



ZOLGENSMA Treatment Guide

For US Health Care Providers

ZOLGENSMA is the first one-time-only gene replacement therapy for pediatric patients less than 2 years of age with spinal muscular atrophy (SMA)¹

INDICATION

ZOLGENSMA is an adeno-associated virus (AAV) vector-based gene therapy indicated for the treatment of pediatric patients less than 2 years of age with spinal muscular atrophy (SMA) with bi-allelic mutations in the *survival motor neuron 1 (SMN1)* gene.

Limitations of Use

The safety and effectiveness of repeat administration or the use in patients with advanced SMA (eg, complete paralysis of limbs, permanent ventilator dependence) has not been evaluated with ZOLGENSMA.

IMPORTANT SAFETY INFORMATION

BOXED WARNING: Serious Liver Injury and Acute Liver Failure

Cases of acute liver failure with fatal outcomes have been reported. Acute serious liver injury, acute liver failure, and elevated aminotransferases can also occur with ZOLGENSMA. Patients with preexisting liver impairment may be at higher risk. Prior to infusion, assess liver function of all patients by clinical examination and laboratory testing. Administer systemic corticosteroid to all patients before and after ZOLGENSMA infusion. Continue to monitor liver function for at least 3 months after infusion, and at other times as clinically indicated. If acute serious liver injury or acute liver failure is suspected, promptly consult a pediatric gastroenterologist or hepatologist.

Please see additional Important Safety Information inside and on back cover and [click here](#) for Full Prescribing Information.

Introduction to ZOLGENSMA

ZOLGENSMA® (onasemnogene abeparvovec-xioi) is an adeno-associated virus (AAV) vector-based gene replacement therapy for the one-time-only treatment of pediatric patients less than 2 years of age with SMA. ZOLGENSMA is delivered as an intravenous infusion over 1 hour, but there are essential steps to treatment before and after infusion day.

5 steps to a one-time-only ZOLGENSMA infusion

Step
1

Confirm diagnosis and run laboratory tests

Step
2

Store and handle ZOLGENSMA properly

Step
3

Premedicate and plan for infusion day

Step
4

Prepare and infuse ZOLGENSMA

Step
5

Monitor and postmedicate after ZOLGENSMA infusion



If you have questions throughout the ZOLGENSMA treatment journey, contact Novartis Patient Support™ at: 1-855-441-GENE (4363), Monday-Friday (8 AM to 8 PM ET)

IMPORTANT SAFETY INFORMATION (cont)

WARNINGS AND PRECAUTIONS

Systemic Immune Response

Patients with underlying active infection, either acute or chronic uncontrolled, could be at an increased risk of serious systemic immune response. Administer ZOLGENSMA to patients who are clinically stable in their overall health status (eg, hydration and nutritional status, absence of infection). Postpone ZOLGENSMA in patients with infections until the infection has resolved and the patient is clinically stable.

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Step 1

Confirm diagnosis and run laboratory tests¹

Diagnosis and baseline testing can be performed at a ZOLGENSMA ready institution or by a referring physician



- Confirm a genetic diagnosis of SMA
- Patients treated with ZOLGENSMA® (onasemnogene abeparvovec-xioi) should have bi-allelic mutations in the *survival motor neuron 1 (SMN1)* gene



- Determine patient weight in kilograms, as ZOLGENSMA dosing is weight based



- Perform baseline testing for the presence of anti-AAV9 antibodies
- In clinical trials, patients were required to have baseline anti-AAV9 antibody titers of $\leq 1:50$
- The safety and efficacy of ZOLGENSMA in patients with anti-AAV9 antibody titers above 1:50 have not been evaluated
- Retesting may be performed if anti-AAV9 antibody titers are reported as $>1:50$



- Postpone infusion in patients with infections until the infection has resolved and the patient is clinically stable. Clinical signs or symptoms of infection should not be evident at the time of ZOLGENSMA infusion
- Perform baseline tests for liver function, creatinine, and complete blood count (including hemoglobin and platelet count)
- Evaluate liver function with a clinical exam and laboratory testing of hepatic aminotransferases (aspartate aminotransferase [AST] and alanine aminotransferase [ALT]), total bilirubin, albumin, prothrombin time, partial thromboplastin time (PTT), and international normalized ratio (INR)



To begin a ZOLGENSMA prescription, fax a signed and completed Start Form to Novartis Patient Support at 1-855-951-4363, OR upload a completed form at www.zolgensma-enrollment.com. Questions? Contact 1-855-441-4363.

