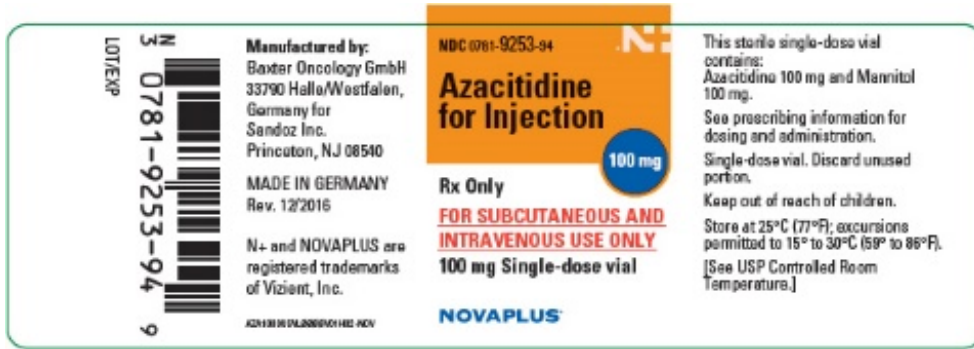
100 mg

Rx Only

FOR SUBCUTANEOUS AND  
INTRAVENOUS USE ONLY

100 mg Single-dose vial

NOVAPLUS®



## PRINCIPAL DISPLAY PANEL - 100 mg Vial Carton

NDC 0781-9253-94

Azacitidine  
for Injection

100 mg

Rx Only

FOR SUBCUTANEOUS AND  
INTRAVENOUS USE ONLY

100 mg Single-dose vial

NOVAPLUS®



## AZACITIDINE

azacitidine injection, powder, lyophilized, for solution

### Product Information

<b>Product Type</b>	HUMAN PRESCRIPTION DRUG	<b>Item Code (Source)</b>	NDC:0781-9253
<b>Route of Administration</b>	SUBCUTANEOUS, INTRAVENOUS		

### Active Ingredient/Active Moiety

Ingredient Name	Basis of Strength	Strength
<b>AZACITIDINE</b> (UNII: M801H13NRU) (AZACITIDINE - UNII:M801H13NRU)	AZACITIDINE	100 mg

## Inactive Ingredients

Ingredient Name	Strength
MANNITOL (UNII: 3OWL53L36A)	

## Packaging

#	Item Code	Package Description	Marketing Start Date	Marketing End Date
1	NDC:0781-9253-94	1 in 1 CARTON; Type 0: Not a Combination Product	03/27/2014	09/30/2024

## Marketing Information

Marketing Category	Application Number or Monograph Citation	Marketing Start Date	Marketing End Date
NDA authorized generic	NDA050794	03/27/2014	09/30/2024

**Labeler** - Sandoz Inc (005387188)

Revised: 9/2022

Sandoz Inc