IMPORTANT SAFETY INFORMATION (cont)

WARNINGS AND PRECAUTIONS (cont)

Thrombocytopenia

Transient decreases in platelet counts, some of which met the criteria for thrombocytopenia, were typically observed within the first 2 weeks after ZOLGENSMA infusion. Monitor platelet counts before ZOLGENSMA infusion and on a regular basis for at least 3 months afterwards.

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Step 2

Store and handle ZOLGENSMA properly¹

ZOLGENSMA® (onasemnogene abeparvovec-xioi) is shipped and delivered frozen and must be thawed prior to infusion



- ZOLGENSMA is shipped and delivered frozen at $\leq -60^{\circ}\text{C}$ (-76°F) in clear vials
- Refrigerate ZOLGENSMA immediately upon receipt at 2°C - 8°C (36°F - 46°F)
- **DO NOT REFREEZE**
- ZOLGENSMA is stable at 2°C - 8°C (36°F - 46°F) and must be used within 14 days of receipt

Do not use ZOLGENSMA unless thawed. Once thawed, ZOLGENSMA should not be refrozen

Refrigerator Thaw



- The contents of the ZOLGENSMA kit will thaw in approximately 16 hours if placed in a refrigerator
- If thawed in the refrigerator, remove ZOLGENSMA from the refrigerator on day of dosing

—OR—

Room Temperature Thaw

- The contents of the ZOLGENSMA kit will thaw in approximately 6 hours if placed at room temperature



- When thawed, ZOLGENSMA is a clear to slightly opaque, colorless to faint white liquid, free of particles
- Inspect ZOLGENSMA visually for particulate matter and discoloration prior to infusion
- Do not use vials if particulates or discoloration are present



- **DO NOT SHAKE ZOLGENSMA**

IMPORTANT SAFETY INFORMATION (cont)

WARNINGS AND PRECAUTIONS (cont)

Thrombotic Microangiopathy

Cases of thrombotic microangiopathy (TMA) were reported to occur generally within the first 2 weeks after ZOLGENSMA infusion. TMA can result in life-threatening or fatal outcomes. Obtain baseline creatinine and complete blood count before ZOLGENSMA infusion. Following infusion, monitor platelet counts closely as well as other signs and symptoms of TMA. Consult a pediatric hematologist and/or pediatric nephrologist immediately to manage as clinically indicated.

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Step 3

Premedicate and plan for infusion day¹



- Ensure required baseline testing has been completed, including anti-AAV9 titers, liver function (including clinical exam, AST, ALT, total bilirubin, albumin, prothrombin time, PTT, INR), creatinine, and complete blood count (including hemoglobin and platelet count)
- Monitoring should continue after ZOLGENSMA® (onasemnogene abeparvovec-xioi) infusion. See Step 5 for monitoring instructions



- If patient weight changes prior to infusion, report those changes to Novartis Patient Support



- **24 hours prior to infusion, administer systemic corticosteroids equivalent to oral prednisolone at 1 mg/kg/day**
- Treatment with corticosteroids should continue after ZOLGENSMA infusion. See Step 5 for postmedication instructions



- Administer ZOLGENSMA to patients who are clinically stable in their overall baseline health status (eg, hydration and nutritional status, absence of infection) prior to infusion
- Clinical signs or symptoms of infection should not be evident at the time of ZOLGENSMA infusion

Administration of ZOLGENSMA to **premature neonates** before reaching full-term gestational age is not recommended, because concomitant treatment with corticosteroids may adversely affect neurological development. Delay ZOLGENSMA infusion until the corresponding full-term gestational age is reached.

IMPORTANT SAFETY INFORMATION (cont)

WARNINGS AND PRECAUTIONS (cont)

Elevated Troponin I

Increases in cardiac troponin I levels have occurred following ZOLGENSMA infusion. Consider cardiac evaluation after ZOLGENSMA infusion and consult a cardiologist as needed.

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Step 4

Prepare and infuse ZOLGENSMA¹

Follow the steps to prepare ZOLGENSMA[®] (onasemnogene abeparvovec-xioi)



- ZOLGENSMA is provided as a kit customized to meet the weight-based dosing requirements of each patient (see Table 1). The recommended dose of ZOLGENSMA is 1.1×10^{14} vector genomes per kilogram (vg/kg) of body weight
- Draw the appropriate dose volume from all vials into a syringe



- Remove air from syringe
- Cap syringe and deliver at room temperature to patient infusion location
- Once dose is drawn into the syringe, it must be used within 8 hours



- Discard the vector-containing syringe if not infused within 8 hours of preparation
- **DO NOT REFREEZE**

Administer ZOLGENSMA as a single-dose, intravenous infusion through a venous catheter^a



- Place a primary catheter into a vein (generally a peripheral vein in the arm or leg)
- Insertion of a backup catheter is recommended
- Program syringe pump for saline priming, or prime tubing manually with saline



- Administer ZOLGENSMA as a slow infusion over 60 minutes
- **DO NOT INFUSE AS AN INTRAVENOUS PUSH OR BOLUS**



- Flush line with saline following completion of infusion

Monitor patients during and after treatment with ZOLGENSMA for infusion-related reactions



- Infusion-related reactions, including hypersensitivity reactions and anaphylaxis, have occurred with ZOLGENSMA infusion.
- Signs and symptoms may include rash, urticaria, vomiting, dyspnea, respiratory symptoms and/or alterations in heart rate and blood pressure.
- Monitor patients during and after treatment with ZOLGENSMA. If an infusion-related reaction occurs, interrupt ZOLGENSMA infusion and administer supportive treatment to manage the infusion-related reaction as appropriate. Infusion of ZOLGENSMA may be resumed based on clinical assessment.

^aDue to the increased risk of serious systemic immune response, administer ZOLGENSMA to patients who are clinically stable in their overall baseline health status (eg, hydration and nutritional status, absence of infection) prior to infusion. Postpone ZOLGENSMA in patients with infections until the infection has resolved and the patient is clinically stable. Clinical signs or symptoms of infection should not be evident at the time of ZOLGENSMA infusion.

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Table 1. ZOLGENSMA Kit Sizes

ZOLGENSMA® (onasemnogene abeparvovec-xioi) dosing and kit sizes							
PATIENT WEIGHT RANGE (kg)	DOSE VOLUME^a (mL)	TOTAL VIALS PER KIT^b	NDC NUMBER	PATIENT WEIGHT RANGE (kg)	DOSE VOLUME^a (mL)	TOTAL VIALS PER KIT^b	NDC NUMBER
2.6 - 3.0	16.5	2	71894-120-02	12.1 - 12.5	68.8	9	71894-139-09
3.1 - 3.5	19.3	3	71894-121-03	12.6 - 13.0	71.5	9	71894-140-09
3.6 - 4.0	22.0	3	71894-122-03	13.1 - 13.5	74.3	9	71894-141-09
4.1 - 4.5	24.8	3	71894-123-03	13.6 - 14.0	77.0	10	71894-142-10
4.6 - 5.0	27.5	4	71894-124-04	14.1 - 14.5	79.8	10	71894-143-10
5.1 - 5.5	30.3	4	71894-125-04	14.6 - 15.0	82.5	10	71894-144-10
5.6 - 6.0	33.0	4	71894-126-04	15.1 - 15.5	85.3	11	71894-145-11
6.1 - 6.5	35.8	5	71894-127-05	15.6 - 16.0	88.0	11	71894-146-11
6.6 - 7.0	38.5	5	71894-128-05	16.1 - 16.5	90.8	11	71894-147-11
7.1 - 7.5	41.3	5	71894-129-05	16.6 - 17.0	93.5	12	71894-148-12
7.6 - 8.0	44.0	6	71894-130-06	17.1 - 17.5	96.3	12	71894-149-12
8.1 - 8.5	46.8	6	71894-131-06	17.6 - 18.0	99.0	12	71894-150-12
8.6 - 9.0	49.5	6	71894-132-06	18.1 - 18.5	101.8	13	71894-151-13
9.1 - 9.5	52.3	7	71894-133-07	18.6 - 19.0	104.5	13	71894-152-13
9.6 - 10.0	55.0	7	71894-134-07	19.1 - 19.5	107.3	13	71894-153-13
10.1 - 10.5	57.8	7	71894-135-07	19.6 - 20.0	110.0	14	71894-154-14
10.6 - 11.0	60.5	8	71894-136-08	20.1 - 20.5	112.8	14	71894-155-14
11.1 - 11.5	63.3	8	71894-137-08	20.6 - 21.0	115.5	14	71894-156-14
11.6 - 12.0	66.0	8	71894-138-08	—	—	—	—

NDC, National Drug Code.

^aDose volume is calculated using the upper limit of the patient weight range for pediatric patients less than 2 years of age between 2.6 kg and 21.0 kg.

^bAll vials have a nominal concentration of 2.0×10^{13} vector genomes (vg) per mL. Each vial of ZOLGENSMA contains an extractable volume of not less than either 5.5 mL or 8.3 mL.

IMPORTANT SAFETY INFORMATION (cont)

WARNINGS AND PRECAUTIONS (cont)

AAV Vector Integration and Risk of Tumorigenicity

There is a theoretical risk of tumorigenicity due to integration of AAV vector DNA into the genome. Cases of tumor have been reported in patients who received ZOLGENSMA post-approval; a causal relationship has not been established based on tumor analysis. In some cases, limited information was available. Report cases of tumor development in patients who received ZOLGENSMA to Novartis Gene Therapies, Inc. at 1-833-828-3947.

Infusion-Related Reactions

Infusion-related reactions, including hypersensitivity reactions and anaphylaxis, have occurred with ZOLGENSMA infusion. Signs and symptoms may include rash, urticaria, vomiting, dyspnea, respiratory symptoms, and/or alterations in heart rate and blood pressure. Monitor patients during and after treatment with ZOLGENSMA. If an infusion-related reaction occurs, interrupt ZOLGENSMA infusion and administer supportive treatment to manage the infusion-related reaction as appropriate. Infusion of ZOLGENSMA may be resumed based on clinical assessment.

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Step 5

Monitor and postmedicate after ZOLGENSMA infusion¹

Monitor patients after treatment with ZOLGENSMA® (onasemnogene abeparvovec-xioi) for an infusion-related reaction.

Signs and symptoms may include rash, urticaria, vomiting, dyspnea, respiratory symptoms and/or alterations in heart rate and blood pressure. Infusion-related reactions, including hypersensitivity reactions and anaphylaxis, have occurred with ZOLGENSMA infusion.

After infusion, assess liver function and platelet count for at least 3 months following infusion (see Table 2 for schedule of assessments).

Consider cardiac evaluation after ZOLGENSMA infusion and consult a cardiologist as needed.

Liver Function

- Acute serious liver injury, acute liver failure, and elevated aminotransferases may occur with ZOLGENSMA
- Liver function should be evaluated by clinical exam and an analysis of hepatic aminotransferases (AST and ALT), total bilirubin, prothrombin time, and INR
- Elevated liver function tests may reflect acute serious liver injury
- The recommended corticosteroid regimen is detailed in Table 3 on the next page and in the Prescribing Information

Platelet Count

- Transient decreases in platelet count, some of which met the criteria for thrombocytopenia, were typically observed within the first 2 weeks following infusion
- Monitor platelet counts closely within the first 2 weeks following infusion and on a regular basis afterwards, as well as signs and symptoms of TMA, such as hypertension, increased bruising, seizures, or decreased urine output (see Table 2)
- Consult a pediatric hematologist and/or pediatric nephrologist immediately to manage as clinically indicated

Troponin I

- Increases in cardiac troponin I levels have occurred following ZOLGENSMA infusion
- Consider cardiac evaluation after ZOLGENSMA infusion and consult a cardiologist as needed

Table 2. Schedule of Assessments Before and After Infusion

Baseline assessments prior to infusion												
Liver function (clinical exam, AST, ALT, total bilirubin level, albumin, prothrombin time, PTT, and INR), creatinine, and complete blood count (including hemoglobin and platelet count).												
Monitoring after infusion												
Test	Month 1				Month 2				Month 3			
	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Liver function ^c	2 months or longer, until the patient is clinically stable with unremarkable findings								1 month			
	Monitor weekly, during the corticosteroid treatment and taper periods.								Monitor every other week at the end of the corticosteroid taper.			
	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
	Promptly assess and closely monitor patients with worsening liver function test results and/or signs or symptoms of acute illness (eg, vomiting, deterioration in health). In case hepatic injury is suspected, further testing of albumin, PTT, and INR is recommended.											
Platelet count ^{a,b}	✓	✓	✓	✓		✓		✓		✓		✓
Consider cardiac evaluation after ZOLGENSMA infusion and consult a cardiologist as needed.												

Administer ZOLGENSMA to patients who are clinically stable in their overall baseline health status (eg, hydration and nutritional status, absence of infection) prior to infusion. Postpone ZOLGENSMA in patients with infections until the infection has resolved and the patient is clinically stable. Clinical signs or symptoms of infection should not be evident at the time of ZOLGENSMA infusion.

Wk, week; ✓, monitoring performed. ^aMonitor platelet counts as well as signs and symptoms of TMA, such as hypertension, increased bruising, seizures, or decreased urine output. ^bMonitor platelet counts for 3 months or longer until they return to baseline. ^cMonitor liver function for 3 months or longer until results are unremarkable (normal clinical exam, total bilirubin, and prothrombin and INR results; ALT and AST levels below 2 × ULN).

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Step 5

Monitor and postmedicate after ZOLGENSMA infusion (cont)¹

Treat with systemic corticosteroids (equivalent to oral prednisolone) before and after infusion

If oral corticosteroid therapy is not tolerated, consider intravenous corticosteroids as clinically indicated.

Table 3. Corticosteroid Use Before, During, and After ZOLGENSMA Infusion

Day 1: 24 hours prior to infusion
Initiate systemic corticosteroid regimen equivalent to oral prednisolone at 1 mg/kg/day.
Day 2: Infusion day
Infuse ZOLGENSMA® (onasemnogene abeparvovec-xioi) and continue the corticosteroid regimen.
Day 30: 28 days after infusion
Check liver status clinically and by assessing ALT, AST, total bilirubin, prothrombin time, and INR. Do not stop systemic corticosteroids abruptly.
If unremarkable (normal clinical exam, total bilirubin, prothrombin time, and INR; ALT and AST levels below 2 x ULN):
<ul style="list-style-type: none"> Then taper the corticosteroid dose gradually over the next 28 days
If liver function abnormalities are present:
<ul style="list-style-type: none"> Consult a pediatric gastroenterologist or hepatologist Continue systemic corticosteroids (equivalent to oral prednisolone at 1 mg/kg/day) until AST and ALT values are both below 2 × ULN and all other assessments return to normal range Then taper the corticosteroid dose gradually over the next 28 days or longer if needed

ULN, upper limit of normal.

Monitor liver function for at least 3 months following ZOLGENSMA infusion, and at other times as clinically indicated.

Monitor liver function (eg, clinical exam and laboratory testing of AST, ALT, total bilirubin, prothrombin time, and INR) weekly during corticosteroid course and taper period.

If the patient is clinically stable with unremarkable findings at the end of the corticosteroid taper period, continue to monitor liver function every other week for another month. See monitoring schedule in Table 2.

IMPORTANT SAFETY INFORMATION (cont)

ADVERSE REACTIONS

The most commonly observed adverse reactions (incidence ≥5%) in clinical studies were elevated aminotransferases and vomiting.

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Indication and Important Safety Information

INDICATION

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WARNINGS AND PRECAUTIONS

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ADVERSE REACTIONS

The most commonly observed adverse reactions (incidence $\geq 5\%$) in clinical studies were elevated aminotransferases and vomiting.

Please [click here](#) for Full Prescribing Information.

Reference: 1. ZOLGENSMA. Prescribing information. Novartis Gene Therapies, Inc.

